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ABSTRACT

In June of 1977, the Council for Educational Development and Research held its sixth annual conference to examine and discuss the role of education in the energy dilemma. This publication contains the proceedings of that conference. The 300 conference participants heard addresses and panel discussions which examined nearly the whole energy education task. Speeches or discussions from each of the 13 sessions are presented in this publication. Titles, as an indicator of content, include: (1) The Energy Agenda at the Office of Education; (2) Energy Resources: Scenarios for the Future; (3) The Moral Dilemma of Energy Education; (4) Constraints Influencing Education's Role; (5) Politics of Energy Education; (6) Confronting the Energy Dilemma; (7) The Meaning of Scarcity; (8) The Impact of the Carter Energy Program on American Schools; and (9) Reactions to the Conference. In general, it was perceived that the pressing energy problems of today may dramatically alter the values and life styles of future Americans and that not only does education need to prepare people for coping with the energy problems, but also with the probable social changes resulting from those problems. (MR)

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# EDUCATION CONFRONTS THE ENERGY DILEMMA

Proceedings of the Sixth Annual Conference
Council for Educational Development and Research
Washington, D.C.
June 22-24, 1977

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# EDUCATION CONFRONTS THE ENERGY DILEMMA

Proceedings of the Sixth Annual Conference
Council for Educational Development
and Research
Washington, D. C.
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sponsored By

Council for Education Development and Research
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# PREFACE

It didn't become apparent, until mid-way through the energy-education conference, that most of the participants who had traveled to Washington, D.C. to be with us were in basic agreement with our theme.

The participants initially were troubled by our word "dilemma." To them, the energy situation was better described as a "crisis." What brought them to Washington and the "Education Confronts the Energy Dilemma" conference was a keen concern about the role that America's schools could play in solving or coping with the crisis.

Consequently, many participants were troubled by our deliberate attempt to present many views about the scope of the energy problem. These participants tended to think that the speakers would simply state obvious and accepted facts about the severity of the energy crisis. By the second day of the conference, however, the participants began to appreciate the energy "crisis" was also an energy "dilemma."

Solutions to the energy-forced problem, for example, ranged from futuristic scenarios about the promise of modern technology to the introduction of soon-to-be-available energy-education classroom materials. But these solutions, when pitted against the magnitude and complexity of the problem, appeared to many to be overly optimistic or too little too late.

Our conference was staged to address the whole energy issue, to present a forum for a wide range of views about the complexities of the problem, and to encourage educators and members of the energy profession to exchange views about the role American schools can or should play in helping prepare a future generation for a vastly different way of life.

In other words, our conference and its various messages were intended to be shared with a much larger audience than those in attendance with us for three days in June.

We're never going to be able to comprehend the consequences of the energy crisis, nor resolve the dilemma such a crisis creates, by assembling groups of 300 concerned citizens in conferences. The debate must take place in a much larger forum. Thus it's our hope that these proceedings will contribute to that necessary dialogue.

The conference was sponsored by the Council for Educational Development and Research (CEDaR), a national association of institutions engaged in educational research and development. James H. Perry, executive director of the Southeast Educational Development Laboratory, Austin, Texas, served as program chairman. Joseph Tallakson, senior associate within CEDaR's Washington Office, was the conference coordinator. Supporting these two individuals in a multitude of ways were the other CEDaR staff members: Mary Saily, Anne McLaren, and Margaret Johnson.

The Council for Educational Development and Research also wishes to acknowledge the financial backing and strong support it received from the conference's primary funding source, the Energy Research and Development Administration. The two project monitors were Donald D. Duggan, chief, Education Branch, Office of Public Affairs and Joseph E. Rogers, Jr., Education and Training Program Specialist, Office of University Programs. Their willingness to advise, but not direct, enabled us to sponsor a conference that was applauded by its participants for both its candor and its diversity of views.

E. Joseph Schneider, Executive Secretary
Council for Educational Development and Research
Suite 206, 1518 K Street, N.W.
Washington, D.C. 20005
202-638-3193

Summary of Conference Proceedings

## "EDUCATION CONFRONTS THE ENERGY DILEMMA"

### SESSION I OUR ENERGY CRISIS AND EDUCATION: A CRITICAL ASSESSMENT

Charles J. Cicchetti, economics professor at the University of Wisconsin, Madison, and chairman of the Wisconsin Public Service Commission, gave the opening conference address. His remarks centered on the historical economic relationships that have led us into the current energy crisis.

### SESSION II THE ENERGY AGENDA AT THE OFFICE OF EDUCATION

Commissioner of Education Ernest L. Boyer outlined the Office of Education plans for energy education. Focusing on the three "E's" of energy, environment, and engagement, Boyer proposed the establishment of an Energy/Environment Action Center in the Office of Education to provide information and technical assistance to schools and colleges; to support the training of new energy and environment professionals; and to initiate the development of new curricula materials focused on the three "E's."

### SESSION III ENERGY RESOURCES: SCENARIOS FOR THE FUTURE

Edward J. Hanrahan, director, Office of Analysis, Division of Planning and Evaluation, Energy Research and Development Administration, opened this session with a description of the administration's projections of our energy future. Basically, Hanrahan described a future world gradually diminishing its reliance on finite fossil fuels such as oil and gas while utilizing coal during the transfer to an age fueled by alternate renewable energy resources such as nuclear and solar.

Earl Joseph, staff scientist with Minnesota-based Sperry-UNIVAC gave the first reaction to Hanrahan's scenario. Joseph predicted that high technology hardware now in the development stages would be the primary means of combating the energy crisis.

And finally, Joanna Underwood, director of INFORM, New York City, challenged the previous futurist scenarios as unrealistic to our needs. Underwood sought a reordering of economic incentives to reflect realistically the cost of energy to society. Resolving the energy crisis, then, would force changes in consumption patterns and values according to reality.

### SESSION IV MORAL DILEMMA OF ENERGY EDUCATION

Edwin Fenton, professor of American History at Pittsburgh's Carnegie-Mellon University, gave the luncheon address. Given the complex nature of the energy crisis and the overwhelming influence of the latent curriculum advertising high-energy consumption, Fenton concluded that the school's role should be to instruct students according to the government's energy conservation themes.

SESSION V CONSTRAINTS INFLUENCING EDUCATION'S ROLE

A comprehensive energy education program will undoubtedly include conflicting perspectives. This session featured a panel representing alternative viewpoints on the energy dilemma and the role schools should play in coping with it. The panel was chaired by Merilyn Reeves, member of the National Energy Committee of the League of Women Voters. Panelists included: Bill J. Cunningham, economist, AFL-CIO; Merrill J. Whitman, acting executive director, Americans for Energy Independence; Richard B. Scheetz, coordinator of educational services, Edison Electric Institute representing the Energy Educators Forum; and Richard P. Pollock, director, Critical Mass Energy Project representing Ralph Nader's Energy Task Force.

SESSION VI ENERGY EDUCATION: WHAT'S BEEN DONE TO DATE?

Several federal agencies have already initiated energy education efforts ranging from the development of curricula supplements and teacher training materials to labor force projections and specialized postsecondary training. Key federal energy education spokespersons comprised this panel chaired by Donald D. Duggan, chief, Education Programs Branch, Office of Public Affairs, Energy Research and Development Administration. The panelists included: Rene M. Vawter, marketing specialist, Office of Conservation, Federal Energy Administration; John L. Snyder, director, Modes Development Program, Division of Science Education Development and Research, National Science Foundation; Walter J. Bogan, Jr., director, Office of Environmental Education, U.S. Office of Education; James C. Kellett, Jr., assistant director for education and training, Office of University Programs, Energy Research and Development Administration; Willis J. Nordlund, special assistant, Office of the Undersecretary, U.S. Department of Labor; and John W. Eberhard, research psychologist, Office of Driver and Pedestrian Research, National Highway Traffic Safety Administration, U.S. Department of Transportation.

SESSION VII PRACTITIONERS DISCUSS THEIR FUTURE ROLES, RESPONSIBILITIES

The educational practitioner in the field will bear the ultimate responsibility of providing energy education to elementary-secondary, postsecondary, vocational school students, and to some extent, the general public. Twelve education associations delivered statements to the conference outlining their memberships' views on the role and responsibility of the schools in preparing students to cope with the energy dilemma.

During two concurrent panel sessions, the following association representatives presented their respective views: Joel L. Burdin, associate director, American Association of Colleges for Teacher Education, Washington, D.C.; Charlotte Friedman, legislative assistant, American Association of School Administrators, Reston, Virginia and Joseph Ringer, Jr., assistant superintendent of schools, Arlington, Virginia; American Federation of Teachers, Dal Lawrence, president, Toledo Federation of Teachers, Toledo, Ohio; and American Vocational Association, Charles O. Whitehead, president, State Technical Institute, Memphis, Tennessee.

Gordon Cawelti, executive director, Association for Supervision and Curriculum Development, Washington, D.C.; Council of Chief State School Officers, Calvin E. Anderson, energy project director, Colorado Department of Education, Denver, Colorado; Council of the Great City Schools, Edward S. Foster, Jr., member, Toledo Board of Education, Toledo, Ohio; Alan Ladwig, president, Forum for the Advancement of Students in Science and Technology, Washington, D.C.; National Association of Secondary School Principals, Richard E. Bamberger, supervising principal, Schodack Central Schools, Castleton-on-Hudson, New York; Ann P. Kahn, secretary, National Congress of Parents and Teachers, Chicago, Illinois, A. Donald Blakeslee, co-chair, Standing Committee on Instruction and Professional Development, National Education Association, Washington, D.C.; and Nicholas Maravell, legislative assistant, National School Boards Association, Washington, D.C.

SESSION VIII POLITICS OF ENERGY EDUCATION

Senator Claiborne Pell, chairman, Human Resources Committee's Subcommittee on Education, Arts, and Humanities in the U.S. Senate, gave a major luncheon address. Senator Pell authored the "School Energy Assistance Bill" that provides funding to schools to offset rising energy costs and to retrofit buildings to conserve energy.

Senator Pell said the primary energy educators are the family unit. The education community, representing some of the worst offenses in energy waste, should be working in conjunction with the local communities in resolving the energy dilemma. Noting public apathy toward the energy crisis and the continual increase in consumer consumption patterns, Pell noted: "Our progress is still more symbolic than fundamental." He concluded that the energy battle "needs to be fought in public debate and in the media, not in academia."

SESSION IX CONFRONTING THE ENERGY DILEMMA

Several nationally known research and development experts described current instructional programs, and others under development, that are designed to assist educators in teaching about the complexities of the energy dilemma. Panel members included: American Association of Publishers, Sturges S. Cary, editor-in-chief, School Division, Scholastic Magazine; John C. Jones, president and Edward Dalton, Energy and Man's Environment, Portland, Oregon; Bela H. Banathy, director, Instructional and Training System Program, Far West Laboratory for Educational Research and Development, San Francisco, California; Audrey Champagne, co-director, Individualized Science Program, Learning Research and Development Center, University of Pittsburgh, Pennsylvania; and John M. Fowler, director of special projects, National Science Teachers Association, Washington, D.C.

SESSION X THE MEANING OF SCARCITY

Richard J. Barnet is the co-founder and current co-director of the Institute for Policy Studies in Washington, D.C. He is the co-author of Global Reach: The Power of the Multinational Corporation. Barnet presented his views to the conferees in a major after-dinner address.

Basically, Barnet sees a crisis of understanding in the world as basic resources become scarcer and Third World countries and industrialized societies vie for positions in the global economy. The complexity of the resource problems on an international scale, according to Barnet, should be taught in the classroom to heighten students' awareness of possibilities, both positive and negative.

Barnet warned that the impending crisis of scarcity threatens democracy as a way of life. He asserted that the free enterprise values of greed, envy, and competition are "incompatable with the survival of freedom in the next generation." For democracy to survive in the future, he called for a reordering of the economic order "to share the resources in equitable and rational ways" and for a new emphasis in an interdependent world on the values of community, cooperation, and mutual aid.

## SESSION XI IMPACT OF THE CARTER ENERGY PROGRAM ON AMERICAN SCHOOLS

James D. Bishop, Jr. is assistant to James Schlesinger, head of the White House's Energy Policy and Planning Staff. In addition, Bishop serves as director of communications and public affairs, Federal Energy Administration.

In his address, Bishop focused on the general apathy and unawareness of the American public to the energy crisis.

Bishop asserted that the Carter administration has boldly faced the energy issue and proposes an 8-10 year transition period preserving freedom of choice for Americans. Unless our society can band together in a spirit of community to tackle the problem, Bishop concluded, "the cold, dead hand of government will be tapping us on the shoulder with some regularity."

Education, according to Bishop, offers the best window to the future. It can help us develop the "kinds of tools we'll need to manage the future when it comes," he said, "because, if we don't, the future that is facing us is going to be far different and far more chaotic than anything that you and I would dare to imagine in public."

## SESSION XII REPORT TO THE CONFERENCE

The conferees held small group discussions on the energy education issues presented to the conference. Charles A. Whitehurst, professor of environmental engineering, Louisiana State University, served as coordinator of the discussion groups, and thus reported to the total conference his concensus of the groups' deliberations.

## SESSION XIII REACTIONS TO THE CONFERENCE

Elizabeth Dodson Gray, co-director of the Bolton Institute and Harold L. Hodgkinson, former director of the National Institute of Education and presently executive director of the American Management Association's Professional Institute, provided critical appraisals and summarizations of the conference proceedings.

Gray opened her remarks with some accolades for the comprehensive nature of the conference and the diversity of viewpoints and criticism for the conference's structure and setting. She then suggested that future energy education should be holistic in nature, realistic in content, and oriented to "empowering students to make choices about their lives and futures."

In conclusion, Gray suggested a "paradigm change" involving taking individual feelings seriously, particularly children's feelings. As individuals face the uncertainty of the future with its inherent problems and potential, a new consciousness of individual purpose must evolve, individually.

Hodgkinson advised the conference to consider the concept of reciprocity or the teaching of relationships in energy education. He concluded that future curricula should not focus on just energy education, but rather, the teaching of generic competencies. These include the ability to break a problem down into its various parts; the ability to analyze a problem in terms of creating analogies; the ability to create options from the available information; and "no proclamation of success until the test data are in."

In other words, he said that the most important element in energy education is how the student processes the information received, not the information, itself.

SESSION I

OUR ENERGY CRISIS AND EDUCATION: A CRITICAL ASSESSMENT

Charles J. Cicchetti, economi[redacted]sor at the University of Wisconsin, Madison and Chairman of the Wisconsin Public Service Commission, gave the opening conference address. His remarks centered on the historical economic relationships that have led us into the current energy crisis.

# OUR ENERGY CRISIS AND EDUCATION: A CRITICAL ASSESSMENT

Charles J. Cicchetti, economics professor, University of Wisconsin, Madison; and chairman, Public Service Commission of Wisconsin

## Introduction

We hear a lot about crises these days. In fact, someone has recently said that we are suffering from a "crisis of crises." This is probably true. We seem to jump from one straining national issue to another. Nonetheless, I believe that our energy crisis is quite real! The roots of it have been apparent for some time, but its reality has only recently become fully appreciated by both the citizens of this country and our national leaders.

There are two fundamental facets of our energy crisis, that I believe must be understood before we can begin to decide on the appropriate methods for solving some of our very pressing national energy dilemmas. First, we must understand the historical basis of our current energy crisis. Second, we must appreciate the true nature of long-term resource scarcity and the dangers inherent in exponential growth in energy consumption.

In addition to understanding our energy problems, I believe we must also come to understand the various ways in which problem solving in general tends to be formulated by our highly complex society. This consideration will allow me to strike the second major theme of my remarks today. That is, the role that education must play in resolving and understanding society's growing list of problems.

## Historic Perspective

I have always found it surprising that for many people in this country October of 1973, and the Arab oil embargo, was when they first realized that the world oil supply was controlled by an oil cartel. The reason I have felt that this is ironic is that I believe that for some hundred years the oil industry in this country, and indeed the world, has been dominated by one form or another of an oil cartel in the sense that supply has been controlled to keep prices high. It is important to understand the historic evolution of the many faceted and evolving oil cartel in order to understand how our present state of affairs came about. Furthermore, it is important to be able to understand the policy solutions, which have been used in the past to set national energy policies even when they have failed. In brief, we must understand yesterday's policy failures in order to better understand and more clearly define tomorrow's energy solutions.

Let me first recount a brief history of the evolution of the U.S. oil cartel:

> John D. Rockefeller first gained control of petroleum transportation and refinery capacity in the United States, but after several decades the U.S. government forced him to divide his empire.

In the early part of this century, the governments of oil-producing states enacted so-called "conservation" laws. Each state set production levels that controlled supply and helped keep the prices of crude oil, oil producers' profits, and state income taxes high.

When the economic depression of the early 1930's hit the U.S. economy, the demand for crude oil dropped sharply. Producing states and oil companies began to lower their prices to compete for this reduced demand. President Roosevelt developed and promoted legislation to form an Interstate Oil Compact Commission. This act required the producing states to coordinate their production restrictions. It was also made illegal for any state to sell oil which exceeded predetermined crude oil production limits. The U.S. government, in conjunction with state governments, established the quantity of oil that would be produced in the United States and kept prices high.

After World War II, the United States was no longer self-sufficient in crude oil production. The vast reserves in the Middle East provided an alternative source of reserve at a very low cost. In order to protect domestic oil producers, a voluntary import quota program was initiated by President Eisenhower in the early 1950's. When the voluntary program failed, President Eisenhower established a mandatory oil import quota program, which he claimed protected the national security. Later imports would be set at a fixed percentage of domestic production. Once again, supply of oil was controlled by the federal government. The state and federal governments fixed domestic production. Since the level of domestic production determined the basis for imports, this meant that the entire supply of crude oil in the United States was controlled. Prices were kept high.

From the late 1950's until the spring of 1973, import quotas and domestic production were fixed by the U.S. in order to keep out cheap foreign imports and to keep the U.S. domestic oil producers protected from that source of competition. This meant that U.S. oil consumers paid twice as much for crude oil consumption than they would have paid had imports been allowed to freely enter the U.S. It also meant, as some critics of the program have indicated, that our national energy policy was "to drain America first."

By the end of 1971 and early 1972, it was clear that domestic oil production was leveling off in the U.S. At the same time, demand for petroleum products continued to increase at a brisk pace. This put pressure on President Nixon to increase the oil imports that were allowed to enter the U.S. He did this on a temporary emergency basis. This meant that the smart people in the U.S. oil industry were encouraged to search for oil in Washington, D.C., rather than in the oil production regions of the U.S. It also meant that needed U.S. refinery capacity was built outside of the U.S., because of the enormous capital investment and the uncertainty about continued imports of crude oil caused by their temporary nature.

During this same period, the petroleum exporting countries were increasing the posted price that was used to calculate the tax responsibilities of the major oil companies producing in the OPEC nations. At this time, the amount of tax that was paid per barrel was allowed to be credited against the U.S. corporate income tax obligations of these same oil companies for the U.S. portion of their businesses. Because domestic oil prices were raised along with the OPEC prices, multi-national oil companies were willing partners in the OPEC price increases prior to the embargo. The taxes could be paid out of U.S. tax obligations. At the same time, price increases attributed to posted price increases were permitted to be passed on to the U.S. consumer.

By the spring of 1973, President Nixon was under pressure from the major oil companies, who were unable to get sufficient crude oil for their refineries and meet the product demands of their customers. He ended the Mandatory Oil Import Quota Program. For the first time, large non-quantity-controlled products and crude oil were permitted to flow into the U.S. economy. At that point in time, the U.S. price of crude oil was about $4.25 per barrel, while the imported price of that same crude oil was only about $2.00 to $2.50 per barrel. Just prior to the announcement of the OPEC embargo in 1973, a slight downturn in the cost of crude oil in the U.S. was perceived. But, before customers could benefit, war broke out in the Middle East. Along with that war came the political and economic realization of the strength that the producing countries possessed with respect to world oil pricing. The price of foreign oil increased by more than 500 percent in less than six months. In addition, the quantity of oil that was available for consumers was curtailed.

The reality of our past national energy policy has been that the federal government, state producing governments and oil companies have conducted themselves in such a way that our national energy policy has benefited a small special interest, while costing the rest of the nation dearly. The prevalent pattern inherent in our national energy policy strongly suggested, if it did not require, that oil companies spend considerable resources searching for oil profits in our nation's capital. We all know that there are not any oil resources to be found here in Washington. But the past fifty years indicate that by achieving more favorable regulations, new interpretations of existing regulations, better tax treatment and more, the greatest oil profits were to be found here.

The sorry history of mutual government and industry involvement in our oil industry did not stop with the Arab oil embargo in 1973. Since the oil embargo of 1973, we have added several new dimensions to our Federal-Corporate oil policy at the national level. Just prior to the embargo, oil imports were less than 25% of our total oil consumption. And almost half of this came from Canada. Today, the circumstances are quite different. In some months oil imports equal half of our oil consumption. Canadian oil imports into this country are almost non-existent.

Surprising, even outrageous, as it may be, for some time now our national policy has been one of rewarding imports with higher profits, while discouraging domestic oil with lower profits and unfavorable regulatory

policy. Under these circumstances, our oil imports have doubled, coming at the same time from less secure foreign sources, while our consumption in this country has remained relatively stable.

The oil embargo has ended. More importantly, the short-term oil shortage is over. The system of having one oil refiner sell low cost domestic oil to another refiner has not completly ended. Under these circumstances, an oil company that has low cost oil is sometimes required to sell its low cost oil to its competitors. In order to keep its share of the market, the "seller" is forced to turn to "new" domestic oil or imported oil, which costs at least $7.00 more per barrel. It is no wonder that domestic oil production has been declining ever since the embargo began and Project Independence was announced.

The Entitlement Program complicates and aggravates the first program. Oil refiners that use imported oil are paid $7.00 per barrel (the difference between "old" and "new" and produced in the U.S.) for a portion of the imports that they use in their refineries. A national index of imports is established each month. Some companies fall on the winning side of this index and receive entitlement payments, while others are losers. They must pay. Oil companies are encouraged to shift into the winning category, thus rewarding imports and discouraging domestic oil production. As a nation, we have become much more heavily dependent upon imports as a source of crude oil in our domestic refineries.

Although frequently changing, the Old Crude Oil Allocation Program and Entitlement Program have been with us for some time. The more recent incentives of the federal government, which encourage imports, have been with us only for the last few months. The Energy Policy and Conservation Act was worked out as a compromise between President Ford and the Congress. Oil companies have been promised that if they just wait 40 months and leave their "old" oil (priced at $5.25) in the ground, they will be able to charge two or three times as much for that same oil (new oil is priced at about $12.00 to $14.00 per barrel). There is no question that oil companies in increasing numbers have decided as a result that it is in their interests to leave known domestic oil in the ground and turn instead to imports.

Even the pattern of price increases that are permitted under the implementation of the Energy Policy and Conservation Act discourages domestic oil production. The two-tier oil price system has been retained and the price of new domestic oil is increasing. The companies leaving "old" oil in the ground will be doubly rewarded at the end of 40 months, if this "old" oil price is brought up to parity with the new domestic oil prices, which have been allowed to escalate all during this period of time. Refiners currently using imported oil will have refined products which are more competitive, since they will be cheaper than products made from the "new" domestic oil, unless OPEC decides to raise the world price to parity with this new "new" domestic oil price. Because of these regulations the most economical thing for domestic oil producers is to import more oil during the next three

years, and then to "rediscover" oil that has been left in the ground. In our current surplus petroleum energy market, it is illogical to retain allocation rules, encourage imports, and discourage domestic oil production. This does not mean that we should forget all petroleum regulations. Instead, we must draw the line intended by the Congress in the Energy Policy and Conservation Act. We must not permit oil prices to be set at monopoly levels by the international oil cartel. Neither should we retain product and crude volumetric allocations, which will accomplish the same thing. We must not allow any policy to put the nation's economy more squarely under the control of the international oil cartel. There is a difference between regulations which control oil prices, encourage domestic production, and discourage oil imports -- and those regulations which have exactly the opposite effects.

I will say more below about how President Carter's energy package addresses these current fundamental policy failures. Suffice it to say oil companies are rational. They respond to the economic signals given them by government. Until this point, government has signaled greater value associated with imports and lesser value associated with a large portion (at least half) of our domestic oil production. Historically and currently, this is an utterly poor record with respect to our national energy policies.

Most of my friends and even most of my critics consider me to be a liberal, so I should hasten to add that while I engage in a strong indictment of past government solutions to our national problems, national energy problems in particular, I do not believe that this necessarily means that government does not have a role to play in solving our energy problems. However, we must take a strong hard look at the source of the problem. We must also recognize that even if it is necessary for government intervention to solve social problems, it is not always sufficient to have that intervention. The job does not end when government steps in. The Carter approach to these problems is based upon a different philosophy. Before discussing it we should consider the depth of our energy problems.

The Long-Term Problem

It is useful at this point to switch from this dreary and gloomy historical record to the future because that aspect of our energy crisis must also be understood. Some think that merely removing government involvement will eventually, under free market conditions, lead to a solution of our energy problems. Their view is wrong, because while theoretically virtuous, it is too simple. The "free marketeers" have a very serious misunderstanding of the long-term nature of our energy crisis. First, let me point out, that if we take a careful and very optimistic view of the total resource base of either the United States or the entire world, we find that if world energy consumption returns to the rates of growth, which existed prior to the oil embargo of 1973, 3.4% per year for the U.S. and 5.6% per year for the world, then even using a very optimistic view of the total resource-base, the United States has 44 years of remaining energy resources. For the world, the situation is worse, even including the prolifically abundant Middle East, it has less than 37 years of resources to sustain the rates of growth in consumption that existed prior to the 1973 oil embargo.

We often hear that in this country we have hundreds of years worth of coal remaining. Therefore, it is presumed that we can be smug about our long-term energy resource needs. This is totally wrong, while factually correct. The explanation to this inconsistency is that while we may have hundreds of years worth of coal remaining, it is hundreds of years of coal for existing uses and levels of consumption. If in the future, as natural gas, oil, and even uranium become less available as they are used up by our constantly growing appetite for energy resources, then the nation will switch over to coal as its basic fossil fuel.

We must not lose sight of the fact that while oil and natural gas represent 8% of our resource base in this country, they currently represent 75% of the total energy consumption that takes place within the United States. Once the petroleum resource base has been consumed, if we are going to continue to drive our automobiles, heat our homes, power our factories, lubricate our machines, and utilize petrochemicals, we are going to have to use coal as a substitute for petroleum and not just for the purposes it has been used in the past. If this kind of conversion takes place, we do not have hundreds of years of coal remaining in this country. Instead, if growth in energy use continues as in the past, we have 50 years of our remaining energy resource base.

At the risk of sounding redundant, growing at the world rate of energy consumption means that in less than a decade and a half, the United States and the rest of the world will use as much new energy as has been used in all of the recorded history prior to that period. In another 15 years this would happen again, even including the doubling effect in consumption of the previous 15 years. Compound growth in energy use must be checked. Failing to heed this warning will mean that the world will use up its energy capital within the lifetimes of most of the students that we come in contact with in our teaching.

Even these numbers do not convince everyone that we have a real energy resource problem. They somehow want to believe in what I call the "Apollo syndrome." In other words, if we can put a man on the moon, we can solve any technical problem once we resolve to do it. I have a friend, who has performed a very interesting and important calculation. To me these calculations show that there is a real limit on the amount of resources that we could ever hope to have available. He begins his analysis with an assumption that the whole sphere, called Earth, is made out of coal. In other words that there is coal at the center, not just the surface, and the entire sphere is coal. He calculated that if this assumption were true, and of course, nobody believes this to be the case, continuing to use energy at roughly today's level of consumption, we would have something like 163 billion years before we would run out of this coal. However, if world energy use growth rate of 5.6% per year were to continue in the future, instead of having 163 billion years of coal, he found that such an incredible resource base would only last for a little more than four centuries or 421 years.

This analysis is a very sobering realization. It shows the power of compound rates of growth; it shows the inherent danger from allowing compound rates of growth in energy use to go unchecked. This is especially true when we realize that of course the Earth is not made entirely out of coal. To sum up, whether we believe it or not, whether we want to address

it or not, we must recognize that there are real long term resource limits, and not long term in terms of hundreds of years, but in a matter of a decade or two at most.

It is essential that we establish fundamental re-directions and reassessments of our energy consumption patterns and habits. Failing this, the world will have to face a much more serious and dramatic societal restructuring than it has ever faced at any point in history. The simple fact is that a world: that runs out of energy; that runs out of resources; that no longer can promise to millions of its fellow-citizens that there is a better life to be had in the future; is a world that is going to have to face up to political and income redistribution problems on a massive scale. These will make the various social reforms, political reforms, and military actions of the past seem inconsequential by comparison.

The President has said that our energy crisis is the moral equivalent of war. I believe, unlike many of the critics of the President, that his warning is an understatement rather than an overstatement of the reality. I find it quite regrettable that so many people have failed to come to grips with the severity and the pressing nature of our resource, energy, and environmental problems on a global scale. This generation and the succeeding generation, that we are currently teaching in our schools, must solve these problems in terms of technical, regulatory, educational, or economic solutions. We must either break past trends and change the current reality, or in the future we are going to be dealing with much more fundamental and pressing problems.

The President's Plan and Education's Challenge

I would now like to move from making the general case that we indeed have multi-faceted energy crisis. As I have argued, we have an historical energy crisis due to an almost total failure on the part of government action in the past. To those who have taken the time to sit down and understand the numbers, it is apparent that energy problems of the future are pressing in on us very rapidly. Both lines of thinking are dismal, but let us get optimistic and begin to address possible solutions.

It is not my intention to engage in partisan politics today, but I think it is very useful to understand some of the specifics and philosophy that underlie President Carter's energy proposals. It is useful to relate them to both our past experience, current inherited policy, and future energy problems that are becoming so readily apparent and will become even more so in the months and years ahead.

While I will resist a politically partisan discussion, I will engage the discussion in disciplinary partisanship. After all, I am an economist and I tend to favor an economic solution to many of our social problems. I will also try to highlight and isolate the role that education plays and, more importantly, is capable of playing. At the outset, I am sorry to report that, I believe education is failing.

I spend a lot of time teaching and lecturing at different universities around the country. I recall the first Earth Week in which I spent a good deal of time traveling from one campus to another speaking about environmental problems. I have not forgotten one of the speakers, who after a

rather long day of discussion and debate stood up to summarize the day's discussion. He concluded that there were four basic solutions to our environmental problems. His summary could also be applied to the solutions of our energy crisis. But the most astute thing, he said, was that the preferred solution to the problem depended upon the discipline of the speaker.

He pointed out that engineers proposed highly technical solutions. When it came to environmental problems, they saw a giant plumbing system could solve our problem of pollution merely by connecting all the various interdependent parts of society into one giant recycling and reprocessing system in order to keep the world clean and provide new resources for future economic growth. When it comes to applying that same kind of engineering logic to solving our energy problems, we hear of new technological solutions to get oil from coal, to get energy from the sun, to get energy from the atom, to find ways of going deeper down into the earth's core to pull out oil, natural gas, coal, uranium, etc.

The educational solution is also frequently proposed. It is believed that if we can just change the way people think about energy, and the environment, we can solve our resource problems. This is the basis of the current educational process in the primary and secondary schools in this country. Achieving a change in philosophy, a change in mentality, a change in the way people think, will lead to a voluntary approach for solving our environmental and our energy problems. It is averred that education could change taste, preferences and the way in which we make our social decisions, spend our public dollars and conduct our private lives.

The third approach is the lawyer's regulatory approach. To many people environmental or energy problems require new forms of federal, state and local regulations. These include regulations to prevent pollution; to achieve pollution-free automobiles; to achieve new building codes and standards for insulation; to achieve improved mileage ratings for automobiles; to improve efficiency ratings for appliances. In other words, it is believed that a regulation for this-that-and-the-other aspects of our public, private, corporate, farming and day-to-day lives will solve all our resource problems.

Finally, there are the economists. (Applause!) Our proposed solution is premised on a belief that price signals can and should play an important function. We economists believe that we pollute because the environment, although an important factor in the productive functions of our society, is treated as a free good because it is not owned by anyone. Our credo is that by imposing a tax on the environment, we will achieve a reduction in its use and, therefore, an improvement in its quality. We have similar views with respect to energy. Energy will be scarcer in the future than it is today. Paraphrasing the President, current energy prices are based upon yesterday's cost when tomorrow's costs and problems are expected to be much more significant. This leads to serious mis-signals for society and, therefore, leads to the overuse of energy, as well as, extra destruction of the environment.

There are four philosophies, or approaches, for solving the social problems of energy, conservation, energy supply, and environmental protection. I have a strong belief that in solving and resolving our energy and environmental problems that a combination of all four of these approaches and philosophies must be utilized. However, I also believe strongly that

the last one, the economic approach, has not been adequately used or considered by society.

This all serves as a proper introduction to my views on President Carter's proposals. The thing that I find most striking about his proposals is that while he has all four ingredients in his package, for the first time in the last forty or fifty years, the economic-incentive approach for solving a national problem has come to the forefront. This is not surprising, when you count the number of economists in his cabinet that he has advising him on energy policies. But it is very different from the traditional "bucks and bureaucracy" approach to our growing list of problems.

The President's energy plan is based upon a strong belief that our energy problem is quite real. Rather than utilizing the tried and true, and even though they have often failed, solutions of the past four decades, he has rejected almost entirely the regulatory solution. Since I believe past regulatory solutions for energy have caused many of our current energy problems, I am delighted. He has recommended solutions built on economic choice rather than on prohibitions, such as not permitting the construction of big cars. Instead, he has proposed a system of rising taxes for those who want big cars, in order to force them to confront the true economic consequences of that decision.

The President has proposed the system in which the old fashion notion that "merit matters" is an essential ingredient. He has a system that has a series of well-defined economic signals to replace the very much outdated and poorly framed sets of regulatory responses.

There are some other important aspects of the President's philosophy. First, rather than simply letting our nation's energy prices becoming completely dominated by the OPEC nations, the President has proposed a system of very selective well thought out taxes to restructure price signals for consumer decisions. Energy consumers in their homes, in transportation, on the farm, or industry, may pay more for energy, but this revenue will be returned directly to the economy. This is the first time that I know that government has proposed a very dramatic and fundamental tax collecting device that is not meant to bring about a growth in "bucks or bureaucracy." The refund mechanism is quite complex and sophisticated, but an essential fact is that this program is not meant to lead to more government. In fact, its philosophy is to replace government with economic signals without resulting in any one part of society keeping too many of the dollars so collected.

Another part of the President's proposals which I find fundamentally different from the past, is that his proposals include what I call a diminishing tax base. The President has proposed a series of social vice taxes. Taxes on things that we want to see society use less of, but which we are not going to regulate. If taxes on energy waste and inefficiency work, the tax base itself will be destroyed and the government's income at the same time will be reduced. This is a completely different approach to any other tax system that we have used in this country. We usually have tax bases which are going to be growing or constant, in order to adequately predict the tax revenues that government needs to conduct its multi-faceted activities. For example, we tax incomes, property, sales, things that we expect to be increasing over time to yield more tax revenue, even if the tax rate

does not change. Taxes on energy waste are expected to result in less energy waste and, therefore, a diminishing or vanishing tax base. This is a very significant change in the way in which our society has attempted to solve problems.

The President has proposed spending more money in the form of negative taxes on subsidies for people, who switch to solar energy or wind power, who put extra insulation in their homes, who buy smaller cars. Again, market signals are being utilized to bring about these important social goals. The President's system would tax those who use or abuse society's scarce resources.

Voluntarism, changing mind-sets through education, might also achieve the same result. The problem is that members of society who follow a voluntary and socially redirected approach in their daily lives, are often bothered by the fact that others are ignoring their social responsibility, and "taking a free ride." This makes a continued voluntary life style very difficult to sustain either for large numbers of people or for a very long period of time. By combining the voluntary/education philosophy with the social-vice tax, those who take the voluntary approach, who drive smaller, more efficient automobiles, who take mass transit, who do not pollute the environment, will be sustained and encouraged by the knowledge that other members of society who reject those voluntary actions will be paying a higher set of taxes in order to continue their wasteful, inefficient and environmentally destructive life styles. Changing life styles with economic incentives in conjunction with a voluntary education in approach can achieve more than either single approach could alone.

The President has also proposed an elimination of some of the regulatory policies which have encouraged us to leave natural gas in the ground by eliminating the two-tier natural gas pricing system. The President in this way would eliminate the profit speculation resulting from leaving gas in the ground. The President has also proposed a series of taxes to discourage those refiners who have switched to oil imports expecting higher prices when "old" domestic oil was expected to be decontrolled. Oil profits would no longer be increased by holding back production under the President's plan.

As an additional production incentive, there will also be additional profits for oil companies who drill, find, produce and supply new oil. After decades of oil companies marching off to Washington with their legions of attorneys, special interest advisors and lobbyists to get favorable treatment, this is truly a remarkable proposed change. President Carter has selected fundamentally different approaches to national problems in general and to energy in particular.

I am not trying to say that the economic approach is the only solution. I tend to think of it more as a glue that reinforces the technological and engineering solutions by rewarding those who find the solutions. I prefer this to the more traditional approach of simply spending more government dollars to subsidize new research and development. Economic incentives also provide the glue to make the educational and voluntary approach stick for the length of time needed to matter. But most important, it provides the glue that is necessary to create a new structure, as we untangle the hopeless maze of "compensating irrationality" now found in our often unnecessary

and inconsistent energy regulatory policies. For too long these foolish regulations have driven this country deeper into our current energy crisis. If left unchecked, these regulations will bring us even closer to our long-term energy scarcity problem. The President has understood all this and seeks to change it. I unabashedly praise him for it.

I would now like to turn, in my final time available, to the question of how we should go about teaching primary and secondary levels about the matters concerning energy and environment that I have been speaking about today. Let my remarks take a critical tone and let me try to tie them into points of view that I have been expressing.

First, I would characterize current efforts at teaching environment or energy to primary and secondary levels as being based on the philosophy that schools should teach students to have an environmental and conservation awareness. In other words, schools should teach people to understand the so-called good life, and the way in which members of the human race are part of nature, rather than simply meant to utilize nature in ways which will lead to its destruction.

In a critical way, this approach to teaching is what I would call special interest formation. This is not necessarily bad, but it is built upon a premise that two things will happen: first, that a voluntary approach will reduce these problems; and second, that a more highly educated, informed and aware citizenry can and will affect the political process. My remarks today should indicate that I am very skeptical about either of the premises, in and of themselves, being capable of bringing about the necessary solutions.

I believe that citizens who practice voluntary conservation, voluntary reductions in the way in which they pollute or destroy the environment, are very desirable. I believe informed citizens, although highly diverse and not well organized, who are environmentally aware and energy conservation oriented, are to be preferred to citizens, who are not so educated or who do not think this way. But by themselves, I do not feel accomplishing these objectives is enough.

First, we must understand the way in which decisions are made in our society. We have to understand the way special interest domination of regulation, legislation, and legal solutions has caused our resource problems to become far greater than they otherwise would be. Second, we have to understand that voluntary solutions by themselves are very difficult to sustain if other members of society can totally ignore and abuse the very things that the voluntarily good citizen is giving up. Third, we have to admit to students the fact that while all of these objectives are good and desirable, by themselves they may not be sufficient. Fourth, we have to accept that replacing our regulatory philosophy for solving our problems with economic solutions makes sense. Fifth, we have to tell students that it is not enough to say that we want to encourage a sustainable energy society and renewable forms of energy, such as solar energy. Indeed, we have to train engineers who are willing to work on such solutions.

In other words, we have to tell our students that thinking good thoughts about energy and the environment is not enough. We need scientific breakthroughs to solve many of the unanswered questions. We need social and institutional reforms, as well as lawyers to think through

and find new ways to solve these problems. We need to devise new regulations that are necessary and not just to compensate and cancel out the old regulations. We need to find ways of eliminating some of the old special interests.

Finally, the most important thing of all about teaching environmental and energy matters is a lesson which I have learned in my own teaching, particularly at the introductory undergraduate level. We must be frank and honest with our students. We must tell them that we do not have all the solutions for our energy and environmental problems. Indeed, we do not even know, how to ask or frame all the questions. This has two effects on students. One, it shows them that there are a great many challenges which await them when they finish school. It is important for students to be motivated by the fact that society requires their talents.

When students pick up the newspaper and hear about the massive amounts of unemployment, when they worry about whether society will be able to continue to have economic growth, it makes them wonder whether they will have a role in our future society. Certainly the energy and environmental problems we face mean that we need lots of hard-working, highly technically trained, and highly-motivated individuals to solve these pressing problems.

The second effect of telling students that we do not know all the answers to these questions, is that our credibility as educators is increased. We will also help students realize the complexities involved in our energy and environmental problems which are not amenable to simple solutions. This will help motivate students to develop technical skills and not just learn the right political position. It will have the effect of making students want to learn more about the problem, and to study more deeply in some of the traditional disciplines so they are better equipped to relate to these complex multi-disciplinary matters. My own experience with telling students "I don't know the answer," or even the best question associated with energy and environmental problems, has had one of the most positive and profound effects of any of the teaching experiences which I have been lucky enough to experience.

On the positive side, from what I understand of the energy and environmental curriculums in this country which I reviewed as part of putting together this speech, I would say that the best curriculums are those which emphasized student involvement in local environmental and energy-related issues. Students who become involved will immediately see that the world is not simple. Most of our social decisions are tradeoffs between the three "E's"! Environment, Energy and Economy. There are some solutions, which will help minimize the amount of tradeoff that any one of the "E's" will have to make. But as we look out over the global, national, state, local and even school-oriented problems, it is most important to think through clearly and to involve the greatest number of people in solving these three interdependent problems, at these different levels. In this way, we can hope to make the future world a better place to live; to produce a healthier, cleaner and more enjoyable environment; to develop a society in which individual effort is rewarded; and to sustain an economy that will continue to grow in strength and vigor, but with perhaps not quite the same dependence upon resource extraction and utilization as it has in the past. Despite my obvious cynicism, schools and their functions of teaching confidence building and motivation are the kinds of things that

make me an optimist about the future. As I have recently moved from teaching to public service, I envy the important role you can directly play in accomplishing some of the tasks which I have hoped to convince you to accept today.

Thank you and good day!

## SESSION II

## THE ENERGY AGENDA AT THE OFFICE OF EDUCATION

Commissioner of Education Ernest L. Boyer outlined the Office of Education plans for energy education. Focusing on the three "E's" of energy, environment, and engagement, Boyer proposed the establishment of an Energy/Environment Action Center in the Office of Education to provide information and technical assistance to schools and colleges; to support the training of new energy and environment professionals; and to initiate the development of new curricula materials focused on the three "E's".

# THE ENERGY AGENDA OF THE U.S. OFFICE OF EDUCATION

Ernest L. Boyer, U.S. Commissioner of Education, Office of Education, Department of Health, Education, and Welfare

## I

A decade ago Arnold Toynbee observed that we have conquered nature, and that now our great unfinished task is to conquer self.

He said that humanity is our most formidable enemy today. We ourselves are more formidable than wild beasts, our oldest foe; and more formidable than disease, which, for the most part, we can now control.

The time has come, Toynbee said, for humanity as a whole to unite against the common enemy in itself. The great irony of our time is that humanity may be destroyed, not by its madness, but by its carelessness -- by its wanton disregard for its special relationship to the planet earth.

Catastrophes of course are not uncommon. We have, since humanity first stirred itself, faced wars, disease, hurricanes, and flood. These calamities have struck; they have taken their toll; and they have departed, leaving us to rebuild ourselves.

I'd like to suggest that the crisis of which Toynbee spoke -- our use and misuse of nature's resources -- is a disaster of a different kind. Unlike flood or hurricane, it is a dilemma we have made ourselves. Unlike disease, there is no miracle drug which can provide an easy cure. And unlike war, there is no armistice in sight.

The energy crisis we confront today will be with us for as far ahead as we can see. It may fade away from the headlines from time to time, but it will remain a crisis that -- whatever our good intentions, whatever our appeals to technology -- simply will not go away.

For two hundred years, we have believed that man's initiative and ingenuity could build a humane civilization from nature's resources. We've witnessed the miracle of production and construction. We've praised human ingenuity and scientific knowledge for this progress -- we've given very little credit to the raw materials of our earth or to the several hundred million years required to produce the fossil fuels we've used to power this civilization.

But whether this new kind of crisis becomes a catastrophe is largely up to us. In explaining the urgency of his national energy plan, President Carter noted that "with the exception of preventing war, this is the greatest challenge our nation will face during our lifetime." And he added, "It will be a test of our basic political strength and ability. But we have met challenges before and our nation has been the stronger for it. That is the responsibility that we face -- you in the Congress, the members of my Administration, and all the people of our country. I am confident that together we will succeed."

Today our earth has begun to show signs of the strain of sopping up the wastes of our constantly accelerating energy use.

We are running out of known resources of gas and oil -- the fuels that represent almost three-quarters of the energy upon which the U.S. economy depends. Both resources have begun an accelerated decline. The world supply will begin to fall in little more than a decade. This is a physical fact, a physical problem.

Suddenly, we are beginning to discover that exponential growth is not forever possible in a finite world. This is undeniable, no matter how badly we may want it to be otherwise.

Like all systems that have been jolted out of their inertial pathways by some massive interruption, the total human system is calling on all its parts to find new energy sources that will enable us to continue solving all our societal problems by more growth.

But to seek new sources of energy in order to build even more sprawling and random additions to our urban jungles, and to fuel our luxuries, seems sadly unrelated to the true nature of our problem.

It is true that alternative forms of energy may help us cope as our oil and gas gauges plummet toward zero. But to think that the chief task of a world with dwindling resources is to hunt for new resources to exploit is myopic vision at its worst.

It makes a false assumption. It presumes that our present style of life can continue. It leaves unchallenged the idea that our centuries-old energy binge must roll ahead. It rests on the idea that our obsessions with endlessly expanded production, insatiable consumption, and carefree waste and pollution can be fed indefinitely.

Here's my point. The energy crisis we now face will require not only new technology, but new values and new attitudes as well. We must change our habits of consumption. We must approach self-indulgence with a new perspective -- an understanding that we are members of a human community, with a common plight and a common fate. And all of this is closely tied to our nation's schools and colleges.

Specifically, I believe energy, environment and education are linked together in three fundamental ways:

> First, this nation's schools and colleges are major consumers of energy. They, like the rest of society, must learn to cut back on consumption.
>
> Second, education must train individuals with the technical know-how to lead us toward a conserving society. New careers require new educational preparation.
>
> Third -- and perhaps most important -- we must embark on a revolution in values. Our schools and colleges must confront today the realities of the 21st century, and begin to focus on the perspectives and attitudes that will be critical in ensuring our global survival in that era.

Each of these tasks -- conservation, training, and curricular change -- represents a major challenge to our educational system. With the right leadership and vision, I believe we can succeed.

II

Our nation's schools alone consume 11% of the heating and cooling fuel in this country, yet it has been estimated that almost half the energy they consume is wasted, because school buildings were constructed without regard to energy conservation. There are 79,000 elementary schools in the United States. The most conservative estimate available indicates that at least 50% of them need major retrofitting.

> The Federal Energy Administration has estimated that if only 30% of the nation's elementary and secondary schools were to become energy efficient through renovation and winterization, then 25 million barrels of oil could be saved each year.
>
> The Department of Commerce has indicated that with no capital modification at all -- simply by changing operating methods -- schools can reduce their energy consumption by 5 to 25%.
>
> With minor capital modifications, involving very small expenditures, another 25 to 35% could be saved.

In 1972-73, the schools spent $1 billion on energy. In 1976-77, the bill was over $2 billion. This amounted to $19.81 per student in 1972, and, last year, $41.60.

In late 1976 projections told us that the cost of gas, coal, and electricity would increase 20 percent annually through 1980. Thus, in a little over three years, most fuels and electricity will cost double what they do today.

School districts will have no choice but to find more and more ways to conserve energy. Some will establish full- or part-time "energy coordinators," and energy conservation teams. They will develop energy management plans and conduct school energy audits. They will adopt good plant maintenance practices, including preventive maintenance. And they will ensure that new construction is designed and built to save energy.

III

But schools and colleges, of course, are more than physical plants. They also provide the knowledge and skills necessary to embark on careers.

What new professionals do we need today, and will we need even more by the end of the century? The process of refurbishing suggests one kind of skill now in demand: the ability to give new life to old buildings. Maintenance workers will have to have their skills upgraded. Architects and city planners will need to learn new techniques of design. If coal is to be a short-term solution in our transition to a conserving society, then we will need to train professionals in new mining technology. We will need environmental experts capable of monitoring the public interest in that

industry. Solar and wind energy generators remain a dream and a promise; we need the personnel who have the skills to translate that promise into reality.

Universities, it seems to me, must focus their great research capacity on the problems of pollution, and find effective ways to clean our air and clear our waters. Is it too much to expect that, in time, we might have non-polluting cars, non-polluting energy, and non-polluting detergents? To be sure, we are already making some progress in this direction. This is encouraging, but we still have a long distance to go.

We must search for ways to use our science and technology, not to promote endless growth and unproductive opulence, but to enable us to breathe clean air, to drink pure water, to conserve our natural resources. In other words, we must learn to live like civilized beings within the restraints of nature -- restraints which can no longer be ignored with impunity.

IV

Schools must conserve. They must contribute to the training of workers in the new energy and environment fields. And they must do more: they must teach our children and ourselves about the wider nature of our energy dilemma, and must equip our society with the understandings necessary to remake our society in the light of that dilemma.

I realize full well that what I am advocating is that wrenching occurrence known as "changing human values," a psychic event that is often as cataclysmic as the earthquakes and volcanoes that change the real territory.

We must start at the simplest level: awareness. A recent Gallup poll suggests that, if Americans were taking an examination on the energy problem, many of them would flunk. Only half the public -- 52% -- knows that America must import oil to satisfy its current energy demands. And of those, only a third -- 17% -- have an accurate idea of how much petroleum the United States imports. Today three out of ten college-educated citizens think that the United States produces enough oil for its present needs. Most Americans just don't know or don't realize how big those "needs" actually are: while we make up a mere 6% of the world's population, we consume a third of its energy.

But awareness alone is not enough. I submit that all of us in education must constantly stress the need to understand and to respect the unity of life -- a unity within which the energy problem can be seen as one part.

In the late 1960's we began to notice that something was happening to our natural world -- the world of physical/biological systems like air and water and wildlife -- and we called it "the environmental crisis." We responded to it in the educational community by developing a fragment we called "environmental education," and we tacked it onto our institutional machine like a bumper strip and congratulated ourselves on a good job.

Just the other day we began to notice that our human world -- the world of societal systems like economics, government, industry, and even education -- was in trouble. It was running out of the energy fix it requires to keep it developing along traditional growth lines. The immediate reaction was to run out and invent yet another fragment and call it "energy education."

This time I have high hopes that we can resist the fragmented approach. With the so-called "energy crisis," enough of the pieces of our real problem have been identified that we can at last begin to see the whole picture. Our many problems are one problem -- they are of a piece, and they cannot ever be "solved" in the sense of arriving at some Utopian conclusion. They are the problems of complex systems in constant motion, and approaches to solutions must take the same dynamic path -- must be able to shift to new modes as the problems shift.

For the first time in the conscious history of mankind, we are becoming aware of the many pieces of our puzzle, and they add up to one interrelated system -- the complex web of human culture and society with all its interrelated parts, and the physical/biological world within which the human-built world is embedded.

One of the tragic by-products of our age has been the inevitable "breaking up" of knowledge -- and for this we have paid an awesome price. In our drive for progress, we have become specialists and have fragmented our efforts. In doing so, we have collided disastrously with nature and, indeed, with truth itself. In spite of its diversity, nature -- like all truth -- spins a marvelously unified web.

If this is so, how can perspective be maintained? How can "unity" be preserved? How can balance be restored? The answer seems to be, at least in part, in the way we educate ourselves and in the way we think about ourselves. We must see more clearly and understand more completely the unity of our world, not just in a physical sense but in a social sense as well. We must constantly remind ourselves that nothing is ever wholly destroyed, and that all of our moves on this planet -- whether physical or social -- are intimately interlocked.

And in this effort the schools and colleges will be crucial. They will have to abandon the fragmented approach to knowledge and the shattered perspectives from which we examine our globe. They will begin to address themselves to the part of us that lives in a community and relates to other human beings. The schools will begin to ask what we have and hope in common, and from this common human agenda will derive a curriculum to highlight and strengthen the linkages among ourselves and with our common future.

On other occasions I have suggested that reading and writing -- as the fundamental tools for all communication and all learning -- should be part of a common core curriculum. But the "three R's" are not enough. Perhaps our schools and colleges need also to look more broadly at the earth that houses them and the society that depends on them. Perhaps they need to realize that the energy challenge will confront us all for the rest of our lives; that our environment is shaped by our patterns of energy consumption, and is passed on as a legacy to all of our children; and that our plight in this nation is determined also by our active, inter-dependent engagement with all nations.

Perhaps these three themes -- energy, environment, and engagement -- could also be keywords in our nation's education system. Our common core might perhaps extend beyond the traditional "three R's," and into these new "three E's" as well.

I've sketched three ways that education can respond to the new realities made more dramatic by our nation's energy needs. Schools and colleges can be wiser energy consumers; they can provide the technological know-how and training for the new energy and environment professions; and they can develop curricula which put today's energy crisis within the context of our single, precious, incredible, common earth.

V

In all this, what can the United States Office of Education do?

I propose that the Office of Education establish an Energy/Education Action Center which will have as its mission the coordinating of all the various Federal Agencies' educational responses to the President's energy plan.

The three educational goals of the center will be:

The providing of information and technical assistance to schools and colleges as they move toward effective energy conservation;

Support in the training of new energy and environment professionals; and

Leadership and support in the development of new curricular materials focussed on the "three E's."

The Energy/Education Action Center will work closely with all units and interagency committees of government which are concerned with education's response to the new energy realities. It will draw on the staff, resources, information, and good will of those units. Through the use of inter-Bureau teams, the Center will also bring together OE program personnel responsible for the scores of existing energy- and environment-related programs in the Office of Education in order to focus their work more effectively on the goals of conservation, training, and curriculum. We will direct available discretionary funds on these goals, and will develop plans to target new discretionary monies toward those ends.

Projects undertaken by the Center might include:

Serving as an information and technical support clearinghouse for all Federal Departments, Agencies, and committees with education programs in the energy conservation and transition areas;

Developing a media appraoch, including the use of educational television programming, to spread public awareness and disseminate technical know-how;

Encourage the development of new curricula addressed to our fundamental global interrelatedness;

Sponsoring curricular innovations and demonstrating programs at all levels of education;

Developing curriculum guides in fields like insulation, solar energy, and resource conservation;

Preparing a technical assistance plan to help schools conserve;

Installing a toll-free telephone line to provide immediate technical assistance and curricular guidance; and

Building effective links between the government and the private and non-profit sectors.

We hope to be a magnet for all federal efforts in educating our nation toward responsible membership in a conserving, interdependent world. We hope to aid the major national educational associations as they confront the new energy realities. And we hope to be of service to the state departments of education and local school districts as they formulate their own plans of action.

VI

In the few months that I've been in Washington, I've been struck by the frequency with which people in the world of education refer ominously to "next winter" whenever they speak of energy. Facilities and maintenance are important, to be sure, and restructuring must be part of our national conservation effort. But we must break free from the mentality that equates our "energy crisis" with last winter or next winter, or any winter, of our discontent. "Crisis" -- to return to its Greek root -- means "decision." Let us decide today to abandon our panic and siege mentality. Let us decide to see today's worries about gas and oil as the signal of a much more profound, much more transcendent problem in our relations with our globe and with one another. Only in that broader context, only in the context of who we are as a society, and what world we want our children to inherit, can anyone's energy agenda make sense.

## SESSION III

### ENERGY RESOURCES: SCENARIOS FOR THE FUTURE

Edward J. Hanrahan, director, Office of Analysis Division of Planning and Evaluation, Energy Research and Development Administration, opened this session with a description of the administration's projections of our energy future. Basically, Hanrahan described a future world gradually diminishing its reliance on finite fossil fuels such as oil and gas while utilizing coal during the transfer to an age fueled by alternate renewable energy resources such as nuclear and solar.

Earl Joseph, staff scientist with Minnesota'based Sperry-UNIVAC, gave the first reaction to Hanrahan's scenario. Joseph predicted that high technology hardward now in the development stages would be the primary means of combating the energy crisis.

And finally, Joanna Underwood, director of INFORM, New York City, challenged the previous futurist scenarios as unrealistic to our needs. Underwood sought a reordering of economic incentives to reflect realistically the cost of energy to society. Resolving the energy crisis, then, would force changes in consumption patterns and values according to reality.

# ENERGY RESOURCES: SCENARIOS FOR THE FUTURE

Edward J. Hanrahan, Director, Office of Analysis, Division of Planning and Evaluation, Energy Research and Development Administration with the assistance of Frank C. Emerson

I appreciate the invitation to talk with you today on energy resources and their likely and possible impacts on life in the future.

As is apparent to virtually anyone following the news these days, developments in energy policy and technology are the subject of a wide variety of speculation and cynicism and of optimism and pessimism. In addressing a wide-ranging topic such as this, what I hope to be able to do is to outline a number of the possibilities, but, in doing this, attempt to give some notion of which sorts of future developments are somewhat unlikely to occur. In an area which is such a fertile ground for the exercise of ingenuity and imagination, I think that much is to be gained by emphasizing some of the fundamentals. This is particularly true when we attempt to suggest the possible effects of changes in energy systems upon future life styles.

Any consideration of the effects of energy systems on future life styles must recognize a broad range of interacting factors. These include: (a) the structure and growth of the population, (b) the make-up and growth of economic activity as it affects the occupational skills in demand and goods and services produced, and (c) the location of economic activity.

In envisioning the likely changes in life style in store for your students, there appear to be some fairly predictable effects which arise from the age structure of the population, in particular the decline in births which has been quite apparent during the last 15 years or so. One source of optimism arising from this is that the age cohorts which leave school to find employment in the mid-1980's are likely to have an easier time landing a first job than is the case for the unprecedentedly large age groups now entering the work force. It is not difficult to speculate that the job seekers in the mid-1980's will, however, discover that the chances for advancement may be hampered by the relatively large numbers of people from the baby boom years who have moved into their late 20's and 30's. This, it seems to me, means that there will be a real premium on the ability to enter new and expanding fields either through initial training or through the ability and willingness to shift occupations in order to improve the chances for advancement. Of course, changes in the age structure of population can have very major implications for employment in particular types of activities. I'm sure that no one involved in education needs to have an invited speaker emphasize this.

The type of employment in which people find themselves engaged has been undergoing some notable shifts over the years, and it is unlikely that the general directions of these shifts will be quickly reversed. In particular, the service industries, including retail trade, communications, public services and the like, have been employing an increasing share of the work force over the years. The manufacture of goods has been losing its share of the work force for a number of years, as capital-intensive and energy-intensive technologies have made productivity and wage increases possible. It would be surprising if recent high energy prices and the

possibility of further major increases in energy prices were not to slow the historic rise in industrial productivity and slow the relative decline in industrial employment.

Finally, we should make note of the effects of, and trends in, the location of the population. This can have obvious implications for the way in which people spend their time and the uses for which energy will be demanded. Over the two centuries of the nation's existence, we have seen an almost continuous flow of population from the rural areas into the metropolitan areas. In 1776, only about 10% of the U.S. population was living in urban areas. Now, the vast majority are clustered in a few hundred metropolitan areas having a population of more than 100,000. There has been a notable shift, particularly within the last decade or so, in interregional migration. The newspapers these days have frequent reviews of the relatively rapid growth of the so-called "sunbelt" areas and the slower growth or, in some cases, decline in the old industrial areas -- the midwestern and northeastern "snow belt."

In contemplating likely changes in life style and the influence of energy systems upon them, I would now like to make a number of observations more specifically related to energy. Today, we are contemplating how life may be during the period leading up to the year 2000, which may seem a long way away. This, however is only 23 years in the future, when this year's graduating class of high school seniors will be turning 40, and still have the majority of their working lives ahead of them. If we simply measure the passage of time in terms of years, the year 2000 is only as far in the future as 1954 was in the past. There have been major changes in the make-up of the U.S. energy system since 1954, but they have been evolutionary, not revolutionary. Only nuclear power has come on the scene as a major new energy source over this period.

The national energy system which we have inherited is now one where 75% of energy consumption is supplied by oil and natural gas. Coal usage is undergoing a painfully slow renaissance and has climbed back to the point where a little over 18% of U.S. energy is derived from this source. As in the early 1950's, hydropower continues to provide approximately 4% of our annual energy needs. Nuclear power output has risen from essentially nothing in the early 1950's to about 3% of total U.S. energy input. Last year, about 10% of the country's electricity was supplied by nuclear power, and the proportion was somewhat higher during last winter's cold spell.

If we look at long-term trends in energy use and in the economy, what we see, for the last quarter century, is a rise in energy use at a rate of about 3% per year and a rise in the real value of national output of about 3½% per year. If we plot graphs of the energy input to the economy along side of the constant-dollar market value of output of the economy, we see a striking parallelism. The long-term trends are up; but when energy use falls, national output falls. There are a number of studies around indicating that, by the end of the century, it should be possible to somewhat decouple energy and economic growth. Perhaps we can have a high standard of living without continued rapid growth in the use of energy, but any major adjustment of this sort is unlikely to be completely painless.

Major Factors Influencing Future Choices

I believe that it is fair to say that, in the past, the costs of carrying out economic activities, as measured in straightforward dollars and cents terms, have very strongly dominated the choices which have been made. The availabilities of different types of fuels and other commodities, together with a long period of rising per capita incomes, have served to determine the collection of human, natural, and man-made assets which we now have to work with. For example, the shift away from the use of public transportation and toward the private automobile for moving people, and from railroads and barges to trucks for moving goods have been very logical choices in view of the prices and alternatives open to decision makers in the past. The shift, in the past, from the use of coal to the use of oil for producing electricity principally involved changes -- and they may be relatively minor changes -- at the power plant. Such a fuel shift can take place with essentially no changes in the electrical transmission and distribution system. I mention this example to emphasize that, in the future, our choices -- whether we like it or not -- will be affected by the existing stock of facilities. For very many activities, it is simply easier to make an adaptation to an existing system than it is to start all over. For example (a) a new mode of highway transit can, with little adaptation, use the existing highway, street and road system; whereas a new rail system for carrying the same number of passengers may require very extensive and expensive construction of the sort which you see on and under the streets of Washington. (b) A new source of gaseous fuel, especially one which is an essentially perfect substitute for natural gas from the sources which we have been using in the past, such as gas from a coal gasification plant, can easily use the existing transmission and distribution system. A radically new source of space heating or process heat, such as solar energy or methane produced from a home or plant's own wastes, may well require a complete new system on the premises of the user.

Of course, on environmental grounds, many of the new systems may be clearly preferable to those which we are now using. I believe that the experience of the last decade has shown us that future choices of energy systems, of components of these systems, and for the locations of these parts of the energy system -- will be more strongly affected by environmental considerations.

In mentioning characteristics of energy system choices for the future, I should briefly comment on what many regard as a major issue, that of centralization vs. decentralization. Some seem to regard the apparent centralization involved in building large energy facilities, such as power plants, oil refineries, and the like, as undesirable -- or at least less acceptable than decentralized energy systems such as those relying upon individual solar heating units. I think that it is difficult to argue convincingly that the energy developments of the last half century have made consumers in the economy worse off by contributing to centralization. There are a number of countercurrents at work here. For instance, farmers in the northern Great Plains willingly gave up individual household wind-powered electric systems when they were connected to distant generating stations by an expanding electrical network. Certainly employment over the last century has become more concentrated in the large metropolitan areas which have been fueled, first by coal, and now by oil, gas and nuclear power. But the era of cheap petroleum -- which is ending -- has contributed very strongly to

the decentralization of not only residences but employment within metropolitan areas. The long-term trend towards a loss of population within the central cities of American metropolitan areas testifies to a type of decentralization which is facilitated by existing energy sources. My own feeling is that the issue of centralization vs. decentralization is essentially one of individual choice. As new decentralized energy systems become available, consumers and businesses will choose to use them -- if they provide energy more cheaply, cleanly, and more reliably than alternative centralized systems, or have appeal on other grounds.

All that I've said up to this point is really by way of providing a background for what will be a relatively broad brush sketch of energy systems that we're likely to be using in the future. Cost and environmental acceptability are likely to have the dominant roles in the choice of future systems. Much of the infrastructure of wires, pipes, generating facilities and the like which were in place five or 10 years ago will still be in service at the end of the century. Given the long lead times for the construction of new major energy facilities -- on the order of 8 or 10 or more years for a nuclear power plant -- it would be quite surprising if the energy system which we will be using in 1985 were radically different from what we now see. The notion of a speedy revolution in the American energy system may be an appealing one, but I believe that a carefully reasoned evolutionary shift in directions which are already apparent is the more likely outcome. In any case, such a course is likely to be the more cost-effective path to take in adapting to major changes in our circumstances.

## The Next Eight Years

With this as background, I would like to briefly outline likely developments over the relatively near term, the eight years through 1985.

Oil, which currently supplies about 47% of the energy consumed in the country, will very likely remain our major fuel in the near future. The problem here, in terms of public policy, is most obviously that of balancing the risk associated with our burgeoning oil imports against what could be relatively high short term costs involved in drastically reducing our dependence upon foreign oil. Oil production in this country has been declining for well over five years now. We now rely on imports for between 40% and 50% -- depending upon short-term demands -- of the oil which we use. There is likely to be a fair amount of displacement of oil by coal as an industrial and utility boiler fuel. It is likely, however, that petroleum will remain the near-term fuel of choice for transportation. And our prospects for reducing the use of petroleum products in transportation are somewhat mixed. On the one hand, we have the baby boom arriving at the age when it is normal for an American to cut the apron strings, buy a car, and drive off to an apartment. We now have enacted, however, requirements which are likely to lead to rather dramatic improvements in the fuel efficiency of new cars. Nevertheless, it will take a long time to replace the existing fleet of autos in the U.S. Many of today's new cars are likely to be guzzling gasoline in 1985 -- unless there is a change in public policy which makes their continued use very expensive. In addition to shifting to smaller cars, there are a variety of transportation conservation measures which we can use today. Where available, public transportation has obvious benefits -- the passenger miles produced per unit of fuel are much higher than for passenger automobiles. Car pooling -- sharing the ride -- can easily multiply

the number of persons served per gallon of fuel by a factor of two, three, or more.

There has been a popularized debate going on for several years now regarding the possibilities for increasing U.S. oil production. Certainly we expect to see a modest rise in domestic production as the Alaskan North Slope oil fields come on stream this summer. Both industry and government have been investigating ways of increasing the supply of domestic oil. A number of technologies which will increase the recovery of oil from existing reservoirs are in use or under test. Currently, we get about 2% of our oil through these enhanced recovery methods. Perhaps there is a major breakthrough on the way here, but I'm dubious. In thinking of oil, the facts which strike me are that, in recent years, 80% of the oil and gas wells drilled on earth have been within the U.S.; and during this period our oil reserves have been continuously declining.

Of the energy consumed in the U.S. during 1976 about 27% was natural gas. About 36% of the energy produced in the U.S. last year was natural gas, making natural gas the principal fuel produced in this country. Natural gas has undergone a rapid evolution in status from that of being a waste by-product of petroleum production in the early part of this century to being a premium fuel in short supply during the last few years. Price ceilings, together with its desirable clean-burning qualities have combined to give us the current situation -- one where, at interstate prices, more gas is being demanded than is being supplied. We have a large efficient distribution system for natural gas in place in this country. If additional supplies can be found, there appear to be few problems involved in getting them to the consumer and in using them. So here, the interesting question, as with oil, is that of the possibilities for increased domestic production. Industry and government are currently investigating the potential for producing additional natural gas from known, or at least suspected, sources which have not previously been exploited. Much of the problem here appears to lie in present gas prices which have been lower than what appear to be necessary to encourage the exploitation of some of the less promising, but nevertheless known, prospects. Two potential sources of natural gas being investigated by ERDA are those in the so-called Devonian shales underlying much of Appalachia and the middle west and the so-called geopressured methane under the Gulf Coast. The geopressured methane, in particular, has been estimated to contain truly huge amounts of gas. The problems with this resource are a combination of deep drilling, extremely high underground pressures, and the large amount of brine in which the gas is dissolved. The brine would have to be brought to the surface and then -- the hard part -- disposed of in an environmentally-acceptable manner.

As is the case with oil, gas can be conserved by replacing it with coal, where it is used as an industrial and utility fuel. Since gas is the major home-heating fuel, training future consumers to use lower temperatures, better home insulation, and better control of use, such as turning down the thermostat at night, can have obvious conservation, as well as financial, benefits.

Coal, as I noted earlier, is staging a slow comeback. There are currently plans for the rapid development of a very large coal resource which has been largely unused in the past -- the low sulfur, low-energy-content coal underlying much of the northern Great Plains. With coal, there are a

variety of problems amenable to technological solutions. These include repairing the environmental damage involved, particularly in surface mining, and the collection of ash and sulfur oxides released upon combustion.

One rather promising coal-using technology which ERDA has recently been developing is the fluidized bed combustion of coal. This is a process in which limestone is put into an agitated bed of burning coal in order to both reduce the production of nitrogen oxides and react with the sulfur liberated when coal is burned. A major advantage of this process is that its adaptation would permit the environmentally-acceptable use of high-sulfur coals of the type which are readily available in the midwest and much of the Appalachian area.

I have already mentioned the recent rapid rise of nuclear power. Nuclear power as we now use it involves the so-called light water reactor. The President has deferred the reprocessing of nuclear fuel and the recycling of plutonium as well as the commercialization of the breeder reactor because of nuclear weapons proliferation concerns. Nevertheless, in its present form, the light water reactor has been regarded by a large number of electric utilities as a very cost-effective way of producing electricity. President Carter's energy plan, I might note, envisions something more than a tripling in the output of electricity from nuclear power plants by 1985.

It is worth noting that we might expect to see a continued rise in the use of waste materials for fuel. In terms of the total quantity of energy supplied, our waste materials are likely to remain a relatively minor energy source -- although in specific applications they will be quite important. Of course, there is nothing really novel about this idea, it's simply the recognition that, in very many cases, wastes are simply resources for which we haven't devised a use. For instance, the more modern paper mills in this country and throughout the world frequently provide 40% or more of their own power through the use of waste components of wood.

As a final, and perhaps most important, source of relief from our near-term energy problem, I want to reemphasize the possibilities for conservation. This has already been mentioned in connection with the use of more fuel-efficient automobiles and homes. In the modes of transportation which we use and the buildings which we heat and air condition, it is easier -- and cheaper -- in the long run to do things "right" from the beginning, by building in energy-conserving capabilities from the start. Since we really don't have the option of returning to "go" and starting over, a very large share of the energy savings which we achieve between now and 1985 will have to be through fixing up the capital goods which we now have -- that is, retrofitting -- and through changing our habits in the use of energy. A federal program of tax incentives is in the making for encouraging the use of energy-saving measures such as additional insulation in homes and other buildings. My own strong suspicion is that there are a large number of very cost-effective conservation measures which have yet to be even looked at by the average American. Such measures as additional caulking around window frames and doors in order to reduce air leakages and the installation of simple passive ventilation systems to cool attics are certainly less than exotic technological developments. But it's the large number of small savings which are necessary to make a real impact upon total energy demand in the U.S.

I have suggested that we are going to see something less than a major revolution during the next eight years. I think it's fair to say that we will learn to be more frugal in our use of energy, that we will see more coal and uranium used for fuel, and that automobiles will be getting somewhat smaller. These are all trends which have become apparent within the last few years, and I believe that the adjustments in individuals' life styles which will be involved are likely to be relatively modest.

1985 to 2000

I'd like to now briefly outline some of the new energy systems likely to have a notable impact in what we call the mid-term, that is, between 1985 and the end of the century. In all cases, the technologies I'm going to suggest are relatively well-advanced in the sense that most have gone beyond the laboratory stage of research at least to pilot plant status and, in some cases, the construction of a major facility somewhere in the world.

We are likely to be using more coal, not only directly to produce electricity or steam for space heating, but also by way of a number of processes through which coal can be made into even more direct substitutes for petroleum and natural gas. There are several processes for turning coal into a gaseous fuel. The cheapest of these processes produces so-called low BTU gas, a relatively low-energy-content fuel composed mostly of hydrogen and carbon monoxide. This is very similar to what used to be called coal gas or city gas, the gas used for cooking throughout much of the country before the old coal gas plants were retired as a result of the arrival of natural gas from the Gulf Coast. The principal limitation on low BTU gas is the relatively high cost of shipping it long distances. Most low BTU gas, at least in the mid-term, is likely to be used within industrial complexes surrounding the gas generators. ERDA, for instance, is currently contributing to the establishment of low BTU gas generators in a number of locations, including a brickyard which now operates on natural gas.

High BTU gas is formed by producing low BTU gas and subjecting it to additional, and we must note, somewhat expensive treatment. The great advantage of high BTU gas is that it is a direct substitute for natural gas and can be easily mixed with natural gas in the existing pipeline system. If the country were to shift to the use of high-BTU coal gas, we would note little change at the users' end of the pipeline. The principal impact there would be in terms of higher fuel bills. There would, however, be a need for the construction of a large number of relatively massive coal conversion facilities, probably close to the coal-producing areas.

Liquid fuels which are a direct substitute for gasoline, fuel oil, and the like can also be produced from coal. Facilities for producing oil from coal were in operation in Germany during World War II and currently supply a portion of the gasoline used in South Africa. As would be the case with high BTU gas, liquid fuels from coal would be compatible with existing distribution systems and their costs would be somewhat higher than what we're used to paying for petroleum products. The required facilities would appear to be little different from many of the chemical processing complexes of today. They, too, would probably be located in remote sites where their presence would be obvious to only a small share of the U.S. population.

This country has a very large hydrocarbon energy resource in the form of oil shale in the Great Basin of Colorado, Wyoming and Utah. What is involved in producing oil from shale is, one way or another, heating large quantities of rock in order to evaporate the hydrocarbons. The vapors can then be collected and processed in much the same manner that crude oil is refined in a conventional facility. The environmental impacts of a facility for mining, processing, and disposing of the waste rock from an oil shale processing facility could be fairly substantial. Experiments are now underway for so-called in-situ recovery, which involves heating the oil shale underground, then collecting the vapors driven off from the heated rock. This system, if successful, should have less environmental impact. As with the other technologies which I've just discussed, if the country were to shift to the massive use of oil from shale, most users would experience few perceptible changes in the fuels which they use.

An entire new class of energy resources likely to have a notable impact before the end of the century is that associated with so-called geothermal energy -- the heat of the earth. If you drill a hole in the ground, in most locations, you discover that, typically, the temperature rises by about one degree Fahrenheit for each hundred feet of depth. The imagination is easily inspired by the notion of simply digging down until the earth is warm enough that we could use its heat, for instance, for space heating or industrial processing. The problem with this is that the gradient, the rate of temperature increase with depth, in most locations is sufficiently low that it simply wouldn't pay, under current conditions, to pursue such a scheme. In a number of locations, however, the temperature gradient is relatively high, so that if we drill down a few hundred or thousand feet, we encounter relatively high temperatures. A major limitation on the use of geothermal energy is that sites favorable for its use tend to be relatively localized. A few areas, mostly in the West, may experience substantial benefits from its exploitation. In a few very fortunate sites, geothermal energy is available in the form of steam at relatively shallow depths. Since at least 1960, a share of the electricity used in Northern California has been generated by the use of geothermal steam at The Geysers, California. Currently, ERDA is supporting investigations aimed at locating and investigating other types of geothermal resources, in addition to steam fields. These include the investigation of very substantial hot water resources under the Southern California deserts and experiments aimed at extracting heat from beds of hot granite which are available in a number of locations. Of course, if the so-called geopressured methane, which I mentioned earlier, comes on stream, we would have the possibility of using the pressure in the geopressured water and gas to drive turbines for the production of electricity, and, in addition, have a source of heat which could find a number of applications.

In the mid-term, we are also likely to see a notable, but not terribly large, impact upon our energy-using habits arising from a genuinely renewable energy source, the sun. Probably the first application of solar energy which will become widespread is the use of solar hot water heating. The major reason why hot water heating will probably spread more rapidly than solar space heating is that the demand for hot water is relatively constant from season to season, so that the expense of installing collectors can be recaptured in year-round savings on oil, gas, or electricity.

Solar space heating has received a large amount of attention in the press in recent years. Because of the seasonal nature of heating demands, solar space heating is most likely to first pay its own way in regions where the costs of alternative energy sources are relatively high, there is a fair amount of winter sunshine, and heating seasons are relatively long. It may seem ironic that the longer the heating season and, to some extent, the colder the weather, the more likely it is that solar energy can pay its way. We should bear in mind that a major prerequisite for solar heating is a well-insulated building. Conservation measures are an integral part of any solar-heating plan. The number of solar-heated homes in the U.S. appears, according to one estimate, to have approximately doubled between 1974 and 1975, and then to have doubled again in 1976. But the total number of completed solar heated homes in the U.S. was still only on the order of a few hundred.

In the mid-term, as well as the near-term, we can expect continued additional savings from conservation. However, as we move into the mid- and long-terms the adoption of new energy-conserving technologies will become a more conspicuous complement of energy-saving habits. New technologies adopted by industry and the utilities, including improved management and timing of energy use, will continue to be put into use. As consumers, we can expect to see electric-powered vehicles come into wider use for short-distance travel. As old home heating plants and water heaters are retired, their replacements will differ by including more insulation, better controls, and devices designed to reduce the escape of useful heat up chimneys. Energy-conserving modes of behavior learned over the near-term should be making substantial contributions to conservation well before the end of the century.

2000 and Beyond

Finally, we come to the long-term -- the period beyond the year 2000. When we get this far into the future, the new energy systems likely to be coming on the scene are even closer to the laboratory development stage of their life cycles than were the technologies mentioned for use in the mid-term. I will restrict my comments to the technologies which are likely to be really new in the year 2000, or shortly thereafter, rather than repeating comments on geothermal, solar energy, and the like, the mid-term technologies which are likely to be quite conspicuous by the year 2000.

First of all, I must mention the really vast potential of fusion energy. This is the energy which is released when atoms are fused together, rather than broken apart, as they are in the nuclear reactors now in service. When controlled fusion has been accomplished, we will be in the intriguing position of having an energy technology which can produce very large, indeed essentially unlimited, quantities of energy -- while using water as its principal source of fuel. The earliest major applications of fusion power will probably be for the generation of electricity. This need cause no basic reorganization in our electrical distribution system. It would be basically a change at the power plant. And it is quite likely that the main effect noted by the consumer may be a reduction in the cost of electricity.

We have the potential for developing breeder reactors which could be in commercial service by the year 2000. These would be essentially replacements for existing nuclear and fossil fuel fired power plants. Their principal advantage is that they would be able to use the product of existing

reactors, plutonium, and unused by-products of today's uranium fuel processing to produce essentially unlimited quantities of electricity. The reactors would literally produce more fuel than they use so that we would be relieved of concern about resource depletion in the case of uranium.

Also in the longer run, we have the possibility of producing substantial quantities of electricity with the use of solar power. This is already done on a very minor scale using the so-called photovoltaic cells. These cells produce small quantities of electricity, often in remote locations where there is a need for an energy source for a marker light or a small radio-relay transmitter. An additional method of producing electricity from the sun is through the use of mirrors to focus the rays of the sun on a boiler. A pilot plant for this method of electricity production is expected to be in operation soon in the Southwest. Investigations are also being carried on with a view to improving methods of capturing what is really the solar energy which propels the winds. This also would be used principally as a method of generating electricity. Although the future of solar electric generation is somewhat speculative, here we do have a technology which appears to be readily adapted to the production of electricity in an environmentally acceptable and decentralized manner at dispersed sites.

Solar energy is also the ultimate source of fuels from biomass -- such as wood, plant stems, and a variety of hydrocarbon-producing desert plants. ERDA and some forest-products companies are investigating the possibility of creating "energy plantations" of fast growing species which may serve as long-term renewable sources of fuel for the future.

In the long term, as in the immediate future, I believe that conservation will play the role of a major source of energy. Conservation can help give us the time needed to develop the renewable energy sources which can power the economy beyond the end of the century. Energy withdrawn from wasteful use is freed up for application where it yields the greatest benefit to both consumers and industry. In other words, conservation is likely to be pursued by households as a matter of intelligent resource management, rather than primarily as a result of altruistic motives.

In conclusion, I think it's apparent that, when we try to sketch energy sources for the future and to imagine their impacts upon life styles, the variety of choices and the speculation about these choices becomes greater as we look into the more distant future. Major investments related to energy systems tend to be relatively long-lived. Once they are in place we tend not to abandon them -- it is simply expensive to replace them, and the near-term response to higher energy costs will be conservation. Thus, I think that the nation's energy system is likely to change rather slowly. This arises not only as a result of the need for prudence through judicious choice in the management of resources devoted to energy systems, but because of the increased public participation in decisions relating to major energy investment. Nothing that we do is without its effect on the environment, and the management of these effects, in large part, explains the increasingly slow and cautious decision making which goes into the establishment of new facilities.

Alongside of the careful examination of our major energy investments, I believe that we need to continue to investigate a wide variety of new energy sources and systems. It is through this means that we can hope to preserve our freedom of choice in energy systems and life-styles in the future.

# REACTION TO THE ERDA SCENARIO

Earl C. Joseph, Staff Scientist-Futurist Sperry-UNIVAC,
St. Paul, Minnesota

In this article, I will take you on a few short trips into alternative futures. Time permits me to discuss only a few of the many alternatives that are currently being investigated which allow society to increase (conserve) energy availability for the future by increasing energy productivity.

In the process of discussing these scenarios, we will need to repeal O'Toole's law. How many of you are familiar with O'Toole's law? Anybody? Most of us are not, but most of you, I assume, are familiar with Murphy's law. It states that if anything can go wrong, it will. Now, O'Toole, being a countryman of Murphy, his law simply states that Murphy was an optim[illegible]! We're going to try to repeal that law by increasing our knowledge of future alternatives.

However, before delving into the future, let's muse about the relevancy of learning about future options for energy education. I've had the wonderful opportunity to teach options for energy futures at all grade levels: kindergarten, elementary school, high school, college, graduate school and in-service education for teachers. I've done this as a part of my job since about 1970 when I started futuristic teaching at the University of Minnesota. This quarter we have 27 graduate students working on their masters and doctorates, leading to degrees in futurism. When we discuss the future, or research the future, or think about the future, we develop a very different outlook and grow very different intuitions than when our mind is worried about the past or present.

When we look into or teach about the past, we're concerned with what happened and our primary mode of thought is the analysis mode. When we teach or think about the past we grow the intuitions primarily for answering the question, "What went wrong?"

When we turn our attention to the present, we're still concerned about the problems posed in the past so we search for answers in the present. This problem/solution ethic has been with us since the age of reason when we began believing the myth that once we are in the present we can do something about it. The result of this ethic system is that the present is always negative-laden. In other words, our primary mode of thought is the reactionary mode -- we react to the problems perceived. Since, in the present, we're always looking for answers to the question of "what is wrong?", that is the kind of intuition we develop when we teach about the present. But, when we turn our thinking toward the future, we're looking at possible, probable, and preferable futures. In our minds we try to imagine something out there (in the future) that we can't have at the present time. In our minds, we try to solve the problems that we perceive in the present and grasp desirable opportunities. And immediately our thinking paradigm changes towards a design mode, where we have the ideas and we grow the intuitions for creating and planning desirable futures. Thus the type of questioning which grows in the course of dealing with (energy) futures, is to answer the question, "how to make (design) it right."

We can take only a very narrow tunnel slice through the many futuristic scenarios that are being studied and used in energy future courses. The first set of scenarios I'd like to discuss are in the area of "non-throwaway society" futures. For a long time, we've had an economic system that works the best when we speed up the process of getting goods from the factory door to the scrapheap. The faster we do that, the better it is for profit. Since profit is based on per unit sale, the way to maximize sales once you've saturated a market is to get the academics to design such things as planned obsolescence. This shortens the life of products and forces society to constantly replenish the old with the new. Therefore, once you bump into an energy crisis with this type of an economic driving force, there's no escape from sinking deeper into the crisis. Therefore, I'd like to give you some of the scenarios that will allow us to do things a little bit differently.

First, I'd like to ask how many of you would like to wear the same clothes for 60 years? In the classroom one can see a show of only a few hands. Let's look at the available science; what's in the laboratories at the present time (as opposed to what may be discoverable perhaps sometime in the future) for clothes that we can wear. How would you like to have clothes that are self-cleaning, self-pressing, self-deodorizing and that expand as you grow fatter, skinnier, and taller? In other words, "self-adapting" clothes. How about some that are designed so that, without additional energy or material transfer, you can change the style moment to moment? How about those that use chemicals for dyes and a type of material quite unlike the polyesters we now use so that they repel instead of attract dirt. Now if you should be unlucky enough to get a stain, the dye chemicals are designed to detect the stain and, with a catalytic action, bleach the stain out. The clothes could also be impregnated with a chemical that exudes a sort of aura around you -- that in a sense protects you from external viruses and germs, and prevents you from spreading your cold. Now how many would wear these clothes for 60 years? In the classroom most students change their minds and accept the new idea. That is, they appear to be a fickle group. They quickly change their minds after getting some input into what the future has to offer. This is one of the basic rationales for becoming versed in futurism. This change in outlook is also one of the basic reasons for bringing the study of the future into the classroom. It's a sure bet that we're going to have to go to such a non-throwaway society -- perhaps not exactly as characterized, but not too far from it. The real question is not if, but when.

Let's ask a different question. How many of you would like to own an automobile that lasts 60 years, that never has an accident, and never needs repair? Oh everybody! Let's see how we can put some "smarts" into an automobile to make the automobile system convivial and long lasting. To do so requires a new design. The idea is to attack the problems from the front end, not after the fact of the problem, not after the crisis, not after you can't stand the pain -- but at the onset when the system is being designed. In industry, in a few companies around the country, they're working on a very small radar, about the size of an automobile headlamp. These radars are electronic eyes. They can sense objects out in the distance and determine how far away they are. As a result, they can, with a simple calculation, measure the rate of closure toward any object. Then you can install two in the front, two in the back and two on each side of the automobile (if you make your profit from radars -- if you don't, you can put two on the top and

let them spin around). Furthermore, other types of sensors are needed on the "smart automobile." The condition of the pavement must be sensed. We need to know whether it's dry, wet, slippery, icy, muddy or sandy. In other words, we need transducers to sense road conditions. Now again, if we want to sell and make our profit from transducers, we would insert them into the tires. If not, we would put them in the body of the automobile. Other sensors are needed to determine the condition of the driver. We need to know something about his or her reactions; whether the person suffered a heart attack, is inebriated or drowsy. (Note: All of these sensors should add little to the total cost of a future automobile.) These sensor measurements are sent to a $5 microprocessor where a calculation on the time to impact is being made. When the time of impact becomes critical, the microprocessor sends electronic signals to actuators, the third part of our smart machine. These are nothing but small controllers which could be electric or hydraulic motors. (These may cost $5 or $10 apiece.) The actuators could be placed at the gas pedal, the brake, the steering wheel, the starter motor and at other effective locations.

We should realize that all of these "smarts" require no new inventions. We have all the science know-how to do it. We would call it a collision avoidance mechanism. Using such smarts we could forecast forward in time when we wouldn't have accidents on the highway. And it also supplies one of the mechanisms to extend the life of the automobile.

Let's turn to another reason why the life of the automobile is rather short. How short is the life of an automobile? Well, there are more than 100 million cars in use in this country. This year is a good year for automobiles -- last year was a good year for wine. We're going to produce somewhere in the neighborhood of 12 to 13 million automobiles and import 2 to 3 million more this year. If you divide the total, which is about 16 million, into a little over 100 million, one obtains a number close to seven years as the replenishment rate or the average life of an automobile. Imagine the energy required to replenish all of those automobiles approximately every 7 years! Imagine further the energy savings (energy productivity increase) achievable through extending the automobiles average life to 60 or 70 years! To extend the life we need to also draw upon a different science. The sciences that we have been discussing so far are in the anticipatory sciences areas where we try to forecast forward and to find out what the future has to offer. The next science area that we need to draw upon is the fault-tolerant sciences. By "fault-tolerant," it is simply meant that even though we expect parts of the system to fail, we do not expect that the system, as a result of that failure, needs to make an error. There's only one way to achieve fault tolerance, and it can be summed up in one word, "redundance." Let me give you an example. If we're going to have a car which lasts 60 years, it's probably going to have to travel about 500,000 to 1 million miles. How far can you expect to go with a set of piston rings? In the average American car, about 100,000 miles, maybe a little bit more, maybe a little bit less. Well, how would you design them to go further? Instead of one set, shall we put many sets of rings on each piston? Shall we have one set out and active, wearing down the walls of the cylinder and the rings themselves. That's the equivalent of that set of rings going into the piston. We can sense such a condition by sensing the cylinder's compression and when it gets low, we can actuate an actuator to bring out the next set, and then the next set, and so on. You see what comes along, with a redundant fault-tolerant system -- a "self-repairing system." Such an automobile design

change toward fault tolerant automobiles gives society the ability to build long-lasting systems.

There is a third reason why all of us buy new automobiles. Our old automobile may not have enough chrome, or it lacks a new "wing ding" carburetor or perhaps the ashtray just gets dirty. These are cosmetic reasons for purchasing a new car. However, society could reach a point where we cannot afford to buy gasoline. At such a time we need to change the automobile's motor system to a long electric cord or a flywheel or something else. In other words, there are cosmetic reasons and there are real reasons for a need to change. Today, change leads to the need to buy a new car. Since we can anticipate the future with the anticipatory sciences, we can forecast forward in time the need to change; whether it's real, like a crisis, or whether it's cosmetic. Thus, we can then impact, at the front-end, designs so we can develop for "piecemeal updating," -- a key feature in extending the productivity of energy resources, allowing society to build things which last longer.

Given that the basic sciences exist and are readily available, we can make long lived systems, whether they be toasters, microphones, clothes, homes, furniture or automobiles. This science does not apply to everything, though. For example, it is difficult to envision attaching a string on food, like we do with teabags, and reusing it. Therefore, the idea of designing non-throwaway systems works in many but not all cases. So it is only a partial solution. But it could increase the energy savings by tenfold.

Okay, let's go on to scenarios (designs) of other future energy unintensive systems. One of the areas where we use considerable energy is in farming. Not long ago, someone came up with the idea that we do non-tillage farming. For thousands of years we've been using sticks or plows to turn the soil over. Now it takes a lot of energy to pull that plow. Further, when we turn the soil over, we lose 40 to 60 percent of the moisture. When we lose that moisture one of two things happens. Either the soil blows away, or it becomes so compacted that you can't grow anything in it. In non-tillage farming, the soil isn't turned over so the moisture is not lost. One of the methodologies/technologies for non-tillage farming is to use silent sound -- e.g., microwaves -- to loosen the soil. Let's envisage a smart farm machine for non-tillage purposes. (By the way, the U.S. Department of Agriculture is forecasting that over 50 percent of U.S. farms will use non-tillage equipment by 1985. That's an awfully short time to adopt something new. Let's see why.) As the ground is wiggled (loosened) with the microwaves, the machine will also drill holes every so often. As it drills, it is sensing the condition of the top of the soil and the soil underneath. Why? So this "smart" farm machinery can perform a sorting operation. It sorts out the capsules which will be dropped into the soil. These capsules will be biodegradable and possess time-release capabilities of their contents similar to the familiar cold tablet. Only these capsules will be effective for the entire growing season. Each capsule selected for planting will contain enough seeds for germination, enough fertilizer to carry the seed to maturity and enough fungicide, pesticide, herbicide and oxygen. The capsules will also contain enough wetting agents and moisture based upon weather forecasts for the agricultural areas.

Now, imagine the savings. Today farming is capital intensive and energy intensive. Today we take a plow, which is an energy pass, and two pieces of equipment; a plow and a tractor. Then we go back over with a disk to break

up the soil -- that another piece of equipment and another energy pass. Again we go back over the soil to seed. That's another piece of equipment, and another energy pass. Then we go over it more times, with another pass, for the pesticide, and then the fungicide, with different equipment and more energy passes. Thus, one piece of equipment and one energy pass in the future, with a smart farm machine, can accomplish all of what today takes a multitude of different pieces of farm equipment and considerable energy passes. Can you imagine the savings it would produce in fuel? Can you imagine the increased productivity of energy for producing food?

Let's go on. Let's consider our new information age. Our society has moved into the post-industrial age and the key resource now is information. In an agricultural age the key resource was the land on which we tickled (tilled) the soil to grow food. In the industrial age, the key resource became oil and the ores that we dug out of the ground to convert into something else. In the post-industrial age, the key resource becomes information (since by definition the post-industrial age is one based on services) and we're growing exponentially in the use of and need for more information. For example, today in the United States, do you know how many pages of newspaper we publish each day? If you were to take each one of the pages, unfold them, lay them end to end, they would go around planet earth at the equator 50 times -- that's each day, every day! Can you imagine the energy used to manufacture and deliver these newspapers? In the laboratories there's a lot of research going on with paperless medias like flat screen, television-like devices. Additionally, at the University of Utah, for the last eight years, they've been studying micro-television sets, about the size of a fat pen. When TV's get that small, guess where you can put them? You can put them on the bows of eyeglasses. With a proper lens system, you can fill up a person's whole visual space with written words and, since there are two TV's, one can also create three dimensional images. By the way, if you had seen PARADE Magazine (one Sunday in June) you would have read about these micro-TV glasses as a prosthetic device for giving vision to blind people. PARADE suggested that this technology is about ready to leave the lab before the end of the decade. A couple of years ago the researchers put micro-video cameras on eyeglasses and coupled them with a bundle of wires going to the skin surface on the head near the visual cortex. They then discovered that such devices could give primitive vision capabilities to blind people. For a moment, let's label the micro-TV eyeglasses a "paperless newspaper." They will contain electronic storage (memory) so that we can capture the newspaper by plugging it into the wall a few times a day. This information will be stored in the glasses' memory and the information can be replayed at our convenience over and over again using energy supplied by small batteries in the eyeglasses. Can you imagine how much less energy it takes to move electrons versus moving bundles of newspapers? A lot less, an awful lot less. Further, such an information delivery and dissemination system could deliver our future school books, other types of books (e.g., fiction), reports, office memos, mail, etc. The energy savings achieved by substituting electronic transfers of information are considerable. But they are trivial when compared to the other potentials of this technology. Why? If you talk about 1985 and beyond, this type of technology would allow us to "wear" our future "office," or our future "school." In other words, this technology could provide a substitute for our "second homes." It deletes the need to expend energy for constructing these second homes and it deletes the need to heat and cool them throughout their lives. Further, it deletes the need to spend the

energy to maintain offices and schools throughout their lives, and it deletes the need to travel back and forth to them. For example, in the U.S., the average worker travels about 100 miles a week back and forth to work. Imagine the savings if a relatively high percentage of the public worked where they wanted to be by using such micro-TV glasses rather than going to the physical office. In other words, instead of allowing the office to dictate where you're going to live, you can let a different activity -- a leisure time activity -- decide where you live. If you like to be on the ski slopes of Utah, that could be your future office. Or if you enjoy the Florida sun, your office could be on the shores of Miami Beach. The energy savings from developing such positive options are enormous but, in the process, we will experience a drastic and radical change in the sociological environment of society.

Time only permits me to discuss a few of these opportunistic options of alternative future energy. By now, from the foregoing, the need for the educational system to begin to teach about the future should be obvious. We need to get the students, as well as the educational system, into the mindset of the future so we can develop future desirable alternatives in addition to those outlined here. We will not have to look forward to only a deprived future, nor will we need to go back to a lesser quality of life. The type of non-throwaway societies and energy intensive systems that I've discussed have the potential to increase the quality of life for everyone.

In conclusion, it is my hope that these word sketches of alternative futures have drawn an image in your mind's inscape of some of the possibilities for creating and designing these positive options as well as some of the rationales for bringing the study of alternative energy futures into the classrooms.

# REACTION TO THE ERDA SCENARIO

Joanna D. Underwood, Director
INFORM, Inc., New York, New York

Perhaps you noticed in Mr. Joseph's talk that in looking into the future -- one piece at a time -- he eliminated, via the gadgets and technologies that he believes science will create -- the clothing industry, the auto industry, the farming industry, the publishing industry, and a lot of other industries. Of course, in the process, he would also be eliminating the labor and interest we invest in sustaining these industries, and in changing and developing them, factors that may be an important component in making our lives interesting and satisfying. He would also be eliminating the products of these industries, which form part of the aesthetic and cultural continuity of our lives and the choices and uses of which are a source of individual identity and pleasure. I certainly concur that the visions Mr. Joseph summoned up of our future may be technically possible. From the point of view of pure engineering and science, they are fascinating. But the question is "Do we want the changes he describes?"

Would they be a step ahead -- either as necessary changes or as changes that would make our lives happier? I have great faith that technology will ultimately express whatever our values and goals are. But perhaps the important underlying question is what are our values?

The decisions we make about products of the future, about energy use and supply will largely be based on value choices which involve also our underlying beliefs regarding our needs, our human limitations and the environmental realities and constraints of our world. As I comment this morning on the scenario our government, and particularly the Energy Research and Development Administration, have laid out for our energy future, I'd like to focus on the value assumptions those governmental plans seem to entail. These assumptions that seem to be to a disturbing degree contradicting governmental stated concerns.

I believe that many of you here are particularly concerned with how to bring the subject of energy to students. So I'd also like to comment on questions that need to be faced in dealing with them -- and trying to create for them a fair and accurate picture of the choices ahead in our energy future. What they are told about the energy crisis and what they actually see happening today may give a picture of confused values and goals. Unfortunately they may more likely imitate what they see, rather than what they hear.

The ERDA scenario for energy supplies in the future and the governmental plan at present both seem to assume that we are on a road moving ahead in terms of energy -- that will take the technologies and fuels of the past and gradually change and alter these, so that we use more carefully the oil and gas we still have, increase the use of coal for power generation, and carry through perhaps more prudently on the use of nuclear technology developed over the past 20 years. Conservation of energy fits into the plan as an important short-term goal. We must do some revision

of our lifestyles, in order to make them more energy efficient -- at least until some limitless source of energy is developed, such as might be supplied by extensive coal and nuclear sources, and ultimately by fusion or solar technologies. The government scenario assumes that the reorientation of our lifestyles can be gradually brought about by better public information on the scarcity of existing fuels, tax benefits, and by slowly increasing the price of energy over the coming years.

I would like to raise some questions about the kind of road we are on and where it is going. I think that, rather than being on a straight road proceeding from past into the future, we are today at a crossroads. The road we have been traveling in fact, may be coming to an end. That road, traveled over the past 25 years, assumed cheap and plentiful energy as a base for an increasingly mobile, comfortable, and technologically sophisticated society. As one convenience and engineering advance has been added to another, we have moved faster and faster down this road -- and become more attached to it.

We are dependent on the oil and gas which since 1973 has made up over 75% of our energy, and we have willingly continued to act on a vision that nuclear power would come galloping in like the cavalry to save us by the time oil and gas really became scarce. We've set up a lifestyle that relies on sustained cheap energy -- that has thrived on waste. We have more cars and deteriorating mass transit systems. We have homes that leak heat and cold like sieves (since they're cheaper to construct) so that we have to keep pumping heat and cold air into them just to maintain a stable level of temperature. We have homes that are filled with all kinds of energy-consuming gadgets -- from electric toothbrushes to devices for opening cans and car doors. We have homes that sprawl over acres of suburbs and that are dependent on cars and highways for access to the outside world.

We are even building whole towns and allowing land sales companies to market lots in new residential communities, in places where the environmental support systems aren't available -- towns in the dry Southwest which will rely on enormous energy-intensive systems to transport the water needed for large populations -- towns in parts of Florida which will rely on multi-million dollar water purification and desalinization plants to make the local water supplies, or sea water potable.

Business has followed the wasteful trend. Did you know, for example, that in our economy, for every million dollars for gross domestic production, we consume 1513 tons of oil or oil equivalent, while in Sweden, with a comparable standard of living, the consumption rate is 865 tons, in West Germany it's 997 tons, and in France, it is only 817 tons. So here we are -- with 6% of the world's population using 30% of the world's energy.

President Carter says we have a crisis. We have wasteful values and wasteful technologies and systems to go along with them. We need to make a basic change. But to be convincing, perhaps he needs to say it more loudly and more often. Congress may think we have a crisis, but many Congressmen and women fear loss of support if they act on that belief. If they vote for increases in the cost of oil and gas, reflecting the increasing difficulty in finding and tapping sources, and the long distances the fuels must be transported for our use, they are voting for disruption in the habits and lifestyles of Americans. ERDA was brought into existence

to develop new energy sources. And where are its efforts focused? Perhaps under substantial pressure from industries, whose continued profitabilities rely on technologies based on fossil and nuclear power, ERDA is mainly funding R&D of sources using scarce or difficult fuels. The government, in sum, seems to evidence a new awareness of resource limitations and environmental problems, and to acknowledge a need for both human and technological orientation. But its current programs are creeping along on the current road, not yet convinced enough to say straight out that such a new awareness means a radical change of direction on the path ahead. After all, the crossroads is not in actual sight yet.

Of course, the change in value and in planning is not just the government's responsibility. We talk about the energy crisis too. And what actions are we taking? How many of us have had our pilot light disconnected? (They account for 3% of all natural gas used in the U.S.) How many have limited driving speeds to 55 mph, walked a few blocks somewhere instead of driving to save energy, unhooked a few gadgets, turned off the dishwasher during the dry cycle (which uses 50% of the energy in each cycle). How many have had a home inspection to see if better insulation is needed or actually put more insulation in? Yet all of us are educating our children, some of us formally, others of us just by the example we set. If we don't take this crisis and the need for change seriously, who will? If we oppose politicians who support the realistic need for higher energy prices, how can we expect them to stay in office. If we vote for illusions, we'll get illusions...for the moment that is. Should we, however, round the last turn and see a dead end before us, who can we then call to account?

It is clear that our oil and gas supplies are running out. It is also clear that because we cannot decide on air pollution and land use requirements, we are not seeing a fast enough expansion of our domestic coal supply to meet demand in the next few years. It is clear further that nuclear power is in trouble. After 20 years of technological development, its environmental problems are not fully understood, let alone solved. Its safety is in question, and its economics have gradually lost their once impressive advantage. The cost of building a nuclear power plant today is $1500-2000 per kwh, while for coal fired plants it's only 65-70% as much. In addition, nuclear plants are delivering on the average, only 45-50% of their planned capacities, even though the nuclear industry continues to predict deliverance at 70-80%. The fuel reprocessing and breeder systems which were to insure a long-term cheap source of nuclear fuel, are faltering, for technical, financial, and environmental reasons.

If indeed there are limits to our ability to manipulate the world and its finite resources to meet our wasteful demands, and if we accept the fact that a real transfer to another road is needed, then there are a number of areas in which real change may have to be made. I'd like to discuss three of these important areas and compare the governmental response today with the kind of response that may be warranted to really put us on a new road.

The first area I'd like you to consider is the area of our individual lifestyles, and the changes needed there. As I mentioned, the current governmental approach, at least in the near term, is conservation,

entailing a gradual change of habits to adopt less energy-wasteful ways, until new supply sources are available. I suggest that allowing conservation to be viewed as a short-term effort may be to misrepresent its importance. In a world of limited resources, it should not be treated as a temporary effort. It may indeed be a permanent new way of living. It may require a revolutionary change in our self image and in our sense of relation to the world around us. It means reconnecting and developing a sustainable and harmonious relationship with our environment--feeling a part of it and not just the user of it. An energy conserving lifestyle may perhaps ultimately necessitate a renewed stress on our inner and intellectual growth, and on recreational activities that compliment and enjoy nature, instead of trampling and using up its resources. It may mean hiking instead of snowmobiles, sailboats instead of motorboats, etc. Conservation with its temporary discomforts and disruptions may be a very positive step for us and one that, with a little more vision, we would joyfully and energetically strive to achieve--not resist every step of the way. Additionally, we may not have time to adjust to this new way of life at our chosen comfortable speed.

Limited supplies are not as flexible as political promises. If we must change, then how else might we go about it effectively? I'd like to suggest you consider the possible benefits of a real jolt, rather than inch by inch change. Why don't we just let industry raise its prices on dwindling fuels right now to decontrolled levels, the richer in this society could absorb the shock more readily, and certainly we could find ways of relieving poor and middle class citizens financially of their immediate distress for the coming few years of readjustment. Now, why might I suggest a jolt? Well, to get a right angle shift in direction. We may need to set up a roadblock on the old route and flashing blinkers pointing to the new way. President Carter tried to put up some attention-getting signs when he gave his energy speech. Now he's rather letting them sit in a corner and is mired down in everyone's objections to what his views of our options are. In fact, it may be harder for people to make little tiny annoying changes over years--to poke at one cobweb at a time, if you will, simplistically speaking, rather than to do spring housecleaning all at once. If the government decontrolled oil and gas prices, I suspect many of you would be making the kinds of changes we discussed earlier in a hurry...don't you think so? A basically conserving lifestyle is a revolutionary new concept, not a stop-gap program. U.S. industry presently accounts for 42% of the energy used in this country each year. But many industry leaders point optimistically to the fact that they used 6.2% less energy in 1976 than they did in 1973. But unfortunately, many recent studies suggest that still 1/2 of the energy consumed in this sector is lost as waste heat. The amount lost is equal to the total energy consumed yearly in American homes. Evidently room for progress in conservation by industry is great. To get beyond simple housekeeping changes in industry practices to get into expensive and basic process changes, to less energy consumptive ways--that will be the jolt here. Radically higher prices may be the only thing that will make it happen. And if we allowed prices of dwindling fuels to rise, we would also be making a market for alternative, more environmentally-sustainable sources, such as solar heating and cooling, and trash-to-energy systems. These sources can't compete economically today, although in a variety of forms, they are technologically available.

Moving from the question of individual lifestyle choices, I'd like to turn to a second area of government planning and choice. It relates to dealing with systems we have a real stake in, but may need to move away from, if we accept a value system which recognizes the real limits of our technological capabilities and of our resources. As a key energy case in point, nuclear power. We started the Atoms for Peace program in 1956, hoping to find a productive and positive use for those atoms. Since the mid-50's, utilities, reactor manufacturers, and the government have spent over a hundred billion dollars building the nuclear power industry. To develop a commercial breeder, an anticipated $12 billion more will be needed. With continuous government support and subsidy, we have built up an industry of over 200,000 people, and now have 63 operating reactors around the country. Nuclear power today produces 10% of our electricity and 3% of all our energy.

But a number of serious environmental and social concerns surround this industry's operations. I'd like to mention the most significant ones. First, we really don't know the risk of meltdowns at reactors. Projections vary. Although the risk may be as small as one in 17,000. A single meltdown--conservatively estimated by the famous 1975 Rasmussen "Reactor Safety Study" could take a toll of 3,300 immediate fatalities, 45,000 long-term cancer deaths, and 28,500 long-term genetic deformity cases: it could create $14 billion in property damage. In addition, it could leave a disaster area 3,200 square miles in size. Clearly, no private company could obtain insurance, faced with even the most remote risk of a meltdown. As a result, the government, under the Price-Anderson Act of 1957, has agreed to cover up to $560 million in insurance costs. This would not be enough--even were substantial industry funds added--to pay for the extent of damage a meltdown might cause.

Second, the key to nuclear industry expansion is its ability to assure a continuous source of nuclear fuel. Even using the most liberal estimates, by the turn of the century, uranium, the price of which has risen 7-fold from $6 to $42 per ton in just the last five years, will experience a prohibitive leap in cost.

At present, the spent fuel from nuclear power plants, after it is removed from the reactor core, is stored on the reactor sites awaiting reprocessing, to separate the recyclable portion of the fuel that the industry can't afford to lose from the wastes which must be permanently disposed of. Reprocessing efforts on a large scale have been a failure. The technological complexity and economic costs have proved beyond industry's ability to cope. The partially constructed reprocessing plant in Barnswell, South Carolina, will never be completed without massive infusions of government monies and technical effort. Even then, would it work?

The breeder reactor, which would take the plutonium in spent fuel and use it as its own fuel, and whose waste would in turn fuel conventional reactors has engendered increasing public opposition both because of the cost of the breeder and, most importantly, because of the fears that transporting and handling a growing quantity of dangerously radioactive bomb-grade plutonium between reactor sites and reprocessing facilities around the U.S. would pose risks of theft and sabotage requiring

military type protection at all times. Even making maximum expenditures for safeguards--what foolproof ways have we ever devised to prevent human error?

Reprocessing plants and the breeder are the key links, completing the nuclear cycle and making available the nuclear fuel in the coming decades. Neither type facility is close to realization. Thus, utilities today have their back yards choked with radioactive wastes that can't be gotten rid of.

The Carter administration seems to be straddling an unrealistic line. It is encouraging an end to the delays in construction of new conventional reactors, yet it is backing off from continued R&D on reprocessing and the breeder--phases essential to the survival of the industry beyond the very shortest term.

The Administration is also not addressing directly the third and most difficult environmental risk that this technology creates--one that simply does not lend itself to technological solution. No matter what type of nuclear power plants we operate, eventually the radioactive wastes they generate will have to be permanently disposed of. Scientists have talked about burying them in trenches under the Atlantic and Pacific oceans, in geological formations or salt mines. They discuss all kinds of sealed containers. Yet the life of these poisons is, in some cases hundreds, in others a quarter of a million years. Whether we choose to create such a growing storehouse of poisons which future generations will have to guard is the ultimate environmental and social dilemma.

At present, engineers and industry people involved with a professional and economic stake in nuclear power continue to express ongoing faith that the technology will one day solve its environmental and social problems. Many citizens, understanding their own demands for energy and not understanding nuclear risks, government people responding to citizen pressures, and investors with nuclear interests, stand together quite unprepared to face up to the long term environmental and social implications that go hand in hand with this energy source.

But, stepping back from all of our short term interests, I'm not sure that many of us, given an objective description of advantage and risk--wouldn't shudder at the prospect of a nuclear future. Yet with the 20 year stake many now have in this technology, the question is, would we be willing to walk away from it. Will we decide to change course and seek other, safer answers? Beyond Carter's equivocation on this subject, ERDA's actual budget for this fiscal year 1978 indicates a strong continued pursuit of this technology. Of a total of $3.2 billion anticipated expenditures, some $1.3 billion (over 40%) is being devoted to nuclear R&D. Only $305 million is to go to solar R&D, $433 million to fusion, $88 million to geothermal energy, and $640 million to fossil energy. I might briefly touch on a few other subjects while we are discussing "things to move away from." Knowing what we now know about our limited fossil fuels and the air pollution generated by automobiles, especially in urban areas, will we really begin to move away from such extensive vehicle use, reducing car traffic in urban centers, accepting the inconveniences of less door to door service, accept the cost of planning and rebuilding new mass transit systems? Knowing what we know about resource scarcity, will we actively discourage

new towns being built where land and water resources don't exist and try instead to begin adjusting our human activities and dwelling patterns to harmonize with the requirements of and sustainable capabilities of the environment? Turning away from a number of habits, technologies and attitudes of the past decades will only be feasible if we are actively pursuing other habits, technologies, and attitudes to replace them.

And so we arrive at a third area of choice. Despite the fact that very few of us have any economic or other kind of immediate stake in new technologies, are we willing to bite the bullet and make the investment to reorient our energy supply system substantially? I mentioned earlier here that I firmly believe U.S. industry has the capability to invent all kinds of new technologies, depending on what our values call for. Our experience with nuclear power has certainly shown that when the government sets its mind to getting a new industry going, it can do a lot. A new industry can soon build up its own momentum and develop a coterie of involved supporters.

At INFORM, during this past year, we completed a three year research study of energy alternatives. In it we found that of 17 new kinds of energy sources, including a range of solar and renewable resource-based alternatives, a number were actually technologically available and some in commercial use. We looked at the projects of over 140 corporations, and found many of them ready and eager to find a market for their systems. A central barrier to broad and commercial use of their products was price. They couldn't compete against the controlled prices of oil and gas.

Solar heating and cooling was one viable option. While solar systems for heating swimming pools or domestic hot water supplies, or for heating and cooling buildings are making some progress, it seemed clear that a quick price rise in conventional fuels would put the spotlight on this technology. One quarter of the energy used in the U.S. goes for building heating and cooling. So the contribution of this alternative could be significant. At this point, domestic hot water systems are already coming into a competitive price range. Were the market demand to suddenly increase greatly, the economics of mass production could make it advantageous.

Our study also found trash-to-energy systems to be available. (We identified 11 producers of such systems.) Cities could use trash, now expensive to dispose of, to generate 10-15% of their electricity. Over 120 trash-to-energy plants exist in Europe; as of 1975 only sixteen existed here (with 18 others in some phase of planning). Why is that? Because utilities have little incentive to change (passing on fuel prices as they do to customers); because cities have little experience in working with private industry; and because citizens are too often too nearsighted to see the savings they might achieve by use of this alternative. Sometimes citizens resist the notion of giving over unallocated land for a trash plant.

We should give serious thought to how we might overcome such political, institutional, and economic barriers. The federal government, which can put the broad public interest ahead of narrower considerations, could take a real lead in encouraging such systems. Yet scarcely a word has been spoken from the federal level about their advantages. Geothermal steam,

for power production, co-generation, for efficient combined production of electricity and steam from one source, and bottoming cycles, capable of recycling industrial waste heat, are all poised on the starting line waiting--so to speak--for the economic incentives to ring the bell and start the competition.

I'd like to close by saying that the choices we make in all three of the areas I've discussed are fortunately, still in our hands. In the past five years, we have taken one important step in acknowledging that the notion of infinite resources, the infinite capacity of man to build technological systems that produce limitless energy has been illusory. Energy has not been cheap for a long time. We just didn't have the right information. Now that more realistic ideas have emerged as to our own and the environment's capabilities, the crisis revolves around whether and how soon we choose to act on this new knowledge.

Our children, are perhaps less likely to suffer from the inertia we have built up vis-a-vis energy consumption. They may be more equipped to take action and change their lifestyles, having heard what we have to say, despite what we do. But perhaps, if we take a hard look at ourselves, and give each other a push, we'll set the example for them.

## SESSION IV

### MORAL DILEMMA OF ENERGY EDUCATION

Edwin Fenton, professor of American History at Pittsburgh's Carnegie-Mellon University, gave the luncheon address. Given the complex nature of the energy crisis and the overwhelming influence of the latent curriculum advertising high energy consumption, Fenton concluded that the school's role should be to instruct students according to the government's energy conservation themes.

# THE MORAL DILEMMA OF ENERGY EDUCATION

Edwin Fenton, professor of American history
Carnegie-Mellon University

In a letter to me, the Council for Educational Development and Research has stated the moral dilemma of the energy crisis in the following words:

> In beginning to educate children about energy, schools will face a moral dilemma: should or will they attempt to develop in students the ability to make choices or should or will they simply socialize them to go along with solutions determined by others?

That issue is complicated enough. But in order to examine the relationship of education to the energy crisis fully, we must complicate the issue still more by asking an additional question: can the schools develop in students the ability to choose wisely among the many alternatives offered by experts in the field? Perhaps they cannot. In the first place, curricular change takes place with glacial dignity, and the Council presses--quite appropriately--for a new curricular orientation. Secondly, and perhaps even more serious, a growing body of research indicates that most elementary and secondary school students have not developed their cognitive abilities, their perspective taking skills, or their ability to grasp moral and civic problems to the point that they are able to think analytically about the abstract and exceedingly complicated issues which the energy crisis presents.

Let me begin with the solution which comes immediately to most of our minds, the development of new curricular materials. Each national crisis brings in its wake demands for curricular reform. The social studies, in particular, feel these demands. During the past decade, social studies teachers have been asked to help students understand a host of pressing societal problems--civil rights, the racial crisis, Vietnam, the treatment of women, the decay of our cities, and dozens of others. Writers and publishers have responded quickly to these demands, usually by publishing supplementary materials. But little happens to either the knowledge or the attitudes of students as a result of most of these crash programs.

In the first place, it's hard to get schools to adopt new materials. Courses of study in both science and social studies are already overcrowded. The real cost of teaching a two week unit about the energy crisis is omitting a two week unit about something else. How are we to pursuade the mass of teachers that they ought to make this substitution, and that they ought to invest time and energy on curricular changes? All of us who teach in the schools have heard pressure groups cry "wolf" too many times. "So what else is new," I can hear some overworked teachers saying when they hear about the proceedings of this conference.

Second, we lack materials. Few science or social studies texts investigate the energy crisis in any depth, and textbooks change at a snail's pace. One of my graduate students at Carnegie-Mellon University, Ms. Susan Puz, has been investigating the treatment of women in high school history texts. She summarized her findings as follows:

In a 1971 content analysis of thirteen of the most popular high school American history textbooks, Janice Trecker concluded that

> Based on the information in these commonly-used high school texts, one might summarize the history and contributions of the American woman as follows: Women arrived in 1619 (a curious choice if meant to be their first acquaintance with the new world). They held the Seneca Falls Convention on Women's Rights in 1848. During the rest of the nineteenth century, they participated in reform movements, chiefly temperance, and were exploited in factories. In 1920, they were given the right to vote. They joined the armed forces for the first time during the Second World War and thereafter have enjoyed the good life in America.[1]

Phyllis Arlow and Merle Forschl undertook an analysis of thirty-six American history high school textbooks five years after Trecker's study. They found that Trecker's analysis of women's historical treatment still held for more current textbooks.[2] The extensive omission of women's history in these newer textbooks led them to conclude that "students will have to rely, at least for the next decade or two, on supplemental materials to present a true picture of history."[3]

A similar generalization, I feel certain, will hold for the treatment of the energy crisis in most textbooks: for the next decade or so, the schools will have to depend on supplementary materials rather than on basic textbooks. Hence, someone in each school must take the time to examine these materials, the initiative to get them approved and purchased, and the energy to prepare to teach them. In the past, many teachers have lacked the skills and attitudes essential to these tasks when crises similar to the energy crunch resulted in demands for educational reform.

Third, we must think realistically about what results we can expect from a unit of work. Let's suppose that an excellent pamphlet accompanied by superb audio-visual materials and carefully constructed suggestions for teachers appears on the market and is adopted by a school. The authors suggest that the unit should be taught in two weeks. A student would use these materials for ten, forty-five minute classes, or a total of 450 minutes. Counting ten hours for sleep each night, each student in a year will spend one hour studying about the energy crisis to 681 waking hours in some other pursuits. Those 450 minutes must have an unusually powerful impact to overcome a lifetime of conditioning and the overwhelming example of the profligate uses of energy which impacts on students at a ratio of 681 to 1.

Finally, teaching about the energy crisis presents a serious teacher preparation problem. Because enrollment is falling, the people who teach in our schools today will make up the overwhelming majority of instructors a decade from now. Most of us who teach do not understand the full dimensions of the energy crisis, and we are not likely to understand them clearly without a substantial in-service education program. Such programs are hard to organize, expensive to run, and often ineffective. Yet the experiences

of the curriculum revolution in the 1960's clearly indicate the vital need for in-service work to accompany new curricular materials.

The influence of the latent curriculum lends an added discouraging note.[4] By the manifest curriculum, educators mean the materials and teaching techniques designed to bring about specified educational changes. By the latent curriculum, they mean the incidental learning which comes with the ways in which schools are organized and teachers conduct classes. In the case of the energy crisis, the whole society in which students live becomes a latent curriculum. Every thoughtless trip to pick up one item left off the weekly shopping list, every athletic hero given a souped-up gas guzzler for performing heroics on the field, every teacher (and particularly every teacher of driver training) who drives a big car, and every shiny limousine transporting a movie star or a politician tells students how important adults think they should behave. When society sets such examples, it sends a message which all of us learned to reject when we were young: "Do not as I do, do as I say." Here indeed is a moral dilemma for American adults.

Let us suppose for the sake of argument that the schools will set aside a reasonable amount of time for the study of the energy crisis and that excellent materials appear on the market. As recent debates in Congress and the press indicate, the subject is fraught with controversy. A report of the United States Energy Research and Development Administration identifies three major themes: increasing exploitation of existing domestic sources of energy primarily by deregulation; reducing consumption by both voluntary action and public measures; and developing new technologies, primarily through tapping the sun or through the increased use of nuclear energy.[5] The Report lists twenty-one technological development programs. It investigates proposed solutions for the immediate future, the mid-term beginning about 1985, and the long term which might begin about the year 2000. Even articles which summarize this report bewilder the reader with alternatives.[6]

To process these data intelligently, a person must be able to think in what the Swiss psychologist, Jean Piaget, has termed formal operational thought.[7] People functioning at the full formal operational level can consider all possibilities, manipulate data, and have thought about thoughts. In other words, they can use the scientific method and employ the sort of inquiry techniques which characterized the curriculum revolution of the 1960's. But almost no elementary school children have developed the cognitive capacity to employ formal operational thought, and a large percentage of high school students--probably more than half--are not fully formal operational. These students think largely in concrete operational terms. They are likely to jump to a solution to a problem and to stick with that solution no matter what evidence fellow students and teachers may present to the contrary. For such students, the question posed by the Council misses the point: these students are unable at their present stage of cognitive development to make rational choices among alternative solutions to the energy problem.

Many students also have a limited social perspective.[8] Like abstract thought patterns, social perspective grows slowly through definite stages. Young children are able to focus only on their own interests, and they do not think of themselves as persons with responsibilities to others. At the next stage, usually in the middle elementary years, they still want to serve their

own interests, but they are able to anticipate another person's reactions so that they can make a deal to get what they want. At the next stage, often reached in high school, they see things from the point of view of shared relationships, such as caring, trust, and respect between two or more individuals who know each other. Only late in the high school years or even later do many students reach Stage 4 where they are able to take the point of view of a member of a social system as a whole and see a situation through the eyes of many actors including people they do not know.

This research suggests that until students reach Stage 4 in their perspective taking ability, they cannot fully understand the energy crisis in all its complexity. At Stage 1, they will be able to think only of their personal needs and interests; they cannot understand the need to save energy so that others--particulary others still unborn--can have some. At Stage 2 their understanding will be limited to making a deal: if my parents insulate the house, then President Carter will give them back some money from their income taxes. At Stage 3 their energy frame of reference extends only to what other people they know care about and are willing to do. Their attitudes are set by peer relationships and by the norms of family and teacher. Only at Stage 4 can they understand the ways in which their energy needs relate to those of other people a continent or more removed in space or a generation or two distant in time.

Stages of moral or civic thought develop after cognitive and perspective taking stages. Harvard's Professor Lawrence Kohlberg has identified six stages of moral or civic development described below in Table I.[9]

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TABLE I: LEVELS AND STAGES OF MORAL DEVELOPMENT

THE PRECONVENTIONAL LEVEL (Stages 1 and 2)

At this level, people consider the power of authority figures or the physical or hedonistic consequences of actions, such as punishment, reward, or exchange of favors. This level has the following two stages:

Stage 1: The Punishment and Obedience Orientation

At this stage, the physical consequences of doing something determine whether it is good or bad without regard for its human meaning or value. People at Stage 1 think about avoiding punishment or earning rewards, and they defer to authority figures with power over them.

Stage 2: The Instrumental Relativist Orientation

At Stage 2 right reasoning leads to action which satisfies one's own needs and sometimes meets the needs of others. Stage 2 thought often involves elements of fairness, but always for pragmatic reasons rather than from a sense of justice or loyalty. Reciprocity, a key element in Stage 2 thought, is a matter of "you scratch my back and I'll scratch yours."

THE CONVENTIONAL LEVEL (Stages 3 and 4)

People at this level value maintaining the expectations of their family, group, or nation for their own sake and regardless of immediate consequences. People at the conventional level show loyalty to the social order and actively maintain, support, and justify it. This level has the following two stages.

Stage 3: The Interpersonal Sharing Orientation

At this stage, people equate good behavior with whatever pleases or helps others and with what others approve of. Stage 3 people often conform to stereotypical ideas of how the majority of people in their group behave. They often judge behavior by intentions, and they earn approval by being "nice."

Stage 4: The Societal Maintenance Orientation

Stage 4 thought orients toward authority, fixed rules, and the maintenance of the social order. Right behavior consists of doing one's duty, showing respect for authority, or maintaining the given social order for its own sake.

THE PRINCIPLED LEVEL (Stages 5 and 6)

At this level, people reason according to moral principles which have validity apart from the authority of groups to which the individuals belong. This level has the following two stages.

Stage 5: The Social Contract, Human Rights and Welfare Orientation

People at Stage 5 tend to define right action in terms of general individual rights and standards which have been examined critically and agreed upon by the society in a document such as the Declaration of Independence. Stage 5 people stress the legal point of view, but they emphasize the possibility of changing laws after rational consideration of the welfare of the society. Free agreement and contract bind people together where no laws apply.

Stage 6: The Universal Ethical Principle Orientation

At Stage 6 people define the right by the decision of their conscience guided by ethical principles such as respect for human personality, liberty compatible with the equal liberty of all others, justice and equality. These principles appeal to logical comprehensiveness, universality, and consistency. Instead of being concrete rules, they are abstract ethical principles.

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Most high school students in the admittedly small samples which psychologists have been able to obtain think at Stages 2 and 3; a minority of senior high school students utilize Stage 4 thought. But the full dimensions of the energy crisis are not evident until a person can think in

principled terms at Stage 5. Only at Stage 5 can they fully understand the basic human rights inherent in the energy question. And only a tiny minority of high school students exhibit any significant amount of Stage 5 thought. Hence, most high school students cannot at their present stage of development make fully rational choices about the energy crisis.

The Council posed an either-or question about education and the energy crisis--should we attempt to develop the ability to make choices or should we socialize students to accept societal solutions. Instead of either-or, I suggest both, but for different groups. If someone became Tsar of Energy Education, he or she should try to organize six interrelated programs or at least a number of programs organized around six interrelated principles. Here they are:

First, launch a program designed to develop supplementary materials which explain the nature of the energy crisis and clearly advocate established government policies. Given adequate funding, good supplementary materials can be developed in a year or two and published for wide dissemination through standard commercial channels. They can be developed for both science and social studies courses. They can be designed for a wide variety of curricular patterns--an occasional lesson throughout an American History course, a two week or one month unit in General Science or Civics, a unit of virtually any length for the elementary schools. Even this minimal program will take a lot of time: get the attention of appropriate members of Congress, draft a bill, pass it, insert notices in the appropriate publications, screen proposals, fund, develop materials, evaluate them, publish, advertise, sell, and prepare teachers, perhaps in workshops. Don't look for a star in the East. There are no overnight curriculum miracles.

Second, be sure to work at all grade levels. Students of different ages and different stages of development understand problems in quite different terms since they function at different cognitive, perspective taking and moral or civic stages of thought. They require different materials, each set developed in keeping with the differing developmental abilities which children have. One package of curricular materials developed for one educational level can no more solve the educational needs of the energy crisis than one technology can solve the crisis itself.

Third, get to the textbook writers and publishers. Why not support a conference of the authors and editors of textbooks which should contain information about the energy crisis? Extend an open invitation. Supply information and practical help. What data can a concrete operational thinker handle? What sorts of materials will be appropriate for a relatively sophisticated formal operational thinker? What reliable information can authors and editors use to revise their texts and present an accurate picture of the energy crisis? Organizers of such a conference could call on representatives of many points of view in an attempt to educate these key educators--the people who write and edit the books which have so much influence on what our children learn.

Fourth, we must try to influence the latent curriculum and to make the latent curriculum work for instead of against us. Isn't there some way to persuade Mean Joe Green or Bill Walton to get out of a small car and explain that they drive it because it saves gasoline, and that saving gasoline is a vital national concern? Can't we have Farah or Chris or Rosalynn--to reach

three audiences--turn off light switches, drive around in small cars, turn down thermostats, or abandon motor boats for sail. Why can't O. J. end up in a small car after his dash through the airport, and why must Baretta burn up rubber to sell an additive, apologizing the while. Energy education is everyone's problem, not only the schools'. We can make the latent curriculum work for us if the society mobilizes itself.

Fifth, we can make the curriculum concrete and understandable instead of abstract and beyond the comprehension of many of our students. In the school where I have been teaching, the heating bill has tripled over a two year period--from $70,000 to $210,000. Those figures do not mean much to most students. They can mean much more if they are translated into books, and band uniforms, and teachers' aides, and librarians, and renovations, and all the other tangible aspects of schooling which cannot be purchased because schools have been forced to spend so much money for energy. What will happen when prices rise even more? What causes them to rise? Will they ever come down again? What do answers to questions such as these mean to educational standards?

We can also make the energy crisis concrete, and hence understandable, by asking students to observe and record the use of energy in their own homes. Here, for example, are ideas for three exercises which might help to make the energy crisis more real to students.[10] Imaginative teachers can think of many other similar exercises.

> Do a survey of the use of electric energy in your home. List all the appliances which use electricity and arrange them in order from most to least important. Then decide how best to use less electricity.
>
> Find out how your home is insulated. Determine the cost of heating and/or cooling the house for a year. Then call insulating specialists to determine how much money (and energy) would be saved by the installation of storm windows and insulating materials.
>
> Make a record of the use of the family automobile for a week or two. Who used it and for what purposes? How much gasoline was consumed? How much might have been saved by eliminating unnecessary trips, using public transportation, joining a car pool, or purchasing an automobile which used less gasoline?

Finally, we can produce curricular materials which raise the moral dimension of the energy crisis in all its complexity. These materials can be used successfully by some senior high school students and by the majority of people enrolled in colleges. Plenty of models for such materials already exist in published materials designed for other curricular goals. College students can, of course, read the enormous literature about the energy crisis which has already been published.

Developing the abilities of students to make intelligent choices about the energy crisis poses a problem which extends far beyond the crisis itself. It implies a fundamental reorientation of educational goals for the entire school system. In addition to stressing knowledge goals, schools must learn to facilitate the development of those higher stages of cognitive

thought, social perspective, and moral or civic consciousness which make the energy crisis truly comprehensible.[11] This reorientation is decades away if, indeed, it ever takes place. But the energy crisis won't wait. It has already arrived and it will become more pressing with each decade. If we do not socialize the public to accept reasonable energy policies, we will hasten the arrival of the crisis and make its impact far more serious. Would that course of action constitute a moral policy for American educators? I, for one, do not think so.

FOOTNOTES

1. Janice Law Trecker, "Women in U.S. History High School Textbooks," Social Education, 35, 3 (March, 1971), 252.

2. Phyllis Arlow and Merle Froschl, "Women in the High School Curriculum: A Review of U.S. History and English Literature Tests," in The Feminist Press, High School Feminist Studies (New York: The Clearinghouse on Women's Studies, 1976), xi-xxviii.

3. Ibid., xvii.

4. The two classic works in the field are Philip E. Jackson, Life in Classrooms (New York: Holt, Rinehart and Winston, 1968) and Robert Dreeben, On What Is Learned in School (Reading, Massachusetts: Addison-Wesley, 1968).

5. A summary of this two volume report entitled "Creating Energy Choices for the Future," can be obtained from the USERDA Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

6. For example see the excellent article by John M. Fowler in Social Education, 40, 4 (April, 1976) 246-256.

7. Perhaps the best short account of Piaget's work is Herbert Ginsburg and Sylvia Opper, Piaget's Theory of Intellectual Development: An Introduction (Englewood Cliffs, Prentice-Hall, 1969).

8. Perhaps the best summary of this research is in Lawrence Kohlberg, "Moral Stages and Moralization," in Lawrence Kohlberg, Collected Papers on Moral Development and Moral Education (Cambridge, Massachusetts: Center for Moral Education, 1973).

9. Adapted from Edwin Fenton, "The Cognitive-Developmental Approach to Moral Education," Social Education, 40, 4 (April, 1976), 189.

10. For a number of concrete examples about the environmental crisis in general, see George Peter Gregory, Environmental Concerns: The Nation (New York: Harcourt Brace Jovanovich, Inc., 1977).

11. For an exposition of this position see Lawrence Kohlberg, "The Concepts of Developmental Psychology as the Central Guide to Education: ..." in Maynard C. Reynolds, ed., Proceedings of the Conference on Psychology and the Process of Schooling in the Next Decade: Alternative Conceptions (Minneapolis: University of Minnesota Audio-Visual Extension, n.d.), 1-55.

## SESSION V

## CONSTRAINTS INFLUENCING EDUCATION'S ROLE

A comprehensive energy education program will undoubtedly include conflicting perspectives. This session featured a panel representing alternative viewpoints on the energy dilemma and the role schools should play in coping with it. The panel was chaired by Merilyn Reeves, member of the National Energy Committee of the League of Women Voters. Panelists included: Bill J. Cunningham, economist, AFL-CIO; Merrill J. Whitman, acting executive director, Americans for Energy Independence; Richard B. Scheetz, coordinator of educational services, Edison Electric Institute representing the Energy Educators Forum; and, Richard P. Pollock, director, Critical Mass Energy Project representing Ralph Nader's Energy Task Force.

AMERICAN FEDERATION OF LABOR AND CONGRESS
OF INDUSTRIAL ORGANIZATIONS

Bill J. Cunningham, economist, Research Department
AFL-CIO, Washington, D.C.

The energy problem our country is facing is a serious one, but it is a problem we can deal with if we make a positive effort. The oil embargo, natural gas shortage and rapid energy price increases have made some people more pessimistic about our country's economic future than is really justified. It has led some political leaders to abandon some of the basic economic goals that were little questioned in the 1950's and 1960's. The pessimism is expressed in the background statement for the conference which says that perhaps students need to be prepared for adulthood in an energy starved world, and which indicates that people may face radically changing life-styles in the future.

I want to call your attention to our basic economic goals and to argue that the future need not be an unpleasant one; that changes in life-styles need not be abrupt or drastic and the American people can have a continuing improvement in their standard of living and full employment despite the energy problems that we will continue to face in future years. The aspirations of the American people haven't changed over the last few years. They still want jobs at good incomes, and they still want a rising standard of living. These goals are especially important for working people in the country. There are millions of people who are not poor, but for whom a Saturday night trip to a local movie theatre in addition to purchases of basic necessities presents a heavy strain on the family budget.

The possible increase in the standard of living is limited by the use of new technology, which is put in place to increase the amount of goods and services produced by each worker in the country. Technology is still advancing because each day people are discovering better and more efficient ways to produce things. The Bureau of Labor Statistics expects productivity, that is, the output that each worker produces in an hour's work, to increase by 2.7 percent per year on the average from 1980 through 1985.

If the economy is managed properly, this rising standard of living can occur with full employment. To achieve full employment in the short run, the economy must produce about 7 percent more goods and services each year over the next few years to provide jobs for those people who are unemployed, to provide jobs for the people unemployed because of productivity increases, and to provide jobs for new members of the labor force which has been increasing at about 2 percent per year. Over the longer run the economy needs to increase its production by about 4 percent each year, in order to provide jobs for an expanding population and to provide jobs for the workers displaced by advances in technology.

A growing economy will need a growing energy supply, but it is essential that the growth in energy come from domestic sources and not from an increase in imports. To achieve this goal and to minimize the strain on

our resources it is necessary not only to develop our own alternatives to oil and natural gas but to put a strong conservation effort into place. Every barrel of oil saved through more efficient use will be one more barrel of oil available to fuel the growing economy and provide jobs for a growing labor force. The largest energy savings we look for are through the use of smaller cars and through the improved insulation of buildings. Energy conservation means driving smaller cars, better insulated homes, and more efficient use of energy by industry, but we don't feel that conservation means a radical change in our life-styles.

We believe that the growth rate of energy can be cut substantially from past growth rates through conservation without compromising our goals of full employment and rising incomes. Energy sources which are alternatives do exist and can replace oil and natural gas. These include coal reserves in the United States which are about 2½ times as large as the world's oil reserves. United States energy reserves also include large amounts of uranium. Enormous quantities of oil are contained in a limestone-like rock called shale which is found primarily in the western states. The oil can be removed by methods such as crushing the rock and removing the oil. A substitute for natural gas can also be produced from coal.

Solar energy should begin to make a contribution to our energy supplies in the next few years. Although it is not the answer to our energy problem by itself, solar should be making an important contribution to energy supplies by the end of the century. The Sheet-Metal Workers Union is now training its members to install solar heating and cooling equipment. The existence of trained workers will greatly facilitate expanded use of solar energy.

Energy costs will be rising in the future, but with productivity increases raising our buying power, our ability to afford energy will be rising as well. With rising real incomes, rising energy costs in the future will be unpleasant, but they should not deter us from the achievement of our basic economic goals of full employment and a rising standard of living.

High levels of employment and rising incomes make it easier to achieve other social goals such as the elimination of poverty, better health care and education. The high levels of employment and rising standard of living in the 1950's and the 1960's increased government revenues and made it easier for us to devote an increasing percentage of our national income to pay for better government services and to expand our educational programs and opportunities for the American people.

## AMERICANS FOR ENERGY INDEPENDENCE

Merrill J. Whitman, acting executive director
Americans for Energy Independence, Washington, D.C.

A Gallup Poll report in the June 13 Washington Post stated that only 52% of the American public knows that we must import oil to meet our energy needs. This situation apparently exists in spite of President

Carter's nationwide TV appeals, the impact of the 1973-74 oil embargo and the fact that we have been importing large volumes of oil for about 20 years -- 19% of our need in 1960, 23% in 1970, 38% in 1975, 43% in 1976 and 48% during the month of April, 1977.

If public study can be related to education, we should understand the energy problem. During the summer of 1973, at the direction of President Nixon and before the oil embargo, 121 Federal employees from 36 departments and agencies and 282 consultants from the private sector reviewed and evaluated over 11,000 specific R&D proposals and proposed a 5-year $10 billion Energy R&D Program for FY 1975 through FY 1979 that was supposed to remove enough obstacles to energy independence by 1980 so that we could see our way out of the woods.

Since 1973 there has been an unbroken stream of national and global energy studies and associated reports: The National Academy of Engineering Study "U.S. Energy Prospects" dated May 1974; The Federal Energy Administration reports, "Project Independence," dated November 1974 and the "National Energy Outlook" dated March 1976; "The National Energy Plan," April 1977, by President Carter's Energy Policy and Planning Office; and also this spring "Energy: Global Prospects 1985-2000" a Report of the Workshop on Alternate Energy, and a number of others.

In view of this level of disconnect on information relating to energy supply and demand between those involved and informed and the general public, there is ground for doubt about the possibility of developing widespread understanding of more complex and technical issues such as the removal of sulfur from stack gas or of the relative merits of magnetohydrodynamics, co-generation, central station solar power and the fast breeder reactor.

I believe that a major restraint on energy education is the smokescreens that major energy industries are putting up to justify continuation of practices that are wasteful of energy -- full page ads extolling the good mileage of luxury automobiles, and efforts on the part of container manufacturers to justify continued use of aluminum beverage cans and throw-away bottles, for example.

It is estimated that 16.5% of our total energy is used on the U.S. food system. Excluding exports, (2.54 ÷ 16.5 = 15.4), about 15% of this total goes to manufacture paper packaging, bottles and cans.

There are other major sources of energy savings that remain essentially unmentioned and certainly untouched by the current conservation effort.

The sugar industry is very energy intensive. Large quantities of heat and power are used in sugar refining. Those of us who are into nutrition and diet know that sugar is not good for us. The television advertising aimed at our children is loaded with material extolling sugar rich products.

Another example is the meat industry. Americans get 36% of their food energy from meat, eggs and milk products. We get most of our protein from these sources. We could get it from cereal-grain, legumes and nuts

and conserve lots of energy. The consumption of beef per person in the U.S. more than doubled between 1940 and 1972.

Cattle, sheep and hogs eat seven times as much food energy as the energy contained in meat. Cattle and hogs are fed on corn and grain in the Western feed lots. Corn is a major component of chicken feed.

There was a 240% increase in U.S. corn yields between 1946 and 1970 which involved a 310% increase in energy to produce the corn, primarily attributable to the use of fertilizer. Fertilizer is responsible for 30% of all U.S. farm output. 450 billion cubic feet of natural gas are used to produce the 12 million tons of anhydrous ammonia used annually for fertilizer in the U.S.

If you want a challenging energy conservation project, you can take on the task of convincing our children that they should eat soybeans instead of McDonalds hamburgers.

In regard to the position of Americans for Energy Independence on the subject of energy -- we believe that a sound energy policy requires conservation. We must eliminate waste, improve the efficiency of energy production and use, and moderate excessive consumption standards. We must all understand that wasteful practices result in the squandering of energy resources and in the outflow of dollars for imported oil.

But even as we do our best to conserve we will need much more energy than we now have to sustain a productive economy and the jobs vital to a stable society. We will need more energy to recover from the aftermath of the 1974-1975 recession and to secure the future economic growth and to generate jobs for an ever-expanding labor force.

National efforts to produce this energy from our plentiful coal and uranium resources must not be thwarted any longer by indecision and inaction, unrealistic legislation, contradictory regulation, ill-founded criticism, or the illusion of a technological breakthrough.

In the near term, the nation has very few energy options from which to choose. We must make the best possible use of our oil and gas resources and make full use of our abundant reserves of coal and uranium. Our immediate research and development tasks are to determine the true potential of obtaining gas and oil from coal, oil from shale, and bulk electricity from the breeder, while maximizing the benefits of available solar and geothermal technology. When it proves justifiable, the commercial demonstration phase of the most promising of the competing concepts must be pursued as a matter of the highest national priority. At the same time, we must continue to apply our resources to the generation of bulk electricity from modern coal and nuclear plants.

For important practical reasons, independent of the intrinsic merits of a new energy concept, some twenty to thirty years must pass before its true potential can be realistically estimated. New products and new technologies -- if they can sustain reliable, safe and economic performance -- generally require replacing and augmenting older generation facilities in an evolutionary rather than revolutionary manner. There

are substantial limitations associated with phasing out large numbers of existing facilities. Acquiring the vast resources, obtaining the regulatory approvals, and phasing the transition to use of new equipment and facilities requiring long construction periods make introducing energy options a difficult task.

In the short run, pursuit of advanced concepts must not distract us from those energy options which have the greatest potential for meeting our near-term and intermediate energy needs. The nation must proceed in a practical and efficient manner to provide an assured supply of energy using the energy technologies in hand.

We have -- here and now -- the proven technology, know-how and capability to make use of our coal and uranium resources while maintaining the environment's quality and assuring the health and safety of workers and the public.

Finally, Americans for Energy Independence believes that a healthy, expanding economy is necessary to provide employment and guarantee health and opportunity for us all. During periods of high economic growth, the number of people living in poverty has always been reduced and the living standards of low and middle-income Americans have improved. But economic growth -- and the jobs it provides -- can only be maintained by a steadily increasing supply of energy, increasing even if we make the most conservative use of that energy.

## ENERGY EDUCATORS FORUM

Richard B. Scheetz, coordinator of educational services
Edison Electric Institute, New York, New York

The statement which follows is made on behalf of the Energy Educators Forum (EEF). The Forum members are representatives of energy-related national associations and a government agency with responsibilities for educational relations and services. Represented in the Forum are the American Gas Association (AGA), the Atomic Industrial Forum (AIF), the American Petroleum Institute (API), Edison Electric Institute (EEI), the U.S. Energy Research and Development Administration (ERDA) and the National Coal Association (NCA).

The members meet, on call, to exchange information about educational services and consider ways to advance the energy education of students, teachers and the general public.

The opportunity to present this statement before the national conference on "Education Confronts The Energy Dilemma" is appreciated.

We hope to convince you that energy should be in the school curriculum at all levels and in all disciplines. We hope to convince you of its importance, its urgency and that it can be done.

To accomplish these objectives, the statement will deal with the WHY - WHAT - FOR WHOM - and HOW of Energy Education.

Why Energy Education

From a self-interest point of view, energy education is needed so that the energy industries may, over the long term, continue to provide the products and services customers need and want. Improved knowledge about energy, improved understanding of the complex relationships with the economy, the environment, society and technology, and informed decision making by students, teachers and adults are needed if we are to provide secure supplies of readily usable energy now, in the mid-term and beyond the year 2000.

In addition, the Forum members recognize, along with other concerned industrial and educational leaders, the following: Next to maintaining peace, the most important issue we face in our lifetime is energy. Our jobs, our standard of living, our recreation, in short, our future and that of our children will be influenced greatly by the availability and cost of energy.

This nation's progress, indeed the progress of all mankind, has been directly tied to the development and utilization of energy. Man's climb from the cave to modern civilization has been due largely to his ability to develop and use energy.

Few Americans recognize the role abundant low-cost energy has played in their choice of life-styles. The availability of energy has, for the most part, enabled us to choose where we live and work and how we spend our leisure time.

During the past three decades, a large number of people of all ages have altered their ways of living significantly. Some in their "golden years" have resettled in warmer climates. Some young adults have chosen to live in harmony with nature. A communal way of living has been the choice of others. For the most part, these decisions have been based on freedom of choice. This freedom of choice has been made possible, in large part, by the use of energy to perform much of labor.

Profound alterations in our traditional energy patterns and trends are taking place. Rates of energy use, sources of supply, cost relationships, environmental considerations and energy technology are involved in significant changes.

If freedom to choose the way we live is to continue, all citizens, youth and adults alike, must understand the basic issues and be prepared to make informed, rational decisions. For decisions made today about energy, its supply, its social costs and the trade-offs necessary will determine the quality of our life and that of our children for the next several decades.

As stated by John C. Winger, the concern is urgent. "Without question, an adequate supply of energy is a matter of vital concern to everyone. Every individual consumer has essential needs that must be satisfied. And so does every business, large and small alike. Their

survival and growth depends upon an adequate supply. Every member of organized labor has a stake in the adequacy of the supply of energy - their jobs depend upon it. And, for the same reason, every independent wage earner has an equal interest.

"All the students now in school should be concerned about the energy supply because their future ability to obtain employment will depend upon how much there is. And parents with sons and daughters now in school should be concerned for the same reason. Government, too, should be ... concerned ..., for government's financial ability to conduct all its normal activities depends upon the economic health and productivity of the nation." [1]

Energy Educators Forum members hold diverse viewpoints on a number of issues associated with energy. However, the members are united in their belief in the importance of energy education. We are convinced that energy education in the nation's schools and colleges is essential to provide the basis for informed decision-making by sizeable segments of the youth and adult population.

What Energy Education .

It is essential, therefore, that students at all curriculum levels have access to accurate, factual information about the role of energy in an industrial society. Children in school now will soon form family units of their own, establish homes, obtain jobs and become customers of goods and services which must be produced with energy.

We strongly recommend that, among other things, today's students and adults need to know about:

The sources of energy.

The uses of energy.

The conservation of energy resources.

The environmental impact of energy conversions.

The need for energy in achieving environmental improvement.

The economics of energy.

The limits of energy.

In addition, students and adults need skill in the application of knowledge and clarification of their values to understand and decide on the trade-offs that are necessary. For one desirable result cannot be

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1. Winger, J. C., Nielsen, C. A., "Energy Report from Chase" The Chase Manhattan Bank, N.A., N.Y., NY, September, 1976.

obtained without some effect--and, more than likely, an undesirable compensating result--elsewhere in our societal mechanism. [2]

We agree with the statement by John M. Fowler that: "Cost/benefit questions must ultimately be answered by the public which puts responsibility for discussion in the lap of educators." [3]

The knowledge, the understandings and the values clarification can be accomplished if we seize the opportunity and if schools and teachers have the necessary tools to do the job. The tools necessary to do the job can be developed through enterprising cooperation between the academic community and the business world.

Cooperation between education and business is not a new idea. Many of the Energy Educators Forum members have a long history of providing educational aids for teachers and students. We have responded to educators' invitations for assistance by providing personnel, materials, equipment and, when appropriate, funds for specific projects.

Examples of cooperative efforts between education and the energy industries will be noted later.

Energy Education For Whom

We Forum members believe that there is sufficient lack of knowledge about energy by all members of society. We recommend that energy education be developed for those in grade levels kindergarten through post-graduate school.

There is evidence that young children can be involved in activities which will lead to understanding of such concepts as energy, work, fuel, power, electricity, environment, air pollution, recycling and conservation. A multimedia kit which assists in the development of these concepts was sponsored by Consumers Power Company for use in kindergarten through grade three. It has been used in the State of Michigan for a number of years and will be available soon for national distribution. This instructional aid is titled "A Powerful Friend."

From the many requests received for energy-related information, we know that adults and children have an interest in practices which will conserve energy resources. We believe that the subject of energy conservation is appropriate for all levels of instruction and especially for those at the community college level and for the general public.

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2. Paraphrase of a statement by R. Wheeler, Consumers Power Company in a presentation before the Birmingham International Education Film Festival, March 13, 1973.

3. "Energy, Education and the 'Wolf' Criers," John M. Fowler, The Science Teacher, Volume 43, Number 3, March 1976. The National Science Teachers Association, Washington, D.C.

It is not our intention to delineate a catalog of curriculum guides and specific lesson plans for the various levels of instruction.

We are convinced that energy-education materials, curriculum guides, student activities, glossaries and references, can be developed best through cooperative efforts.

Following are examples of how businessmen and educators have developed energy-related materials at national, regional, state and local levels. It is by no means a definitive listing of such efforts.

The National Science Teachers Association (NSTA), under a contract from the Division of Technology and Environmental Education, U.S. Office of Education, conducted an Energy-Environment Materials Project under the direction of Dr. John M. Fowler in 1975. The results were the publication of three volumes: An "Energy-Environment Source Book," an "Energy-Environment Mini-Unit Guide" and an "Energy-Environment Materials Guide."

A unique feature of the NSTA Project was that twenty individuals from education, industry, and public-interest and environmental organizations were invited to serve on an Advisory Committee. Five members of the Energy Educators Forum served on this Committee.

"The Advisory Committee was assembled to gain diverse perspectives of a variety of interests and points of view. During the several meetings of the committee, the materials under development were read and discussed and suggestions for improvement were made. Many of these were incorporated in the materials." [4]

With the diverse points of view represented, complete unanimity was not expected, nor was it achieved. However, the committee was satisfied that the materials represented a balanced presentation.

The NSTA materials have been distributed across the nation. Several teacher workshops demonstrating uses of the materials have been held in connection with NSTA national and regional meetings.

The U.S. Energy Research and Development Administration (ERDA) has released for review and comment several energy-education materials.

A curriculum guide, "Energy Conservation for Home Economic Teachers" was developed at the University of Tennessee under a grant from ERDA. Forum members were invited to review and comment on the content and it is now being field tested.

Other classroom materials being developed and tested for ERDA by the National Science Teachers Association include a series of six interdisciplinary student/teacher activities for K-12 and 19 Fact Sheets on Alternative Energy Technologies.

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4. National Science Teachers Association, "Energy-Environment Source Book," Volume I & II, John M. Fowler, Director, Washington, D.C., 1975.

Following testing and revision, these materials will be printed and made available for national distribution. [5]

Computer-Based Resource Unit: Natural Gas as an Energy Resource is an example of the results of a cooperative effort between a Forum member and an institution of higher education. Several years ago, the American Gas Association's (AGA) Educational Services made a grant to the State University of New York at Buffalo that enabled a group of teachers to prepare a computer-based resource unit for use in grades four through nine.

Content items, student activities and supporting resource materials coded to instructional objectives are stored in a computer bank. Teachers requesting the information from AGA's cooperating member companies can obtain a Resource Guide printout. The Resource Guide is a compilation of suggested items and not a finished lesson plan. The using teacher and students still need to select activities and to check with the school librarian to see which of the resource materials are available. [6]

Energy and Man's Environment is an example of a regional collaborative effort. Begun in 1972, the project involved teachers and administrators from school districts in several northwestern states. The schools were selected by the State Education Agencies. Funds for the project were provided by grants from the Northwest Public Power Association, Public Power Council and the Northwest Electric Light & Power Association. The project, under the direction of Dr. John Jones, has produced six sections: "Sources of Energy," "Uses of Energy," "Conversion of Energy," "Impacts of Energy," "Limits of Energy," "Future Sources of Energy," plus an "Energy Activity Guide" and a "Glossary." The teacher-developed materials are interdisciplinary and have been approved for use by the education departments of nine northwestern states. [7]

Two examples of state-level cooperative education projects are those initiated by Southern California Edison Company (SCE) and Florida Power & Light Company.

Thousands of school youngsters are being invited to become "Energy Conservation Inspectors" under a new conservation program launched recently by Southern California Edison Company.

Boys and girls will be recruited as "inspectors" through school programs supported with energy conservation classroom kits being distributed to elementary schools by SCE.

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5. Draft materials may be obtained by writing ERDA, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

6. Educational Services, American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209.

7. Energy and Man's Environment, 9224 S.W. Hamilton, Suite 301, Portland, Oregon 97201, Dr. John C. Jones, Director.

Pupils in each of the participating schools will be able to learn how to read their electric meters at home. They also will be able to measure energy consumption of appliances in their homes to keep track of electric energy usage.

Each classroom undertaking the project is asked to set an energy saving goal and reach it with data assembled from the students' homes. SCE hopes the program will involve both the students and parents in developing an interest in saving electricity and this may help encourage a whole new generation of citizens well informed on the need to conserve our energy resources.[8]

In Florida, a series of five booklets on Economics and American History have been produced and distributed. The booklets were written by a university professor and are directly related to the eleventh grade American History course in the state's public schools. Other electric companies and the Joint Council for Economic Education in Florida have joined Florida Power & Light in providing grants making the booklets available for most of the secondary schools in the state.

Last month, a Forum representative spoke before the Anniversary Meeting of the Energy Education Advisory Council for Philadelphia Electric Company (PEC). The members of the council are teachers, supervisors and administrators and represent all levels of educational activity. The council advises PEC on how it can best serve education.

An activity-oriented curriculum guide, "Our World of Energy," has been developed, with the help of teachers, for grades three through eight. The materials are being pilot tested. When revised, they will be made available to teachers in PEC's service area who participate in a teacher training workshop. An activity guide for secondary school application is under development and will be available for classroom testing this fall.

These examples of cooperative efforts in energy education at national, regional, state and local levels have been cited to illustrate procedures by which relevant, balanced and up-to-date curricular materials may be developed.

These efforts have potential for significant impact on energy education. Much more needs to be done.

Constraints such as the crowded curriculum, the availability of supplementary reference material, the limits of knowledge of personnel, of time and of money will influence education's response to the energy dilemma. They are duly recognized.

We do not mean to minimize the difficulty of the job ahead. We do not wish to oversimplify it. Yet, the task of providing energy education in the schools is important. It will be difficult, time-consuming and costly. It is urgent that we get on with it.

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8. Southern California Edison Company, P.O. Box 800, Rosemead, California 91770, E. C. Lund, Supervisor, Educational Services.

The members of the Energy Educators Forum will continue their efforts to provide teachers with the tools to do the job.

We believe we have knowledge, special expertise and resources which can be of assistance for providing energy education in the schools. We welcome opportunities to demonstrate our commitment to join with others in this important job.

The commitment is based on our concern for ourselves, our children and our children's children, all of whom will need energy for their future.

We ask you to share with us ideas for cooperative projects to advance energy education in the schools.

## RALPH NADER'S ENERGY PROJECT

Richard P. Pollock, director
Critical Mass Energy Project

Do we wish to produce children who are thinkers or believers?

It's an age-old question that's confronted educators since the day one. It should be a major question confronting every elementary or secondary teacher who's about to develop a curriculum on the subject of energy.

Do we want thinkers in our society, or believers?

Clearly, as the debate over our energy future intensifies, I'm sure most--if not all the participants in this conference--would surely respond that given the choice, we would hope future generations would demonstrate critical, questioning qualities.

But is our education system turning out such children? Indeed, are they presently capable of such a task?

Let us examine the sources now available to most elementary and secondary teachers who are searching for an adequate energy curriculum.

First, there are the publishing houses. Today, the publishing business is a heavily concentrated industry, where seven firms control nearly two-thirds of the whole market. The top publishing firms are today controlled or bought out by some of the largest corporate conglomerates in the nation. The names of some of these corporate entities are well known to all of you: ITT, Litton, Westinghouse, Bell & Howell, RCA, CBS, Xerox, Raytheon, the New York Times and IBM.

Second, there are the energy companies themselves and their partners, the electric and gas utilities. Each year they saturate the elementary and secondary market with free materials or with resources that are priced well below commercial rates. This development is causing growing alarm in

some educational circles that our school children are quickly becoming captive audiences to a new form of market advertising.

Third, it is important that there is little accountability for the materials now used in the classroom. Publishers contend that they can't afford field-based testing of their textbooks and careful evaluation of the objectivity, or effectiveness of their resources are therefore unknown.

In addition, nearly all of the industry's educational materials are not tested either. The National Advertising Review Board, a regulatory agency for the advertising industry has no guidelines or evaluation process for the review of industry-prepared educational materials. The same is true for the Children's Review Unit of the Council of Better Business Bureaus, the Federal Trade Commission or the U.S. Office of Education.

This general shortcoming afflicts the development of an energy curriculum for the elementary and secondary level so adversely that I believe immediate attention must be directed to this area.

Fourth, in a recent study conducted by the EPIE Institute, it was found that half of all teachers today receive no training, from any source, in the use of the materials selected for use in their classrooms. Of those who did receive training, twenty-five percent said they received it from the publisher's representative.

Clearly, in the complex and highly contentious debate over energy, our schoolchildren are receiving untested materials, drafted and promoted by corporate industry and delivered by teachers ill-prepared to teach a topic that probably is as beguiling for them as it is for the ordinary citizen.

I have not yet addressed the topic of content itself -- only the restraints and problems affecting the availability of educational materials. But the objectivity of the materials themselves is an important issue too.

First there is the relationship between the Federal Government and the publishing industry. An abundance of elementary and secondary materials now distributed on energy have been authored or produced by the United States Energy Research and Development Administration (ERDA).

For those of you unfamiliar with ERDA, let me take a moment to chart the agency's history. Formerly, ERDA was known as the Atomic Energy Commission. But in 1974, the Congress disbanded the AEC and divided it into two separate federal agencies -- ERDA and the Nuclear Regulatory Commission (NRC).

They eliminated the AEC in 1974 because the Commission was operating under a cloud of scandal and suspicion. The root cause for this problem: the original charter for the Commission. The original mandate for the AEC charged it with both promotion and regulation of the nuclear industry -- twin roles which appeared to the Congress -- and were -- incompatible. For how can an agency aggressively promote nuclear energy and entice industry to purchase the technology while it was also acting as a watchdog over the field?

Following a number of largely scandalous revelations about wrongful actions undertaken by the agency, Congress, under advisement of the Nixon Administration, elected to separate zealous selling of nuclear power from regulation.

Thus today, the NRC is empowered to regulate nuclear facilities while ERDA is still in the promotion business for the technology. Although the agency does have solar projects, and coal projects, a review of the agency by the Natural Resources Defense Council revealed that over two-thirds of its budget is still committed to nuclear power. Alternative energy research and development in such technologies as solar support, geothermal, wind, etc. have unfortunately been given little support.

This raises the question of the type of value systems ERDA-guided or authored textbooks or other materials might convey to the student.

Let me cite one example. In 1976, ERDA published an educational pamphlet called "Shedding Light on Facts about Nuclear Energy." The agency contended that the "Shedding Light" material was intended only as an internal document for employees of ERDA as part of their Performance Awareness Program. About 6,700 employees are in the program.

Yet, 100,000 copies were printed, 75 percent of which were distributed in California prior to the statewide referenda on nuclear power, called Proposition 15. Before it was ordered withdrawn by Congress, Westinghouse had asked for 300,000 copies. General Electric placed large orders too.

The U.S. General Accounting Office had this to say about the objectivity and factual basis of the "Shedding Light" material:

> "The pamphlet contained several statements labeled as 'facts', which do not fully discuss the issues in sufficient depth to provide an objective statement of the facts. As a result, the pamphlet is misleading.
>
> "For example, in discussing nuclear safety systems, the pamphlet states as a fact that 'key safety systems are tested periodically to assure they will work if needed.' This statement would lead the reader to believe that key systems such as the emergency core cooling system have been tested and will work. GAO noted, however, that the emergency core cooling system has never been tested on an operating reactor under accident conditions and that experimental tests will not begin using nuclear fuel at an agency facility until the fall of 1977."

Later the General Accounting Office noted, "In an attempt to discuss major nuclear issues in a simplified manner, ERDA failed to adequately discuss relevant facts, such as the status of certain key safety systems and the problems involved in controlling and storing nuclear wastes."

In conclusion, the GAO reported that "We believe the pamphlet is pro-nuclear and does not provide an objective discussion of the issues surrounding the development of nuclear power. Although ERDA did not violate any laws or regulations . . . in publishing and distributing Shedding

Light, in our opinion, the pamphlet is propaganda. In our view, publication and distribution of Shedding Light has only served to raise questions about ERDA's credibility and objectivity."

The intent of ERDA programs, declared the GAO, "meets the definition of propaganda -- the deliberate spreading of facts, ideas or allegations to further one's cause or to damage an opposing cause."

I would thus urge all educators who wish to obtain materials that are balanced to avoid publications that are authored by either ERDA or by its new agency title, the U.S. Department of Energy.

A second problem for educators is in the area of corporate-produced materials about energy. The issue is a difficult one because many of the "free" offers of educational resources appear attractive to financially strapped elementary and secondary school systems. But their ultimate price may be much more costly.

Today, corporate industry, public utilities, and national trade associations have been quietly entering the educational resource field. They are producing on a massive scale teachers' guides, student texts, printed matter and audio-visual materials for grades K-12.

In some quarters there is concern that our schoolchildren will in effect become a captive audience for a new form of market advertising. If this proves to be the case, then our public school system may be reduced to little more than an extension of the American corporation.

How widespread is this new industry effort? At the moment, it is very difficult to precisely quantify it, mainly due to the secrecy most corporations cloak their promotional activities in.

But we do have some figures. And the picture they depict is disquieting. Let me cite several examples.

One of the major teachers' guides for energy is published by the National Education Association. One series available has been written by the U.S. Energy Research & Development Administration (ERDA), formerly known as the Atomic Energy Commission. The series was financed by the Mobil Oil Company.

An initial study conducted by the Center for the Study of Responsive Law reveals that the American Gas Association sends out nearly 20,000 educational packets for school children each year.

The General Electric Company mails out packets designed for classroom use on the energy issue at the rate of 75 per day. The rail industry's Association of Railroads responds to about 12,000 teachers' requests annually.

Among electric and gas utilities, the Center has discovered that the amount of classroom materials made available for grades K-12 is mushrooming.

The Center asked elementary and secondary school teachers to request information from 106 investor-owned utilities.

Thus far 55 percent of the utilities have responded and more are still being processed. Among the respondents, 87 percent provided our teachers with educational material, half of which was specially prepared for direct classroom use.

An additional 23 percent made available extensive catalogues for teaching school children the energy problem.

Overall, 92 percent of the respondents sent educational materials to our inquiring teachers. Among a separate survey to Fortune's 500 top industrial corporations, 63 percent of the respondents have provided information, materials, catalogues, and elementary or secondary school materials. I've brought some of the materials from utilities to this panel today for your own examination.

The Metropolitan Edison Company of Pennsylvania offers this packet, described by Met-Ed as "designed to acquaint you and your students with the basics of electricity and with energy management."

It has 22 brochures, makes available 69 other articles, 5 resource kits for grades 3-12 and 7 films and filmstrips, free of charge.

Metropolitan Edison typifies the planning now underway by energy companies to take advantage of our public school system to promote their product.

To assist the teacher, Met-Ed now offers -- free of charge -- an extensive program called "Educate the Educator". In the words of the utility, "it is a new program designed for teachers, many of whom are community opinion leaders as well as our customers. This program will acquaint educators with the basics of electricity and will provide them with reference and resource material suitable for classroom use. In turn these educators can multiply our hands by utilizing the provided materials with their students -- our future customers."

As I noted, the Met-Ed campaign is not isolated. Public Service of Colorado each month distribute 90 films to public schools in their state.

The Florida Power and Light Company has a teacher's guide that proposed nine different projects for the elementary school level. These are some of the project concepts that they propose teachers adopt for the classroom.

1. "If electricity was eliminated, what jobs and conveniences would be eliminated?"

2. "Name as many new businesses that were formed due to the increased production of electricity."

3. "If you had no electricity for schools, hospitals and businesses, how would your life change?"

Ms. Sheila Harty, the project director for the Center's industry survey, best summarized this problem in a recent working paper on the subject of corporate accountability in educational materials.

"The concern here is whether industry is taking advantage of school children as a captive audience for market advertising. Instructional material in a product area prepared by that industry's public relations should be scrutinized for bias. Such vested interests are seductively packaged in multicolored glossies and distributed as if sound educational material.

"Industry argues that their specialized fields can provide invaluable technical knowledge and experience. The classroom, however, is an inappropriate forum for weening children as prospective customers under the guise of special interest expertise."

My advice to this panel today is:

1. We need to test instructional materials for their effectiveness in the classroom. A systematic evaluation of the energy textbooks for elementary and secondary schools needs to be undertaken.

2. There is an urgent need to select materials on the basis of their effectiveness, not on the grounds that they are "new" or "exciting."

3. We should scrutinize textbooks and other supplementary educational materials for bias.

4. Federal or industry-sponsored items should be banned from the classroom and industry should not be entitled to tax credits for their material.

5. We should involve the teacher in the selection of materials on energy.

6. We need to advise teachers about how they can best utilize their resources.

7. The major education associations should urge the U.S. Department of Justice to investigate the publishing industry for potential anti-trust violations.

8. Associations like the National Science Teachers Association need to receive fuller support from public school systems.

9. Teachers should be encouraged to investigate controversial issues like nuclear power and the inequity of our utility rate structure.

For only with dispassionate, balanced investigation will our children learn. Pie-in-the-sky simplifications and distortions about our energy problem will only breed resentment later in life -- against the school system -- and indeed against the overall system itself.

But then, if we take action now, we might one day have a generation of independent thinkers, not a society of blind believers.

# LEAGUE OF WOMEN VOTERS

Marilyn Reeves, member
National Energy Committee
League of Women Voters, Washington, D.C.

As stated in my letter of invitation the major purpose of this conference is "to explore education's role in preparing students to face a changing energy future," and this panel was charged with the responsibility of focusing "on particular perspectives which should be included in a balanced energy/education program." I welcome this opportunity to participate today and to present the energy conservation position of the League of Women Voters.

It is difficult to address the "Constraints Influencing Education's Role," which is the topic for this panel, for we believe that the problems posed by energy issues represent an opportunity and a challenge to educators, not a constraint. We are on the brink of a new frontier which will test public patience, confound the political process, and challenge the scientific community. Before I explain further what League members think about the energy situation let me first describe a little about our organization which has a long history of study and action in addition to our well publicized voter education activities such as our sponsorship of the 1976 Presidential Debates.

The League of Women Voters of the United States is a national organization with membership open to all citizens of the United States. It is nonpartisan, supporting neither candidates nor parties, but political in the sense that the members select major issues for study and lobby for specific courses of action. There are League organizations in over 1300 communities throughout the United States. We strive to attract members from all segments of the community and I believe that our 140,000 members represent a cross section of liberals and conservatives, young and old. Within a few years I hope that I can add the words male and female to that description for men are welcome to join. Since 1974 we've already added 4,000 men to our membership.

The League is a strong grass roots organization with a structure which emphasizes member involvement and direction. It is a volunteer organization which employs very few professional staff members but relies on volunteers who learn by doing. All League positions are developed through membership initiative and study; all public statements on issues are based on consensus developed through discussion and study by members.

League members protect and nurture this grass-roots system for they know that it is a proven method of developing informed citizen leaders. Indeed, samplings indicate that 50% of the women holding office today at all levels of government would claim League affiliation. The issues surrounding energy are so complex, so urgent and so comprehensive that now, more than ever, we need informed citizens who understand the relationship of the demand for energy and the availability of supply. With this background on how the League develops a position let me share with you what our members think about the energy situation.

At least six months before the Arab oil embargo, the League began taking a look at various facets of energy. At the 1974 League national convention the delegates voted to establish a multi-disciplinary Energy Task Force which underscored the League's sense of urgency vis-a-vis energy. Its immediate assignment was to review this complex issue and to develop information about the difficult choices to be made. Following a 1975 League national conference on energy conservation, a position was drafted and submitted to the 1300 Leagues throughout the nation for their concurrence. This position stated that "energy conservation must be a part of any national or state energy policy," that "public understanding and cooperation are essential to the success of any program of energy conservation," and that "citizens should be involved in the difficult choices that must be made."

The League believes that energy conservation must be the keystone of government energy policies and citizen responses and that new patterns of energy conservation must be encouraged. Members believe that a national energy plan should aim at more efficient, economical use of energy in order to reduce per capita and per household consumption. They further believe that the burden of energy conservation measures should be distributed as fairly as possible among all categories of energy users -- residential, commercial, industrial and transportation -- without bearing unduly upon people of low income. League members also want government policy at every level to provide, as part of the public education process, a basic understanding of what energy is, what it does, and its true costs -- social, environmental, economic and international. The League believes that wise, rather than profligate use of energy resources will buy time to decide on other long-range energy-related policies and programs and will enable Americans to act as responsible citizens of the world community.

For those of you engaged in educational activities I believe the years ahead can be exciting. There has been far too much pessimism in public energy discussions while prophets of doom predict that we face a drastic change in life-styles and lowering of our standard of living as we try to reduce energy consumption. We believe that the life-style changes which will occur as we use energy more efficiently can improve our way of life.

Is the life-style of the harried urban automobile commuter who is forced to spend many hours per week in nerve-wracking traffic one we wish to perpetuate, or is there a better, more energy efficient way?

Must we continue to pave our productive farm lands with shopping centers and single family dwellings while our urban centers decay and we are forced to import vegetables and other food, or is there a better, more energy efficient way?

Must we destroy the grasslands of Wyoming and Montana to provide coal which is used to generate electricity for buildings which are not insulated, or is there a better, more energy efficient way?

Must we threaten the recreation-rich Atlantic beaches to produce more oil to be used in automobiles which get 12 miles per gallon, or is there a better, more efficient way?

We believe that there are more efficient ways to use energy resources and that conservation is the foundation for an energy policy. The life-style changes caused by implementation of energy conservation policies need not lower our standard of living. Change need not be feared, for as the ancient philosopher Heraclitus observed about 400 B.C., "There is nothing permanent except change." Problems caused by energy scarcity create new frontiers and opportunities for creative action.

We look to the education community to provide preparation and inspiration for those who are seeking solutions to this energy dilemma. The League of Women Voters is ready to use our resources to assist in this endeavor.

## SESSION VI

## ENERGY EDUCATION: WHAT'S BEEN DONE TO DATE?

Several federal agencies have already initiated energy education efforts ranging from the development of curricula supplements and teacher training materials to labor force projections and specialized post-secondary training. Key federal energy education spokespersons comprised this panel chaired by Donald D. Duggan, chief, Education Programs Branch, Office of Public Affairs, Energy Research and Development Administration. The panelists included: Rene M. Vawter, marketing specialist, Office of Conservation, Federal Energy Administration; John L. Snyder, director, Modes Development Program, Division of Science Education Development and Research, National Science Foundation; Walter J. Bogan, Jr., director, Office of Environmental Education, U. S. Office of Education; James C. Kellett, Jr., assistant director for education and training, Office of University Programs, Energy Research and Development Administration; Willis J. Nordlund, special assistant, Office of the Undersecretary, U.S. Department of Labor; and, John W. Eberhard, research psychologist, Office of Driver and Pedestrian Research, National Highway Traffic Safety Administration, U. S. Department of Transportation.

## FEDERAL ENERGY ADMINISTRATION

Rene M. Vawter, marketing specialist
Office of Conservation

Among the things that the 1973 oil embargo did was give birth to the Federal Energy Administration. From its controversial beginning, FEA tried to educate the American public about the energy crisis, the finiteness of fossil fuels, and the economic impact of importing increasing amounts of oil.

In developing its energy education program, FEA followed a marketing approach which calls for audience segmentation. How FEA worked with educating one segment of that audience -- youth -- is what I'd like to share with you this afternoon.

In 1974, FEA took its first step into formal energy education with a high school program. It funded 24 energy conservation training workshops for high school students in the New England States.

In 1975, FEA extended those training workshops to include 7 additional States that wished to participate: Alabama, Colorado, Georgia, Illinois, Michigan, New Jersey, and New York. That year, FEA's formal energy education program also grew to include materials for students and teachers at several academic levels. FEA published and widely distributed:

- ENERGY: UNDERSTANDING AND ACTIVITIES FOR YOUNG PEOPLE, a booklet designed for use with junior high school students and with club groups such as Boy Scouts and 4-H.

- ENERGY ACTIVITIES WITH ENERGY ANT, a booklet designed to tell children, K-3, about energy and how to use it wisely.

- ENERGY ENVIRONMENT MATERIALS FOR TEACHERS, a three-volume study done by the National Science Teachers Association under a grant from the Office of Environmental Education, HEW. The volumes include a Teacher Resource Book, an annotated bibliography, and a guide to the development of energy mini-units, K-12.

In 1976, FEA anticipated developing a whole range of interdisciplinary energy education units to be used as curricula enrichment, K-12. While the material development never materialized, this objective explains our rationale for conducting the following two needs-assessment activities:

- Regional teacher hearings were conducted to determine the status of energy education around the country and to hear educators' perceived needs in regard to energy education. (While there is no time to get into the findings of those hearings now essentially the teachers told us that to have an effective energy education program they needed direction, materials, and money.)

- We also conducted a materials survey to discover what energy education materials were available, K-12. This survey revealed about 4,000 items which are listed according to media -- print, films, kits, and games. The study, called the Energy Education Materials Inventory, is getting a topical index, so it is not yet ready for distribution.

In addition to doing needs-assessment studies, FEA did produce some hands-on teacher and student material in 1976. It developed and distributed:

- THE ENERGY CHALLENGE, a booklet that contains spirit duplicating masters of student activity sheets and teacher background information for use in the middle school.

- Additional energy ant materials -- a story book, posters, and two film strips with cassettes, for the primary grades.

1977 brought us an historically cold winter, a natural gas shortage, and a new administration that has taken on dealing with the energy problem. This year, FEA has expanded its energy education endeavors to include activity at the community and junior college level. With ERDA, FEA is funding the development of 10 energy modules for insertion into the community/junior college programs.

I think it is safe to say that FEA will continue to work in the area of energy education as long as FEA exists, which probably will be about another two months. At that time, of course, with ERDA and with energy pieces of other agencies, it will become part of the Department of Energy. I'm certain the merged agency forces, in tandem with the U.S. Office of Education, will provide even stronger momentum to encourage the implementation of energy education at local levels.

## ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Donald D. Duggan, chair
Chief, Education Programs Branch
Office of Public Affairs

The next logical progression, carrying on from some of the work that the FEA has been doing, is the work that my own agency, ERDA, is doing in my office, which is the Office of Public Affairs, Education Programs Branch. Each of the speakers here brought a packet of handouts which they will probably refer to. Mine is a listing of materials we have developed which are available free of charge to educators. I invite you to come up after the session and help yourself to all of these handouts. They are self-explanatory.

Rather than going through the list of the materials that we have developed in our planning and development, let me just simply describe in principle the approach that we have been taking. Our position, relative

to energy education, is this: Energy education involves a complete understanding on the part of the student of the energy situation with all of its ramifications. Let me spell out in a couple of sentences what that means. That means more than what a lot of teachers seem to think it means, and what some of our speakers today seem to think that it means. Energy education is a far broader subject than just teaching children to conserve energy. That's important, but unfortunately many teachers, curriculum writers, and even publishers, seem to think that is the sum total of energy education, and that is not the case. Once you've taught a child to turn off the light, turn down the thermostat, and, when he gets to be 16, to drive at 55 miles an hour, you have not educated that person in energy. The scope of energy education, first of all, is to educate our future citizens to the very difficult decisions that they will make as citizens, as voters, and as consumers. Very hard questions are coming up -- have come up already -- and sometimes are being decided largely on grounds of ignorance. The nuclear referenda are a good case in point. Most people voted pro or con, for or against nuclear power without any understanding of the real issues involved. They based their votes largely on fear, either fear that a nuclear plant was going to explode like a nuclear bomb or that they were all going to be out of work and freezing in the dark. Neither of those views is real.

But you know we are going to be faced with many hard questions. The people in some areas complain about the price of fuel, but they don't want any refineries, they don't want any deep ports, and they certainly don't want any nuclear plants. I don't know what they want. There are serious issues surrounding every form of energy. Environmental issues, economic issues, and social issues arise whether you talk about strip mining or offshore oil or solar energy. Whatever you talk about, every energy option has a hook attached to it, including conservation. These are decisions which require the best of an informed citizen.

So, that's number one. We have to teach students, not just to turn down the thermostat, but to be informed citizens, and they have to know a depth of technology that is frightening to us today as educators. Second, they need to know how to make wise purchases as consumers. We need not go into the whole area of first cost, life cost, and that whole picture. Suffice it to say that this is a vast topic. They need to understand and make a rational choice about an energy ethic in their lives. This is a subject which touches every discipline in the school. It touches the sciences, social studies, home economics and industrial arts. There is hardly a class that is taught at any level that does not have implications relating to energy.

The third aspect of energy education which is essential is related to careers. There will be some new careers growing out of the changing energy picture -- solar energy technicians, and so on. But every career will be impacted by either the new forms of energy which will become available, or by the lack of energy if this nation does not meet the challenge of the energy dilemma.

Our agency (ERDA) -- and hopefully the Department of Energy -- is going to attempt to promote and make available materials and programs that will assist educators in meeting this energy challenge. We're going to try

to leave time at the conclusion of our panel for questions and discussions among the audience, so I won't go into any more detail at this time. What I would like to do now is to pass on to John Snyder of the National Science Foundation. The National Science Foundation has been charged by Congress with a great deal of basic work in the development of science education.

## NATIONAL SCIENCE FOUNDATION

John L. Snyder, director
Modes Development Program
Division of Science Education Development and Research

The National Science Foundation is an independent agency of the United States Government, funded directly by Congress. Its mission is to support research and education in the physical, biological and social sciences, mathematics and engineering. In fiscal 1977 the total budget for the Foundation was just under $800 million. The educational cut of that budget -- at least, the amount appropriated directly for education programs -- was about $74 million. However, the total amount for education is probably close to double that when you consider the money that, spent in straight research projects, goes for the support of students and student systems. In the education directorate, which I am representing today, there are three divisions, two offices, and over a dozen programs. I would like to describe briefly how some of these programs handle the problem of energy education. There is only one program that can be considered to be directly focused on the problems of energy education. In fact, even this year that statement is not true. The Postdoctoral Fellowship Program last year required that applicants have a research project directed at the problem of energy. This year, however, the scope has been broadened to "national needs," of which, of course, energy is a major one. In fiscal 1977 we had approximately $1.1 million to spend on 89 awards to individual postdoctoral fellows which allowed them to carry on research at institutions of their choice.

None of our other programs focus on energy, but they do accept proposals having energy as a major concern -- at least, most of them do. I will briefly describe some of these programs and give an idea of the kinds of things they support and the kinds of energy proposals they have been considering recently.

The Comprehensive Assistance to Undergraduate Science Education Program (CAUSE) accepts proposals from two- and four-year undergraduate institutions. The main purpose of the program is to improve undergraduate science teaching. The grants are generally fairly large -- the $100,000 plus range -- and in the last two years, out of the 115 grants that have been made, roughly three or four have been in the energy area. One example was a grant to Williams College to renovate an existing structure for field use in forestry. In so doing the building was to be made energy self-sufficient through the use of solar energy and so on, so that the structure was energy efficient although the purpose of the building was only indirectly related to energy.

Another program is Research Initiation and Support (RIAS). This is in a sense a graduate counterpart to the CAUSE program. It provides support for young scientists; researchers, who are just getting started at colleges and universities. Again the grants tend to be reasonably large. There have been two or three grants in the last two years in the energy area. A combustion sciences research project at Stanford for $105,000; a coal task force project at the University of Wyoming under $200,000; and a program on problems in the extraction of oil shale, again for over $100,000, at the University of Colorado.

A somewhat different kind of activity is supported under the Local Course Improvement program (LOCI). This provides small grants -- by and large in the $10,000 to $20,000 range -- to assist people who have good ideas in science education at a local level. Again, in the past year there were six grants out of a total of 129 that could be considered by stretching the imagination a little bit to be energy related. Some of them were specifically so, some of them were marginal in that respect. We supported such things as a solar-heated astronomical observatory, a computer-aided undergraduate laboratory on petroleum refining, a model electric power system, another program aimed at electrical powered distribution, a health physics degree program in which the emphasis was on protection from radiation, and so on.

A program called Student Originated Studies (SOS) provides grants directly to students through the university where they happen to be, but instead of having a faculty member as the principal investigator or the project director, an undergraduate student has this position and the students themselves write the proposals and receive the awards. One aspect of this program is that the research that the students engage in has to have an environmental focus of some sort, and there have been nine grants out of 64 in fiscal 1977 that were in the general energy area. For example, studies were done on agricultural uses of C4 plants in arid environments, micro-processor based energy meters for power wheel chairs, conservation, nuclear waste disposal sites -- things of that general nature. The size of these grants is under $20,000.

A program that is directed at college teachers is the Chautauqua Program, in which people in the forefront of scientific areas give what amounts to short courses spread over a period of time at sites around the country. Teachers from other schools come to these sites and take the courses. The courses are set up in two stages: a two-day period followed by an interim of several months, then another two-day period. In academic 1977-78 there will be 52 such courses given under this program. Five focus specifically on energy: one on solar energy, one on energy systems, one entitled "Food, Energy, and Environment," another on alternative energy technologies, and one on the economics of renewal sources.

Finally, the Division of Science Education Development and Research provides development money for experimental projects -- so-called "innovative projects" -- in science education that are likely to have a national impact. Very few of the roughly 80 projects in the last two years have been directly focused on energy. One that comes to mind is the development of educational materials about underground space. The assumption in the proposal is that this will be very important in the future as

underground space is put to greater use because of its energy-conserving properties. There is also a continuing education program for electrical power technicians and one or two others peripherally relating to the energy problem.

In conclusion I can say that the National Science Foundation places no special emphasis on energy education, with the possible exception of the Graduate Fellowship program. Furthermore, to the best of my knowledge there is no intention to go to new programs specifically on energy. However, our plans are in a state of flux and this may not be true in the near future. Proposals that are energy related, or that focus on energy, can be considered in several programs. In the past these have represented somewhere between 0 and 5 percent of the total proposals that were funded. There has been a wide range in the degree of our emphasis on energy, but in the future we expect to get some good energy proposals.

## OFFICE OF EDUCATION

Walter J. Bogan, Jr., director
Office of Environmental Education

The context in which the Office of Environmental Education supports energy education is the Environmental Education Program which is a developmental and financial assistance program. I will separate those things that we support in response to grant proposals, much in the same way the National Science Foundation operates, from initiatives that we take through our contractual authority, where we describe work that we would like to see done and seek able offers to fulfill the specification for us.

From 1973 to 1976, twenty percent of the appropriated monies under the Environmental Education Act, or $1.5 million, have contributed to support of projects directed at energy in the context of the environment. I use "contributed to" because, in many instances, we bore, or are bearing, only part of the cost of the project, and in some instances we are supporting it fully.

One example, and one that we are particularly pleased with, was the one that Rene Vawter mentioned earlier. That is the work that was done by the National Science Teachers Association in the preparation of an instructional sourcebook and materials guide for elementary and secondary education teachers, on the interrelationship of energy allocation, depletion and conservation in light of environmental, social and economic needs. OEE was in the position because of our authority to engage in a contract for the production of this much needed material. The Federal Energy Administration, because of its authority, was able to assume responsibility for facilitating distribution of the material and making it available to science and social studies teachers in many parts of the country. This is one of the examples of shared support. The sourcebook and materials guide are available from the National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009.

There are several areas in which OEE is attempting to be responsive to the energy education needs. One of these is the development of materials for teachers at the 7-12 grade levels. (We have not been able to do very much, nor do I think we will, in terms of materials for students themselves.) Our sense of the educational problem, and given the resources available to us, suggests that greater impact can be achieved through the preparation of materials to aid school systems and teachers in development of instructional programs. This, in effect, means a survey of primary literature and development of basic resources, putting that in a package or place, and then making grant monies available to educational institutions, such as the R & D labs, state departments of education, local school district, etc., for the development of the materials for actual classroom use.

The material available on the front table lists some of the products from our grant efforts; one of which is now available through a commercial publisher. We are particularly pleased with that one -- the result of a grant to the Biological Sciences Curriculum Study (BSCS) in Boulder, Colorado. BSCS developed a nine-week instructional unit for high school, college or adult students entitled, "Energy and Society: Investigations in Decision-Making". Energy issues, questions and concerns are considered in light of politics, economics, technology, attitudes, health and safety, environmental impact, and physical laws. We agreed to a limited copyright and Hubbard, Northbrook, Illinois, is now distributing the material through normal commercial distribution channels.

In this regard, one of our great concerns is to, in addition to meeting our responsibility to assist in development of materials, assure their distribution and use. We are continually searching for ways to make materials available to potential users and to make their availability known.

One product that is getting considerable use in the State of Colorado is a series of nine films and workbooks on the economic, technological, environmental and social implications of alternative energy sources, produced by the University of Colorado. The project represents a joint effort within that university, involving people from the various departments within the university that have substance knowledge of the energy issue. This goes to the heart, I think, of one of the issues that Don Duggan (ERDA) was discussing. That is, the necessity, if we are to communicate the complexity of the energy issue, of having those people most knowledgeable about the energy situation involved in the preparation of the materials that are going to be used by teachers who are not specifically trained in that specific content or subject area. The Colorado films are available from the Educational Media Center, University of Colorado, Stadium Building 360, Boulder, Colorado 80309.

Two additional projects are identified in the hand-out as representative of energy-focused environmental education efforts.

The University of Pittsburgh produced a study guide for use in adult education programs (including teacher certification) on the world energy problem and its technological and social aspects: John H. Anderson, Professor of Physics, University External Studies Program, University of Pittsburgh, should be contacted for information about this guide and its use.

The Washington State Office of Public Instruction, Olympia, Washington, is developing a very promising interdisciplinary secondary education program ("Energy, Food, and You") which focuses on global food problems, energy and resource use, the U.S. food system, and energy-efficient alternatives.

OEE efforts are directed by the appreciation that to discuss the environment meaningfully, and to appreciate the inherent complexity of environmental issues, there has to be some substantive entry point. Over the past several years energy has been appreciated as one issue that is particularly significant in this regard. Because it is of such immediate concern in the context of the current energy crisis and energy conservation efforts, the energy issue has the advantage, over many other substantive issues, of being a very effective means for engaging people's attention, and for facilitating their desire to comprehend complexity. In terms of the educational process, however, we do not, hopefully, view energy as a recently recognized problem that society is likely to overcome through specific short-term actions and that will go away as an issue of major educational concern. Rather, energy and environmental issues have an importance in societal, and therefore, in educational terms, that is, we think, here to stay.

There is one additional environmental education funded project that is of tremendous significance in this context and which is underway through a contract awarded to the Far West Regional Educational Laboratory by the Office of Environmental Education. As it will be discussed in detail tomorrow by Dr. Bela Banathy, I will only mention here that we engaged in this contract to develop teacher training models for environmental education using energy as the substantive point of entry for the discussion of the environment.

## ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

J. C. Kellett, Jr.
Assistant Director for Education and Training
Office of University Programs

Americans need better knowledge about energy. This knowledge can be discussed in two areas, I think: first, it is important for all citizens to gain an appreciation for the complexities of the energy problem, and an understanding of the overlapping systems in our society that contribute to the problem. Second, it is important that informed persons have an understanding of the technical detail which is part and parcel of a discussion on energy, be that detail scientific, economic, or social.

The nation also needs an adequate supply of technically trained manpower to design, build, manage, and operate the various energy technologies that are coming on line and will be developed in the future. Determining what is an adequate supply, in terms of both numbers and competence, is difficult at all times because of the difficulties of anticipating the

skills required for embryonic or yet-to-be-discovered technologies; it is particularly hard without a clearly articulated national energy policy.

ERDA's mandate regarding manpower development is found in Section 103-10 of the Federal Energy Reorganization Act of 1974 and, as such, is more interesting as a historical document than as a guide to the future since, as we all know, the Department of Energy legislation will start afresh with the responsibilities and authorities of the federal government with regard to energy. The current legislation gives ERDA the authority to:

> ... assure an adequate supply of manpower for the accomplishment of energy research and development programs by sponsoring and assisting in education and training activities in post-secondary institutions, vocational schools, and other institutions....

While our current legislation deals specifically with manpower, we have interpreted that mandate in a more general way. We are certainly concerned first and foremost with the quantity and quality of the actual work force, but we are also aware that energy skills throughout the entire academic community are important in the timely and competent implementation of a national energy plan. ERDA's current programs approach the issue through (usually) the postsecondary institutions, as we shall see shortly.

A major activity of ERDA deals with manpower forecasting requirements. Obviously such forecasting for various solutions to energy shortages requires an acceptable fix on the technical development that the country intends to pursue. This is no small part of the problem, since the country has trouble staying put on a technical fix long enough for the manpower to be trained; the current nuclear debate, with the implications of a sharp curtailment of the nuclear option from R&D on down to operation, is a case in point. One does not generate the trained manpower required to do research, for example, in less than the four to ten years it takes to train the student. Like von Braun's analogy, one cannot speed up the gestation of a fetus by putting more men on the job. These difficulties notwithstanding, it is necessary to analyze the current and anticipated manpower needs at all levels, including research, which deal with energy.

Our Manpower Assessment Office is now engaged in several activities in this direction. For example, we have recently concluded an interagency agreement to develop a Comprehensive Energy Manpower Information System (CEMIS) which promises to provide data to the federal program manager and the educational institutions on projected manpower needs at all levels in energy. There are also several special studies under way. One, for example, deals specifically with short-term needs of the solar industry.

ERDA's support to specific education projects is based on a principle as old as Sophocles; that one learns to do a thing by actually doing it. It is possible to miss the point in an education or training program if the student is merely taught <u>about</u> the thing; such teaching results in an impression - albeit false - that the student is truly competent in the field. In developing educational programs dealing with energy, we are faced with a fascinating dilemma. Energy, unlike chemistry, economics, or theology, is not a discipline. It is a cross-cutting problem area, and all

the traditional disciplines of learning are involved. I suggest this constitutes a major challenge to the educator: to "do" energy rather than "do about" energy. The concepts of system interrelatedness and the need for substantial technical detail conspire to make educational projects in energy superficial.

Let me get on with some of the programs ERDA is actually supporting. Figure 1 shows six major educational program elements now funded by my office. Starting from the bottom up; the Puerto Rico Center for Energy and Environmental Research (CEER) is a unique program probably not of much interest to this audience. We are engaged in a transition from the Puerto Rico Nuclear Center (a government-owned contractor-operated research center founded by the Atomic Energy Commission) into an autonomous research center of the University of Puerto Rico.

Moving up, the Reactor Sharing and Fuel Assistance program provides aid to universities in the fabrication, shipment, and storage of nuclear reactor fuel. It also provides modest support to some major reactor facilities to permit them to share the research and training capability of the reactor with other universities; in other words, to share the wealth.

Special projects support provides support, often to unsolicited proposals, for projects which produce information useful to ERDA in developing education-related positions and/or policy. Projects which promise to provide useful guidance to the academic community as a whole on energy education matters are also considered. An example of the activity of the program is our participation in this conference; to gain data and information on the state of the art of energy matters in elementary and secondary education.

Our largest program, in terms of dollars, is the Laboratory Cooperative Program. In reality, the Lab Coop program is a complex set of projects carried out by eight ERDA field research facilities and three "integrated contractors" who interface ERDA education and training needs, the university community, and the ERDA research laboratories. Through this program, undergraduate and graduate students, and faculty are provided access to state of the art research in energy laboratories in assignments that may vary in length from a few days to one or more years. The laboratories also provide special training programs for specialized audiences, and host conferences which are valuable to the university teacher/researcher.

ERDA provides modest support to a Graduate Traineeship program. In FY 1977, 74 trainees (out of a request for 1,666) were supported in projects dealing with energy in all its components.

The last program on this list, our Faculty Development program, provides support to colleges, universities, and ERDA laboratories to conduct teacher workshops and institutes, primarily for secondary school teachers. In FY 1977, something over 1,000 teachers will participate in these projects, learning about energy and developing approaches and materials for inclusion in their own classes.

I have brought with me today a supply of the Guidelines for the Preparation of Proposals for this program which will give you more detailed information.

# Education and Training Program

Thousands of Dollars

| | Budgeted 1976 | Budgeted TQ | Estimated 1977 | Requested 1978 |
|---|---|---|---|---|
| Faculty Training | 900 | 425 | 1552 | 1950 |
| Trainee Ships | 700 | — | 525 | 1000 |
| Laboratory Co-op Program | 2600 | 1991 | 1988* | 2160 |
| Special Projects | 450 | 224 | 350 | 1000 |
| Reactor Sharing & Fuel Assistance | 500 | — | 550 | 600 |
| Puerto Rico Center for Energy and Environmental Research | 1200 | 436 | 925 | 650 |

* Reclassified in FY 77 to reflect on-site non-research activity; see faculty training.

FIGURE 1

The campus based portion of this program deals with what we call general energy education as well as specific energy technologies. Figure 2 illustrates the FY 1977 breakdown of support in this component. General energy education, by the way, consists of projects which deal with the entire scope of the energy issue: energy production, distribution, use; alternative energy technologies; and a systems approach to the understanding of the complex interactions of technical systems, social systems, and environmental systems. This area was the target of nearly half the projects. Solar energy commands another major component. Technology specific projects are particularly appropriate for regions in which one of these technologies is now or is anticipated to play a major role.

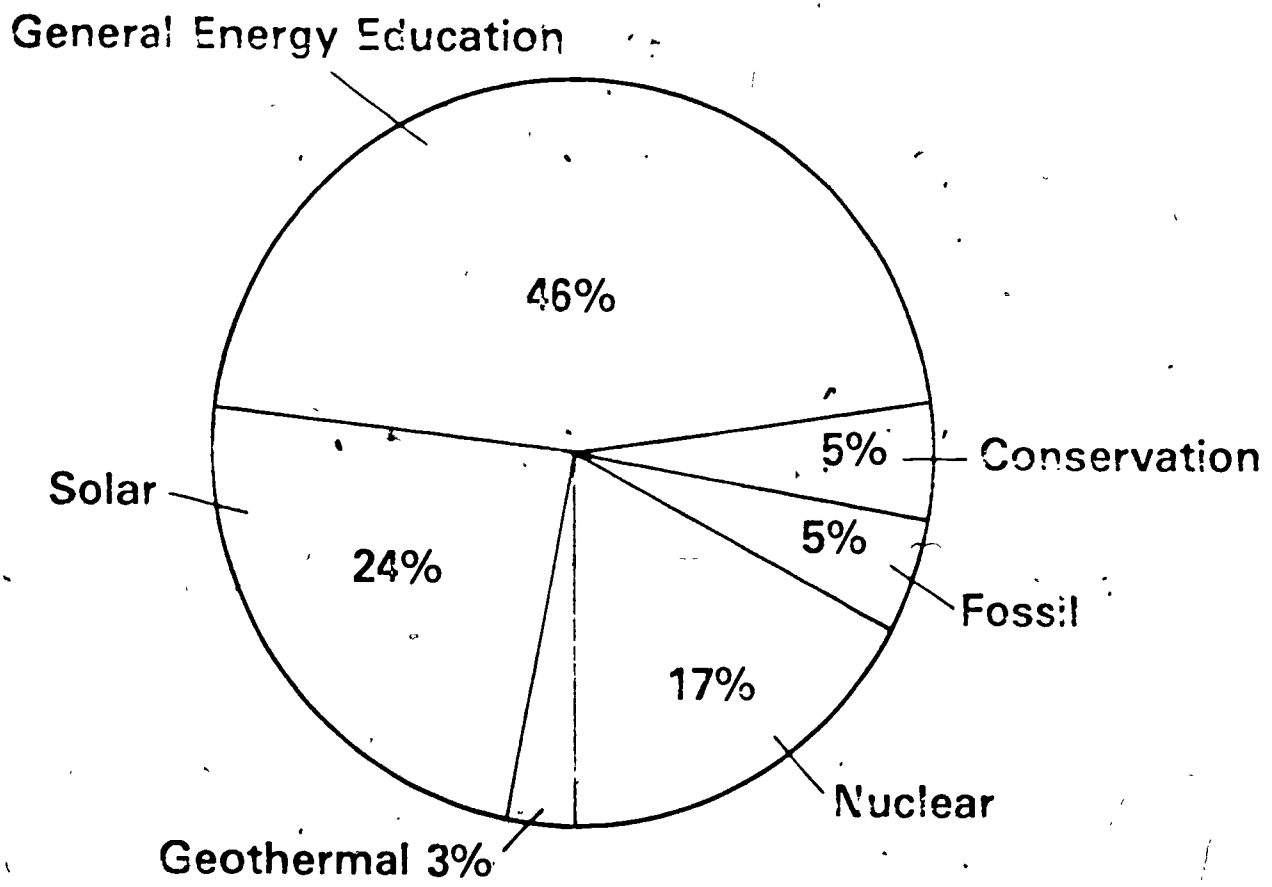
As you can see from Figure 3, these projects are scattered about the country to effect geographical coverage. Assuming that our FY 1978 budget is approved as it now stands, we shall expand this coverage about threefold.

In closing, let me return to some earlier comments on the quality of the programs with which we are dealing. There is reason to believe that, today, we are faced with a student body of ever decreasing skill. In considering the viability of a technologically and socially complex society, I am concerned about the ability of our students to absorb knowledge. The quality of students now entering college is, by most standards, nothing for the educator to be proud of. Recently, for example, a local institution certified for graduation math teachers who could not demonstrate the ability to perform math at the sixth grade level. Further evidence of rising concern on the competence of students is given by the fact that 28 states have passed or are considering legislative approaches to the problem of certifying minimal competence of high school graduates. We may well hazard the suggestion that two decades of permissive education has taught us that students are probably not good organizers of the curriculum, and certainly not the technical curriculum.

Finally, perusal of the April 29th energy plan leaves one underwhelmed by the reference to education. In that portion dealing with the national solar program, it says: "...that public initiative would consist of a joint federal/state program of standards development, certification training, and information gathering." In a more comprehensive chapter, another oblique reference: "Schools can help young people understand the energy problem and develop the conservation ethic." A challenge falls on the shoulders of educators to refine and articulate exactly what their role will be in this energy plan. We welcome your advice and counsel.

# Faculty Development Projects

## Total Funds: $695,737




FY 1977 (Est.)

FIGURE 2

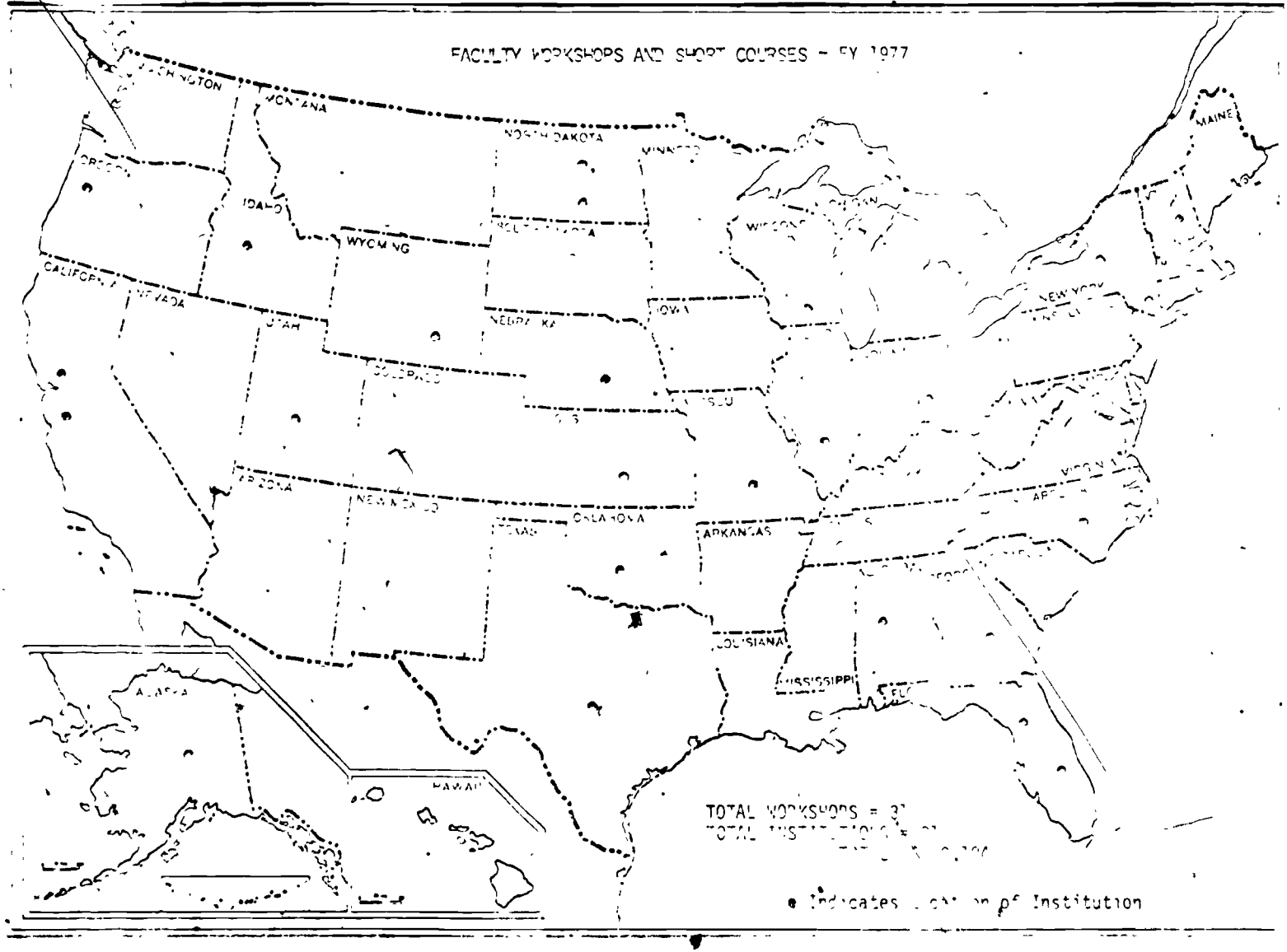

FACULTY WORKSHOPS AND SHORT COURSES - FY 1977
MONTANA
NORTH DAKOTA
MINNESOTA
IDAHO
WYOMING
NEBRASKA
IOWA
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
OKLAHOMA
ARKANSAS
LOUISIANA
MISSISSIPPI
ALASKA
HAWAII
MAINE
TOTAL WORKSHOPS = 3
• Indicates location of Institution

FIGURE 3

DEPARTMENT OF LABOR

Willis J. Nordlund, special assistant
Office of the Undersecretary

One of the most critical dimensions of our national energy strategy is the realization that the problems are extremely complex, pervasive, and long term. Consequently, the only strategy that will succeed is one that involves an appreciation of the respective roles played by public agencies, private industry, organized labor, and a variety of public and private interest groups. No single organization can realistically hope to solve its problems in isolation from all the rest. In my judgment, the energy problem "solution set" begins and ends with education. What I mean is that there is a major educational job to be done in relation to the public generally about the energy problem, what the options are, what the various options mean to them as producers and consumers, and what the longer run consequences are if a reasonable approach is not developed. I believe that the American system will respond to the problem if we understand and believe that reasonable, equitable, effective, and efficient approaches are being developed.

In this general sense, the Department fully supports the theme of this conference: Education Confronts the Energy Dilemma. We believe that the educational community is one of the most important ingredients in this strategy and unless the educational process succeeds, there is probably little hope for a long run solution.

However, there is another dimension of education that is also very critical. The energy problem provides an example of the kinds of problems the educational community has faced and continues to face in a rapidly changing world. New consumption patterns are emerging for all goods and services; complex technology requires understanding and adaptability; new occupational areas will evolve and old ones will fade away; the political and economic power structure will change dramatically in the next several decades; ad infinitum. Only through education can these energy related challenges be met. In short, the educational system must develop curricula that will instill flexibility and adaptability in their students.

I want to focus on one set of problems that everyone faces early in their educational experience, i.e., employment. Questions focusing on where to work, how much will be earned, and opportunities for promotion, confront students. Since about one-half of a person's time is spent working, these are critical questions. The energy crisis provides opportunities as well as challenges to those considering employment and training options. However there are no easy answers or sure avenues for success.

Energy Labor Markets. To put the energy-employment question in perspective, it is important to note that the energy sector is relatively small. About two percent of the work force is directly employed in the principal energy industries. In 1977 that amounts to about 2 million workers. We expect a number of industries to expand rapidly over the next two decades and they include: solar, coal, insulation, and a variety of renewable energy sources. Few occupations are unique to these industries;

however, we can identify "high demand" occupations that are represented in these industries.

First let me focus for a few moments on some specific problems in the energy labor market. For the most part it involves employees in the construction and operational phases of the production and distribution process. The skill requirements for the two phases are distinct and relatively unique. The avenues through which a worker enters either phase are diverse but there are several identifiable routes. In the construction phase, for example, a large percentage of workers are unionized. As a consequence, prospective workers frequently must go through an apprenticeship program to gain entry. There are some exceptions but in general this is true. The operational phase requires highly-skilled craftsmen, technicians, engineers, and a variety of support workers. The secondary and post-secondary system provides most of these employees. The military provides training in some occupations. Industrial on-the-job training is also an important source. We must understand how each source fits into the overall picture.

One of the most difficult problems we face is the geographical isolation of major energy resources. Few energy resources coincide with population use centers. As a consequence, workers must move to new locations that are frequently in small towns or remote rural areas. A number of major adjustment problems arise in these areas, such as conflict between the indigenous population and new residents; dissension at the work site that prompts turnover, absenteeism, and low productivity; rapidly expanded demand for social services causes disruption of the established political structure; and, so forth. Some areas adapt well, others are less successful.

One of the problems that requires special attention is the utilization of rural workers in the developing energy sector. Frequently rural workers are completely excluded from meaningful participation in the development process. There are a number of reasons contributing to this problem. First, local residents may lack the necessary skills required by the energy company. Second, the energy companies may find it expedient to move in a contingent of trained workers rather than retrain local workers. Third, some local residents see the energy process as temporary and therefore are reluctant to forego other opportunities.

Where will the jobs be in 1985? I would like to consider what the energy problem portends in terms of employment opportunities. I can say with some assurance that the energy problem will create as many new jobs as it eliminates old ones. For those just entering the world of work, this observation should be viewed as an opportunity. For those of you who are well established in your career, this observation is much less reassuring. I cannot reasonably argue that no one currently employed will not experience periods of unemployment as this nation embarks on dramatically different energy production and use patterns. However, it is clear that the transition period is going to be relatively long (ten to twenty years) and as a consequence there should be opportunities for those who find diminished occupational opportunities to upgrade their skills.

I won't be able to tell students exactly where to find a job when they leave school, but I can give them some general guidance about where the most fruitful search is likely to be. There are some guidelines and rules that constrain their search. The most important constraint any job seeker will encounter is self-imposed. This constraint is lack of initiative. Obtaining a certificate or degree only points students in the right direction, it does not guarantee them a job. Some people mistakenly believe that once they have a formal certificate or degree that they can just sit back and wait. This is a fatal tactical error. Second, many opportunities require formalized apprenticeship training and frequently a licensing or certification procedure. Many of our highest paid skilled craftsmen (electricians, pipefitters, millwrights, and sheetmetal workers) are trained in apprenticeship programs. Third, good job opportunities seldom exist within walking distance of students' homes. They should be prepared to search as wide a geographic area as their resources permit. At the same time, however, they must make some explicit personal choices about where they would accept employment (rural v. urban, cold climates v. warm climates, and so on). These are not trivial choices as our experiences in the remote areas of the Rocky Mountain Region suggest.

I'll outline some general trends and then provide some specific occupational estimates. The major growth <u>industries</u> are:

-- Service (transportation, utilities, trade, finance, services, government)

-- Energy Sector (petroleum and natural gas extraction, coal mining, electricity generation)

-- Health Services

The major growth <u>occupational</u> clusters are:

-- Clerical workers

-- Scientists and Engineers

-- Service workers

In virtually every occupational area there will be rapid growth occupations. A comprehensive list is not possible, but our Bureau of Labor Statistics has identified occupations that will have ten thousand or more annual openings (new demand and replacements) between 1975 and 1985. These include:

| | | |
|---|---|---|
| -- | Machine tool operators | 18,000 |
| -- | Assemblers | 63,000 |
| -- | Inspectors (mfg) | 51,000 |
| -- | Welders | 27,000 |
| -- | Receptionists | 57,500 |

| | | |
|---|---|---|
| -- | Secretaries and Stenographers | 439,000 |
| -- | Computer Operating Personnel | 27,500 |
| -- | Bank Clerks and Tellers | 84,000 |
| -- | Accountants | 45,500 |
| -- | Lawyers | 26,400 |
| -- | Bartenders | 15,200 |
| -- | Cosmetologists | 50,800 |
| -- | Guards | 26,400 |
| -- | Police Officers | 22,000 |
| -- | Telephone Operators | 28,000 |
| -- | Elementary and Secondary Teachers | 51,500 |
| -- | Retail Trade Saleworkers | 190,000 |
| -- | Carpenters | 49,100 |
| -- | Electricians | 11,700 |
| -- | Construction Workers | 28,400 |
| -- | Operating Engineers | 27,000 |
| -- | Painters and Paperhangers | 18,100 |
| -- | Plumbers and Pipefitters | 23,500 |
| -- | Truckdrivers | 50,500 |
| -- | Electrical Engineers | 12,200 |
| -- | Drafters | 17,300 |
| -- | Engineering and Science Technicians | 32,000 |
| -- | Automobile Mechanics | 24,400 |
| -- | Industrial Machinery Repairers | 42,500 |
| -- | Dental Assistants | 14,500 |
| -- | Licensed Practical Nurses | 93,000 |
| -- | Registered Nurses | 71,000 |

-- Nursing Aides, etc. 123,000

-- Health Service Administration 17,400

-- Social Workers 30,500

Few of these occupations can be identified as being exclusively in the energy industries. There will be abundant opportunities in the direct energy production industries, but equally important are all of the peripheral industries that are developing as our ecological, legal, and economic concerns increase. Geologists, geophysicists, oceanographers, ecologists, land reclamation technicians, surveyors, legal aides, economic analysts, and a variety of others will be increasingly in demand.

Moving into the world of work is a difficult step for many people. This is particularly true during the periods of high unemployment. I think we will see major improvements in the economy generally and employment specifically during the next two or three years. The problems are very great and I am not suggesting that we have all the answers. There are no easy answers to either the energy problem or current economic problems. However, we are moving ahead in what I believe are defensible, realistic steps. There is always room for pessimism, but it seems to me that the prospects for major strides forward are very good.

Involvement of the Educational System in DOL Programs. The Department's principal training programs are decentralized under the Comprehensive Employment and Training Act (CETA) so that the vast majority of resources are allocated by state and local elected officials. Each of these "prime sponsors" has an advisory council that is composed of a cross section of public and private representatives including major client groups. I urge each of you to identify the prime sponsor in your area and to make your interests and concerns known. The composition of the advisory councils varies, but many of them include representatives from the educational community.

A second type of potential involvement involves the flow of discretionary funds directly to State Departments of vocational education. The vocational education organization can allocate these resources to other institutions for a variety of educational purposes. The allocation process involves the direct transfer of 5% of CETA Title I resources to the Governors. A non-financial agreement is then signed by the prime sponsor and the vocational education system outlining the use of these funds. In general there is considerable discretion in the use of these resources, but their use is typically focused on training and other supportive services.

To insure timely development of occupational information we have established eleven occupational analysis field centers.* The Utah center focuses on emerging energy occupations. I would recommend contacting the

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* The centers are located in California, Florida, Massachusetts, Missouri, New York, Utah, North Carolina, Seattle, Wisconsin, Texas, and Arizona.

center closest to your area for analysis of developing occupations. This information should be very useful in structuring curriculum components. Part of the work being done in these centers is being incorporated into the 4th edition of the Dictionary of Occupational Titles which will be released shortly.

Another effort that promises to provide information useful in curriculum development is the inter-agency National Occupational Information Coordinating Committee (NOICC). A joint Department of Labor, Office of Education program, the NOICC has a mandate to develop "an occupational information system to meet the common occupational information needs of vocational education programs, employment and training programs at the national, state, and local levels." This committee is in its early formative period and as a consequence, this may be an appropriate time for substantive input.

The Department's Bureau of Labor Statistics (BLS) is capable of providing all types of occupational data related to current conditions and more importantly projections to 1980 and subsequent selected years. Some publications of particular interest are the Occupational Outlook Handbook, the National Survey of Professional, Administrative, Technical, and Clerical Pay, Area Wage Surveys, and a variety of Industrial Wage Surveys. These data sources provide invaluable counseling and curriculum development input. They are, of course, available from our Bureau of Labor Statistics or may be found in most large libraries.

Summary. The Department of Labor is sensitive to the "energy-forced change" in life-styles that will occur in the next several decades. In most instances, we believe that from an employment perspective these changes will provide opportunities rather than liabilities if labor force participants are prepared to take advantage of them. Most of the changes are expected to be gradual, but there is certain to be some dislocation problems. The educational community must play a major role in the preparation of students for entry or realignment in the work force. Unless the educational system is successful in preparing workers for these changing market demands, the chances for a successful energy-employment strategy are very small. The challenge is great, the opportunities are many. We are confident that the educational system can and will effectively confront the energy dilemma.

## DEPARTMENT OF TRANSPORTATION

John W. Eberhard, research psychologist
Office of Driver and Pedestrian Research
National Highway Traffic Safety Administration

The U.S. Department of Transportation is in the process of developing a driver energy conservation training program. A review of the literature has indicated a need for energy education in the use of transportation. For example, a recent survey disclosed that parents not receiving energy information desired it. Where children received information, 74% would like to have received even more. In the area of transportation energy

efficiency, only 9% of parents received any type of information and only 3% received specific information. Driving technique was the most frequent type of information provided. Other information needs include vehicle maintenance, car pooling, vehicle size and selection, reduction in driving, and implications of public transportation. Thus, parents are not receiving the information they need and they clearly would prefer to have such information.

The goal of the DOT program is to develop energy efficient driving techniques which drivers can and, more critically, will use. Research currently projected will develop training/motivational techniques, coordinated media information, and driver feedback systems which will inform drivers how well they are doing. A number of small pilot studies have already been conducted where individuals were taught to drive more efficiently resulting in a 10% fuel reduction. However, it is not certain that these drivers will continue to use the techniques. Therefore, there is a need to evaluate different types of programs until proven techniques are identified that will reduce fuel consumption on a lasting basis. In addition, DOT wants to make certain that proposed energy efficient procedures are also safe and efficient. Therefore, there is not only the need to develop and evaluate energy efficient materials, but also a requirement to insure that at the same time there is not an adverse impact on safety and traffic flow.

Among the driving public, teenagers being taught to drive are most frequently provided with energy information. However, the total school system should be used to present energy conservation information about transportation. Children of lower ages should also be learning about methods of conserving gasoline. Instruction should be more complete and children should be encouraged to take the information home. Schools have the potential for teaching energy conservation techniques that students can apply immediately. For example, 23% of home trips are involved with transporting children to and from various social activities. If more encouragement could be given to walking or riding bicycles -- which would be healthier as well -- a great reduction could be made in the number of discretionary trips made by parents. Also, children could make suggestions to their parents with respect to vehicle selection, trip planning, and the need or lack of need for second cars. However, there are difficulties in getting new materials into the school system. The design goal is to integrate materials wherever possible into existing course work, instead of creating new course work. In order to accomplish this, the system must be built around programs that are currently in existence in the grade school and secondary schools levels.

As shown in Table 1, fuel savings between 5 and 10% are anticipated for students in newly designed driver training programs. The reason for the higher estimates for novice drivers compared to other groups is that it is assumed that training an individual in fuel efficient procedures before he or she learns bad habits will have a much stronger impact. Energy efficiency can also be developed for other programs that currently exist, such as driver licensing and regulation activities, training and informational programs at the federal, state and local levels of government, company programs, and volunteer programs.

At the present time DOT is soliciting contracts to develop a national energy efficient driving system for the general driving public. As part of that program, curriculum requirements will be developed aimed at reaching drivers to motivate and aid them to be more fuel efficient. Another area receiving attention is the commercial or interstate carrier operator. The potential here is great because of the larger utilization of fuel per mile. Again, if commercial operators can be trained before they develop inefficient habits, major savings can be anticipated. Thus DOT is trying to put together various target groups for both the passenger car and the commercial operator and to identify various delivery systems and various programs that relate the objectives of these specific groups.

Paralleling these efforts will be programs geared to motivate drivers to make judgments that will result in long-term fuel savings. Decisions such as vehicle selection based on size and whether or not to acquire the second or third car are motivational problems. Work is being done on developing concepts such as providing welcome wagon ladies with information about neighborhood car-pooling for new people moving into a community so that a second or third car won't be required. If this kind of information can be successfully presented at the very beginning of the decision-making process, savings in fuel will be more certain. Thus, other primary areas of interest of the energy conservation program will be vehicle selection, vehicle maintenance, driving style (how to drive), trip planning (being more conservative in vehicle use) and use of alternative modes, such as car-pooling, van pooling, public transit, etc.

The program is just beginning. Contracts are being procured which will be aimed at the general driving public and the commercial driving public. Testing will be conducted within high school settings and various government settings. Materials will be pilot tested for commercial carriers. Later other special target groups such as industrial users will receive attention. In the next few years materials will be available for the total school system as well as for the adult education market. If there are adult educational programs, they will probably be provided in traditional educational settings. This will require interaction with educators in developing and applying the program. The program is transportation energy conservation oriented and will require extensive evaluation before full implementation. Program elements that save energy will be provided to the total school system, regulatory/corporate programs and other groups or organizations with potential to disseminate information effectively.

In summary, a DOT energy conservation program is currently being developed with the objective of (1) providing the entire driving public with the latest techniques and methods on how to be more fuel efficient and (2) developing an on-going motivational system that will encourage drivers to implement their use.

PROJECTED TARGET GROUPS AND ESTIMATED IMPACT
FOR THE PROPOSED ENERGY EFFICIENT DRIVER PROGRAM

| PASSENGER VEHICLE OPERATORS | Number of Drivers (Millions) | Trained/ Year (Millions) | %Fuel Saved | Miles/ Year (Thousands) | Gallon* Sav/Yr (Millions) Lo | Gallon* Sav/Yr (Millions) Hi | Impact (Remaining Driving Years) |
|---|---|---|---|---|---|---|---|
| Driver Training | 3 | 2.5 | 5-10 | 10 | 63 | 125 | 50 |
| Licensing & Regulation | | | | | | | |
| Renewal Examination | 30 | 6 | 1-2 | 10 | 30 | 60 | 25 |
| Driver Improvement | 6 | 3 | 2.5-5 | 15 | 57 | 113 | 40 |
| Government | | | | | | | |
| Federal | 4.9 | 1.0 | 2.5-5 | 15 | 18.8 | 37.6 | 27.5 |
| State & Local | 11.9 | 2.3 | 2.5-5 | 12 | 33.8 | 67.6 | 25 |
| Companies | 62. | 3.1 | 1-2 | 15 | 23.3 | 46.6 | 25 |
| Volunteers | 120 | 6.5 | 1-2 | 10 | 60 | 120 | 25 |
| | | | | TOTAL | 285.9 | 569.8 | |

| COMMERCIAL VEHICLE OPERATORS | | | | | Lo | Hi | |
|---|---|---|---|---|---|---|---|
| Driver Training | .12 | .06 | 5-10 | 20 | 10 | 20 | 40 |
| Licensing & Regulation | .12 | .06 | 1-2 | 20 | 2 | 4 | 40 |
| Companies | 3.5 | .5 | 5-10 | 20 | 83 | 166 | 25 |
| | | | | TOTAL | 95 | 190 | |

*Estimates based upon 6mpg for commercial vehicles and 20mpg for passenger vehicles.

SESSION VII
PRACTITIONERS DISCUSS THEIR FUTURE
ROLES, RESPONSIBILITIES

The educational practitioner in the field will bear the ultimate responsibility of providing energy education to elementary-secondary, post-secondary, vocational school students, and to some extent, the general public. Twelve education associations delivered statements to the conference outlining their memberships' views on the role and responsibility of the schools in preparing students to cope with the energy dilemma.

During two concurrent panel sessions, the following association representatives presented their respective views:

American Association of Colleges for Teacher Education

Joel L. Burdin, associate director.
American Association of Colleges for Teacher Education
Washington, D. C.

American Association of School Administrators

Charlotte Friedman, legislative assistant
American Association of School Administrators
Reston, Virginia

and

Joseph Ringer, Jr., Assistant Superintendent of Schools
Arlington, Virginia

American Federation of Teachers

Dal Lawrence, president
Toledo Federation of Teachers
Toledo, Ohio

American Vocational Association

Charles O. Whitehead, president
State Technical Institute
Memphis, Tennessee

Association for Supervision and Curriculum Development

Gordon Cawelti, executive director
Association for Supervision and Curriculum Development
Washington, D. C.

Council of Chief State School Officers

Calvin E. Anderson, energy project director
Colorado Department of Education
Denver, Colorado

Council of the Great City Schools

Edward S. Foster, Jr., member
Toledo Board of Education
Toledo, Ohio

Forum for the Advancement of Students in Science and Technology

Alan Ladwig, president
Forum for the Advancement of Students in Science and Technology
Washington, D. C.

National Association of Secondary School Principals

Richard E. Bamberger, supervising principal
Schodack Central Schools
Castleton-on-Hudson, New York

National Congress of Parents and Teachers

Ann P. Kahn, secretary
National Congress of Parents and Teachers
Chicago, Illinois

National Education Association

A. Donald Blakeslee, co-chairman
Standing Committee on Instruction and Professional Development
National Education Association
Washington, D. C.

National School Boards Association

Nick Maravell, legislative assistant
National School Boards Association
Washington, D. C.

## AMERICAN ASSOCIATION OF COLLEGES FOR TEACHER EDUCATION

Joel L. Burdin, associate director
American Association of Colleges for Teacher Education
Washington, D.C.

President Carter calls for a war footing in responding to the energy crisis. Whatever the facts, there are indeed serious questions which must be addressed now and prepared for in the future. Educators must be leaders among solution seekers and problem solvers, relative to energy and a host of other critical problems.

If we could go back to the "good old days," we wouldn't have much of an energy crisis. George F. Will's informative column in a 1977 issue of a daily paper pictured the ultimate in the self-contained person.(1) Will reported that Gilbert Chesterton once "entertained a fantasy in which he beheld a truly self-made man. This man awakes in a house he had built of his own design; hunts and kills his first meal of the day, fixes it for himself, sequestering the remains for his family less they be deprived of moral fiber with some gift. The man puts on clothes of his own distinctive weave, proclaiming a fashion that no one else could arrive at. He walks off on a brand new route to the work he attends when he wants, to make what he wants, when he wants, because his work is so obviously superior that he commands a market by the mere stamp of his personality on it. Needless to say, that picture does not resemble the life of even the most successful executive." Self-sufficient people--energy-independent persons--are gone, if not forgotten. We are bound together by problems and opportunities.

There is charm to the story, but not reality. Our society has difficulty in getting a handle on the energy dependence of mass society. In spite of our society's difficulties in thinking energy problems and options, our schools can be places where citizens of all ages examine energy issues to determine what must be done. Something in American character responds to the crisis and challenge. An illustrative story makes the point. The story is about a Norwegian family in which the father and sons are out in their fishing boat in the North Sea and get caught up in a violent storm. Turbulent seas and a heavy fog make survival seem doubtful. Then they see a bright fire on the shore and sail joyously toward it. Upon arriving on the shore, they are met by a very frantic wife and mother who points to the ashes where their home had been. She could not understand why they were seemingly indifferent to the fact that they had lost their home. And then she understood their feelings--and shared them--when they told that their burning home became a brilliant lighthouse which saved the life of husband and sons. Unfortunately the energy crisis is not as obvious as the fog-shrouded stormy seas, our salvation not as clearly lighted. The credibility gap relative to our leaders even raises doubts as to whether we have a major crisis.

Granted energy-related tasks of exceptional complexity and diversity, the schools require pre- and in-service education personnel of exceptional vision, drive, competence, and productivity. However, to enlist educators in the energy war we have to establish that energy is not only one topic of

critical importance but also one which is generalizable to the school program at large--that it can be a means to broad curriculum improvement, that its content and processes can vitalize the total curriculum. Teachers cannot add new content indefinitely.

The energy curriculum has to come from the total ranks of academic disciplines. It is necessary to create education personnel training programs of great comprehensiveness and depth. Becoming broadly based and competent specialists requires more intense programs than are commonly available in education personnel preparation programs. We are shamefully short of having resources for good programs. Faced with a complex issue such as energy, education personnel and those responsible for their preparation must have assistance from many disciplines and agencies. For example, they need a distillation, a guide of what Schmieder (U.S. Office of Education) calls a fully developed rationale which includes assumptions, data, research evidence, logic, hypotheses and above all the best judgments of sensible people.(2) Those materials which must be teacher adoptive or adaptive rather, not "teacher proof" like the 60's curricula! Practitioners are not faced with the problem of too much rather than too little information. They cannot be expected to subscribe to multitudes of publications that synthesize. They are not plugged into the right communications and data systems. Unfortunately few scientists, technologists, and officials are either, beyond their rather limited circle of colleagues. Preparation is needed to help personnel as the schools reach out to serve the total community. That requires the knowledge, insights, skills, and strategies found collectively in the disciplines.

The agricultural extension agent model may be useful in the energy arena. Parenthetically, I think that the model is overused in the discussions about too many different kinds of policies which are to be communicated and implemented. However, energy problems are understandable, and specific outcomes can be planned and evaluated in some of the same ways that superior agricultural models are. You can even imagine signs pointing to different means of improving energy practices comparable to hybrid corn use and other means of increasing rural yields. The school which reaches out to serve and to demonstrate established credibility secures support from the community for its endeavors.

Values clarification for education personnel and other decision makers is an essential precondition to selecting knowledge, ideas, and experiences for the school curriculum and for community education. Education personnel are largely of an age in which widespread energy exploitation seemed to be an essential aspect of growth and of prosperity. Both were unquestioned positives.

Values questions must be answered--soon. Should the nation set forth on an energy development crash program comparable to that which resulted in the moon shot? Should we value the rights of future citizens to the point that we assure that they will have sufficient energy, even if we have to curtail our own use today? Should we value energy independence of the oil-producing cartel even if that means our air is more coal dirtied? Should we value lowered standards of living even if we are hotter, inconvenienced by using public transit rather than cars, or otherwise less pampered? Education personnel require much preparation to address such complex questions!

With values restructured to make them energy sensible, educators and the general citizenry can adopt effective policies and practices and enculturate the young and adults as well--without indoctrination and compulsiveness to impose values on others and with confidence and competence, with a proven record which leads learners of all ages to accept guidance and training. With values in place and in practice, the public can develop policies and programs which are serviceable and sensible. Educators can implement curriculum and instructional practices which move the nation towards an energy equilibrium--reasonably independent of external forces, capable of doing necessary tasks, and providing an important service and finding it acceptably comfortable and convenienced.

Pre- and in-service education personnel must have considerable diversified assistance in determining energy content, the scope of energy instruction, and its sequence. Some aspects of energy education should be incorporated into every grade level and subject and much included in several. It's absurd to think that even young children cannot learn about energy and practice some important concepts. A corollary is that energy-related concepts should be taught in the best way possible, using what we know about cognitive and affective behaviors. The insights of Piaget, Erikson, Kohlberg, and others are critical in curriculum planning and in education personnel development.

Education personnel carefully prepared for their diverse role in energy education are then qualified to take on a host of other pressing social demands and their tandem curriculum efforts, for example, career education, citizen education, consumer education, and human relations. Doing well with energy education and other public demands is quite a challenge, granted concurrent public steady pressures for a return to "basics." Usable curriculum packages on energy carefully correlated with other broad and standard topics are essential if energy education is to advance.

As if what has been said isn't complicated enough already, let me add another dimension to that challenge. Relatively recent research and analyses on teaching effectiveness provide some clues on increasing the effectiveness of teaching.(3) Barak Rosenshine's excellent analysis of correlational studies of teaching and learning--where researchers studied student learning and back into conclusions about what teachers do to cause it. I'll summarize a few findings: effective teachers have learned to organize time to create enough time for teaching activities while perceiving and reacting to hundreds of interactions in a day. Effective teachers have learned how to ask probing questions and to reinforce students' positive behaviors. Effective teachers have learned to adapt instruction to very specific grade levels of subject areas and socioeconomic backgrounds.

A futuristic component should be included in energy education as well as in all broad and critical studies. Futurism can aid in avoiding mindlessly doing better what we really should not be doing, mastering obsolete responses and skills, and becoming encumbered with obsolete attitudes and motivations. Futurism can help us move into the future with vision, purpose, and will--with strength and competence. That future is beginning this very moment. We certainly should not move into our alternative futures blindly or fearfully, for we can enhance and build on some emerging future options, modify some, and block still others!(4)

To summarize, the energy education team must be well grounded in vision, content, processes, and instructional competence. Education personnel have a societal role as complex as any--a fact commonly overlooked--and need a much strengthened support system and intensive pre-service preparation and recurring cycles of training (perhaps through teacher centers, which are becoming the "in" thing).(5)

Conclusions are hard on a complex, tough topic like energy. The decisions we make today will have grave impact on the quantity and quality of life for us and our young. Schools which learn to be part of the energy solution team should then be better prepared to take on other bigger challenges. The processing of energy questions and working through solutions requires a kind of competence which is generalizable to a host of challenges which confront the society and education. All of us must resist the temptation to deal with simplistic, cosmetic approaches to problem solving. We need to deal with some problems today in a variety of ways--some simple, some complex; but we must also set our sights on the long, upward road ahead. Facing up to the troublesome energy crisis of today is one means of building competence and will be necessary to face the troublesome uncertainties of tomorrow--a kind of certain agenda for school and society in the years ahead! The energy crisis indeed may be the kind of challenge which is sufficient to bring out and cause to flower our considerable national will, vision, and vitality. We have the technological and fiscal resources to overcome tremendous difficulties and create new national frontiers. The President talks a great deal about moral issues. He is right when he tells us that the way in which we respond to our energy dilemma is a moral issue of great magnitude--a kind of "war." A closing poem captures some of the essence of the essential national will to write the kind of scenario which will create a good life for us today--and which will pass on to our posterity a great nation or a declining one!

"GO, AND BECOME" by Eva Taylor(6)

(Angelus Silesius - pseudonym of Johannes Scheffler, German poet, 1624-1677)

Silesius wrote: "Go, and thyself become the

writing and the meaning."

Vicariously our lives are spent
reading the wisdom of the past,
and then at last we lift our stricken eyes
as strangers claim our mountainpeak
and silhouette our skies....
For us, no perilous ascent, no scars,
nor glorious victory. We are the weak
who sought to make of life
an elevator rise,
air-conditioned, jet-propelled,
foam rubbered, thermostat-controlled;
and vain comfort is our recompense.

"Go and become." They gain the stars
while we but hold a crumbling page.
Pretense was bold
until dreams atrophied with age
and our fingers tremble on words grown cold....

Educators--as energy educators--can help move the nation from its fixation on comfort, convenience, and softness. We can then write our history, beginning today. As they learn to join with the general citizen in confronting the energy crisis, they will be learning how to master other challenges and changes--the inevitabilities of the future. The learning of that competence--and the prior vision and drive--is a task worthy of a lifetime of professional growth.

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AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS

Charlotte Friedman, legislative assistant
American Association of School Administrators
Reston, Virginia

Lately, energy has become a lot like the weather. Everyone talks about it but no one does anything. We fervently hope that the participants in this conference will talk about it but, more importantly, do something about it.

Schools are in a particularly unique position in relation to the energy dilemma. In the positive sense, the schools, as the main thread of our social fiber, are in an unexcelled position to carry the message to the public and to assist students to live in an energy constrained society.

Unfortunately, the schools are likely to be harder hit than any other sector of the economy by the impact of the energy crisis.

Let us first look at the grim economics of energy and the schools. When that situation is sufficiently bleak to reaffirm the concerns that prompted you to attend this conference, we will suggest energy measures which might help your situation. Hopefully, we can conclude on an upbeat by challenging you to exert the leadership role you play in your schools, your communities, and the nation. Only by your concerted effort can we hope to avert some of the more dire consequences faced by the schools and the nation.

For more than a day now you have been confronted with figures that should have you sufficiently convinced that a full blown energy crisis is virtually upon us. Rather than reiterate such statistics or inundate you with more confusing and sometimes contradictory figures from surveys by the CIA, MIT, FEA, or any other three-letter reporting agencies, we'll resolve the issue by stating, "There is no energy crisis!" That's right, there is no energy crisis. Energy resources are there: What we really have is an energy technological crisis.

Technologically, we have trouble getting energy resources into usable form. And, as evidenced by the Winter of '77, even if we have it in usable form, we have trouble getting it to the consumer.

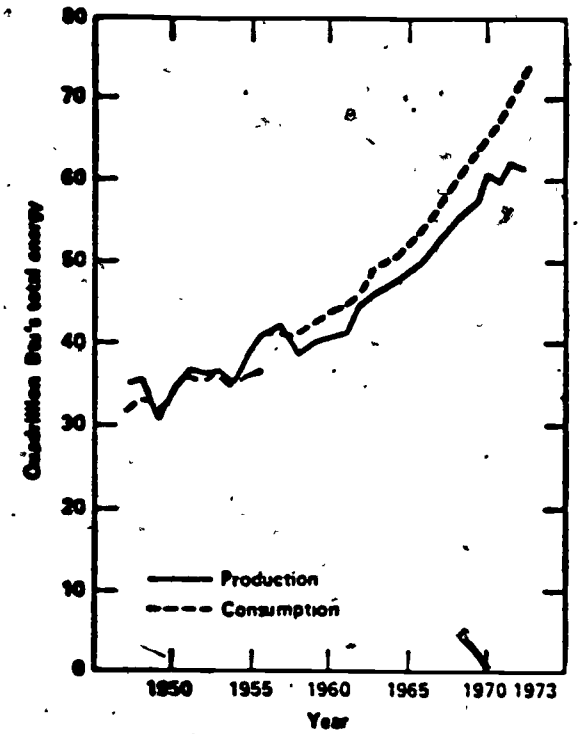
Technology is not instantaneous. It is not cheap.

Too many Americans have viewed the energy dilemma as if it is a TV show. First they look for the villain: -- "Do him in and all will be right with the world!" Next they look for the shining knignt -- in the form of exotic fuels -- to come charging in on a white horse at precisely 23 minutes after the half hour to save the day. But, alas, because of blindness, the horse has wandered off course. The poor horse, suffering from sleeping sickness, compounded by environmental restraints and tied fast by governmental regulations, is very sick. It grieves me to report he probably will not make it in time.

In short, we have a technological lag. Even conventional power plants take 8 to 14 years from decision to fruition. 58 percent of the nuclear plants have been deferred or cancelled. Solar energy can be used in small installations, but we have not solved the problem of how to use massive solar generating plants. We could go on . . . the point is: we do not have sufficient fuel available to meet our needs. While demand increases, our production has gone down.

The chart below shows our consumption compared to production from 1947 to 1973.* In 1973, we faced the oil embargo.

U.S. Energy Production and Consumption 1947-1973




At that time, approximately 26% of our fuel was imported. By January 1, 1975, we were importing 40%; by late '76, it was approximately 44-46%; and for two months this past winter of '77, our imports exceeded our domestic production. A look at our oil imports alone shows the increase since 1973.

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* Source: Exploring Energy Choices, Ford Foundation, Washington, D.C., 1974, p. 2.

United States Oil Imports
in Millions of Barrels/Day

| Year | M/Bar/Day | % Increase |
|---|---|---|
| 1973 | 5.8* | --- |
| 1974 | 6.6 | 14% |
| 1975 | 7.2 | 9% |
| 1976 | 8.0 | 11% |

* Averaged to remove embargo distortion.

To compound the problem, America has an energy intensive society. Our energy consumption is highly correlated with our employment. Our economy is presently at the mercy of foreign powers. We now import about 50% of our fuel. Can we afford to have 50% of our work force unemployed? We can be assured of our foreign fuel supplies only as long as it is in the other countries' interests to export it.

Our immediate problem, then, is one of costs. Costs for more expensive sources of domestic fuel. Costs for increased technology. And costs for foreign fuel -- which we cannot control -- and increased fuel taxes -- which will probably be imposed as Congress acts on the administration's energy plan.

Schools already on austerity budgets can look for rapidly escalating energy prices. In the two years following the 1973 oil embargo, energy costs to the schools increased 48% on a national average. Using Department of Commerce and Defense Department real and projected escalation rates, by 1980 the schools will find their fuel costs at 300% of the 1973 embargo price -- at least!

These increases are particularly disturbing when you consider that school administrators can meet them in one of two ways: go to the voters to increase revenues or cut educational programs. A grim choice.

But there are measures school people can take that will lessen the shock. In order to appreciate where we in education are and what can be done, we need to back off and look at the history of school construction. Most of the schools in use today were built on a first-cost basis when the post-World War II "baby boom" hit the schools in the 1950's. At that time,

space was critical; energy was not. It was imperative that school administrators get maximum square footage per dollar. The consequence was energy-inefficient buildings which plague education and the nation today. It has been estimated that the schools are wasting at least 50% of the heating/cooling energy they consume.

Education dollars are going up in smoke. But for every dollar that goes up the chimney, fifty cents could be diverted back to the classroom.

HOW?

First, by a deep commitment from every person in the district to conserve energy and to cease wasteful practices. This requires information. Solid information as to the energy impact on the school, the school district, the community, and the nation. Clear-cut information can identify what are wasteful practices and subsequent savings from certain actions. A positive energy attitude must undergird all school operations. Dollars should not be expended for major maintenance or building modifications until a sound energy management procedure is pervasive in the district. Only if that is initiated and continued can a district get maximum return on its capital investments.

Good energy management can reduce energy consumption 10 to 30%. But it takes commitment from every man, woman, and child in the district to be effective.

AASA's project, Saving Schoolhouse Energy, was initiated to demonstrate the desirability of retrofitting school buildings to conserve energy. Results of engineering analyses conducted at ten representative elementary schools across the nation showed that, for a mean capital expenditure of $25,823, energy consumption could be reduced an average of 50 percent.

We found the greatest culprits were excessive outside air, controls that could not be (or were not) adjusted for unoccupied periods such as night setback, and inefficient boilers. The more obvious roof insulation and/or reduction of glass were found to be cost effective in four schools. More information on this study is available at our office.

But each situation is unique. The first step is to look at your schools and at the history of their energy consumption. Walk through the schools with energy sensitivity and see how they are operating. Use common sense and correct the obvious. Then select those schools that seem to be using a disproportionate amount of fuel as your first targets. Hire a qualified consultant to do a "mini-audit." Institute these low cost recommendations. Then determine if maxi-audits are warranted to identify capital changes that should be made. Insist on cost benefit analyses so you can decide where your limited capital can be spent most effectively.

Through all this, do not forget the human element -- keep everyone who will be affected informed and involved. This is one dimension of the leadership which school administrators must exert if they are to meet their obligations as education confronts the energy dilemma. The other leadership dimension school administrators must accept within their districts is the development of an effective energy curriculum.

There must be a major turnabout in the American belief that our resources are inexhaustible. Today's elementary students will spend their adult lives in a society with very limited, if not exhausted, oil and gas resources. Such needs go far beyond the textbook/methodology connotation of "curriculum design." An all-out effort to help students and the public at large is essential. Because public schools are the only educational institution and the only industry that exists in every community in this country, they are in a unique position to exercise a strong leadership role.

Notice the reference to "public at large." Much rhetoric about lifelong learning has been espoused. Now is the time to reach into the community as educators and serve to educate every citizen in this critical area.

It is incumbent upon each person in this room, as well as your colleagues who could not be here, to seek out reliable information on the energy situation and to pass along that information using your finest instructional talents.

You must be leaders in your community. You must inform. You must practice what you preach.

As you relate school energy needs to the community, here are a few do's and don'ts that may be helpful:

1. Get your facts straight. Know your energy history by building. Know what operation and maintenance efforts have been made. Know from your audits what can be done and the projected energy savings.

2. Don't get dragged into stating energy crisis figures. In this day of conflicting reports, someone in the community is sure to cite figures to refute you. If you must cite figures, quote them.

3. Be visible in energy conserving practices and be consistent. Recognize that reduced lighting is visible to the public even though it may not conserve much energy and may relate to vandalism problems.

4. Maintain credibility. Talk in terms of cost avoidance, not dollars saved -- due to escalating costs, reduced energy consumption may not actually decrease the fuel budget.

Educators have one more leadership responsibility.

Energy policy decisions related to school programs should involve educators. As energy costs continue to rise and fuel resources are further depleted, decisions will need to be made on the feasibility of maintaining certain educational functions. Whether this comes gradually, rapidly, or as another full blown crisis, decision makers need additional hard data to determine the most beneficial course for the country. At present, no federal agency has the necessary data to balance the desirability of certain educational programs against the respective energy consumed. It is imperative that information be compiled which would reveal how much energy consumed in empty buildings is necessary to prevent deterioration. For occupied

buildings, we should have information by degree days so that decision makers know how much additional energy is actually needed to keep schools open in certain seasons and climatic zones. Other information such as conservation remedies already implemented, maximum usage scheduling, energy use related to certain educational and community activities, etc. is needed for priority considerations for education in the event that energy sources must be allocated or consumption restricted.

These kinds of decisions must be made. If you are not willing to live with the decisions made by non-educators for education, you have an obligation to be involved.

School administrators, who have learned to live in a climate of continuous crisis, are today faced with the greatest crisis ever to face education. If we do not move forward knowledgeably and aggressively on all fronts -- in our schools, our community, and the nation -- we will find education the recipient of uncontrolled drastic changes. Rousseau said that when circumstances are left to chance, chaos will reign. We will be caught in a whirlwind of chaos if we do not step forward to meet this challenge.

To do less is to ask America's youth to pay with their education for their fuel of the future. That is too high a price. One no professional educator worthy of the title can ask.

AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS

Joseph Ringer, Jr.
Assistant Superintendent of Schools
Arlington, Virginia

Introduction

Local school officials are not able to affect the supply of energy and are equally hard-pressed to meet the rising costs of energy. Codes, regulations and policies which require more and more energy for greater light levels, heating or cooling greater volumes of fresh air, or transporting school children are adopted with little or no opportunity for testimony by the school administrator. Only recently have decisions on new plants been evaluated in terms of their energy efficiency. School buses purchased must conform to standard specifications which are generally designed by state authorities and in which fuel consumption seems to play a minor part.

It may be debatable whether or not there is an energy shortage, but it is not debatable that we are an energy-wasteful society. We must regain our forefathers' sense of thriftiness -- "waste not, want not." School officials must be pace-setters. We must be resourceful in ways to save energy by altering the operation and use of buildings and buses. We must encourage new attitudes toward energy-consuming practices.

## Problems Local School Officials Face in Coping With Energy Shortages

1. School building designs are regulated by building codes which many are beginning to challenge as wasting energy. For example:

   A. IES Lighting Handbook for Classrooms (USA) calls for 70 foot candles for general use, 150 foot candles for demonstration areas. The same organization in the lighting code for Great Britain, calls for 30 LM-SF (another measure translating equally in number to foot candles) in general use classrooms and 20-30 in demonstration areas. Miles A. Tinker, a professor at the University of Minnesota, found the latter (20-30 foot candles) an appropriate recommendation for lighting ordinary classrooms. (Bases for Effective Reading by Miles A. Tinker, University of Minnesota Press, Minneapolis, Minn. and cited in AS&U Oct. 1975).[1]

      Solution for existing buildings. We found by consulting with the users of the space, we were able to reduce the lighting in each of our buildings 5 to 10 percent without any noticeable effect. This is roughly equivalent to the electrical power consumed by about 350 homes in our area on an annual basis. (We had about 20,000 pupils at the time.)

   B. BOCA Basic Building Code/1975 currently requires, during periods of occupancy, 7½ cubic foot of fresh air per minute, to be supplied (and exhausted) per occupant.

      This air must be moved mechanically and heated which requires much energy. Many people feel this is two to three times greater than is necessary now that class sizes are smaller and people are more careful about personal hygiene. In fact, Edward Stephan, Director of Federal Energy Management Program, Energy Conservation and Environment, Washington, D.C., observed in a comprehensive study of 176 schools in Fairfax County, Va. (AS&U 1975) that "Excessive outside air in the high school accounted for unnecessary fuel consumptions of 23 to 31%."[2]

      Solution: Close off air handling equipment selectively. In our five story administration building, we rarely operate air handling equipment during evenings and weekends, and only selectively during occupied periods.

2. Overdesign of buildings and equipment is a function of our system.

When a particular performance level is desired, engineers have to rely upon certain standards such as the minimum average temperature to be expected in a certain area.

1 Shein, Carl "School Lighting Re-evaluated," American School & University, October 1975, pgs. 70-78.

2 Stephan, Edward "Energy Guidelines for Schools," American School & University, February 1975, pgs. 51-53.

(For example, in our area our buildings were designed when that standard said to expect zero to five degrees above zero.) Of course, the architect or engineer does not want to be criticized for an uncomfortable building so he adds a little. When the architect or engineer determines the design requirements, the designer generally errs on the overdesign side rather than the underdesign in order to pass the plan review of the building inspectors. When a product is used to fulfill that design requirement, industry representatives converge on the designer to prove the merits of a "better" product. Our bidding rules require it to meet or exceed the requirements. When one carries this back to the raw materials, we can see that overdesign cannot be avoided and that it does consume raw materials and energy disproportionate to the actual need.

3. Architectural considerations do not always complement energy conservation. For example, architects resist using polycarbonate sheeting for glazing because it "pillows" and is more susceptible to scratches and clouding. The light transmission characteristics are roughly 80 to 90% of glass but it weighs only about 1/2 as much as equivalent thicknesses of ordinary glass and conserves fuel since it provides better thermal conductivity than glass. In one of our buildings, which is a compact building completely glazed with polycarbonates, we were able to turn the furnace completely off for 17 of the 24 hours during the heating season last year when the energy shortages were at their peak. This is a combination of the insulation characteristics of polycarbonate sheeting in the building as well as having only necessary doors as fire code requires rather than many convenience entrances as many of our older schools have.

Insulation as design factor in schools has pluses and minuses because of Code requirements with respect to natural lighting (glazing) and ventilation. Extensive glazing and preferences for metal windows rather than wood permit extensive heat loss and solar gain unless canopies, exterior blinds, vegetation or building orientation are employed effectively. Engineers depend upon air leaking through windows and doors for the operation of the mechanical ventilating systems.

4. Simple design factors which save must be considered by local school officials. For example:

1) Entryways should have double doors -- many school buildings in the mid-west are adding small enclosed spaces to provide air locks at their entranceways.

2) Washrooms may not require hot water. A cold water supply may be sufficient, saving both material costs and energy.

3) Shower rooms likewise may be provided with tempered water with simple on and off controls in place of individual hot and cold water supplies.

4) Bright reflective paint will reduce the need for artificial light and certain paint colors will give a feeling of comfort.

5) Many schools use boilers to make up their hot water for kitchens, wash areas, etc. Individual water heaters to serve kitchen or showers or custodial needs are more efficient and more able to be controlled.

6) Task lighting rather than general lighting must have greater design consideration.

5. Retrofitting can save energy but also requires an investment. Controls for heating, ventilating, and air conditioning systems in schools have been kept simple and in some cases, made available to the space users. Now schools must look to making those controls more sophisticated in order to:

- provide night setbacks
- respond to varying program requirements
- respond to external conditions

This sophistication may be as simple as reassigning staff members to manipulate those controls by hand. There are several computerized systems on the market which will use technology to accomplish the same result at all hours rather than just working hours.

6. Use Factor. Grouping children to pass through doorways in a shorter period of time as well as restricting the use of certain doors will reduce the amount of heat loss.

School calendars must pay more attention to seasons, holidays, vacations, early closings, etc. and must recognize weekends and anticipated weather conditions. A spring holiday is fine provided it is part of a weekend, otherwise a winter holiday would save more energy than in the fair, spring weather.

After-hours (extra-curricular) activities and community use must consider energy factors. Can heating plants be turned off before or while the activity is taking place rather than after? Can those after hours programs be consolidated into certain portions of a building (if zoning of controls is available) or to certain buildings? Can community programs which are conducted in other public buildings share available school space on a scheduled or parallel use basis thus conserving communities' energy consumption.

Custodial care of buildings frequently takes place in the evening hours and many studies show that large amounts of energy are consumed when only a small custodial force is in a building - lighting, heating, air conditioning. Can this service be rescheduled? Can heat and light be reduced while these operations are taking place? Also, operating personnel must be made more aware of the fact that clean equipment -- coils, filters, motors, etc. -- cost less to operate than dirty ones.

7. School Vehicles. Local school officials may have to consider city bus routing for school purposes as opposed to neighborhood or individualized bus stops. In many suburban communities, a school bus travelling down a main street will be convenient enough to pupils' homes and schools if pupils and parents assume responsibility for reaching pick-up points and walking from drop-off points. This will also permit continuous bus operation with no lay-overs with idling engines, or split shifts for employees.

School buses operating as city buses could also transport school personnel who serve at more than one building, or even those who live along the route and would prefer to leave their own gas-guzzler at home.

Field trips must be consolidated so that the bus is used to its fullest capacity rather than taking separate groups on separate days to the same place.

8. Instructional Programs. There are many activities at each grade level for science, home economics, math, industrial arts, career education, etc. to be used to prepare students for future life-styles which will include coping with energy shortages.

Conservation clubs, conservation wardens, will help to define student service activities.

Incentive programs to reduce utility costs and convert dollar savings to other worthwhile purposes, may encourage more effective use of available energy.

9. Miscellaneous. Four day work weeks will have to be looked at if school heating plants must be shut down and school vehicles do not have fuel sufficient to operate.

Hot lunch programs may give way to cold lunch programs.

Conclusion

Local school officials may have had little influence on the way our buildings and buses are built, but they can demand a review of the codes which make excessive energy demands.

They can alter the ways in which buildings and buses are operated and used as a means of saving energy.

The local school building is the one place in our communities which serves most of the people at some time during their life; it must be managed in a way that will enable it to survive and also to fill a greater role. It must serve multiple programs and reduce the need for other facilities.

School personnel and patrons must be alert to ways to conserve energy and then demand that they are practiced.

More efficient ways must be found to transport students to schools and to provide them with necessary services such as food.

And, instructional programs must encourage pupils to practice thrift in all matters and to discourage the use of anything which is unnecessary.

## AMERICAN FEDERATION OF TEACHERS

Dal Lawrence, president
Toledo Federation of Teachers
Toledo, Ohio

In December, 1975, the Toledo Federation of Teachers, American Federation of Teachers, AFL-CIO, conducted a survey of classroom environmental temperatures and found that about fifteen percent of the Toledo Public School students, or 9000, were in rooms with a thermostat temperature between 65 and 68 degrees. Nearly 1000 students were in rooms where the thermostat registered below 64 degrees. Considering the fact that seat temperatures fall 5 to 8 degrees below the thermostat temperature, we thought that students and teachers were being subjected to cruel environmental conditions forced upon us by the Columbia Gas Company. Little did we realize that one year later the situation would be worse. In fact, it would be a disaster.

The Toledo school system has an enrollment of 54,000 students. Unlike most cities, enrollment has remained stable. Sixty-two of our seventy-five schools are fueled by natural gas. The system has severe financial problems, primarily due to Ohio's inept system of school finance. This past December the schools were closed thirteen days because insufficient funds existed to operate until December 31. Ohio law requires schools to complete each calendar year without an operating deficit. We reopened in January and were then closed again for two days because of heavy snow and seven days because of restrictive natural gas allocations by Columbia. It was not until the first week of March that students had an opportunity to attend school a full five day week.

Classroom temperatures were dropped to "maintenance levels" under threat of a complete shut off of gas. Damage to buildings was extensive. Students, already deprived of comfortable classrooms, found themselves without school altogether. When they returned temperatures were in the forty degree range. High schools operated on abbreviated schedules in areas heated electrically. Elementary schools moved to other buildings heated with alternate fuel. Attendance declined substantially, even when schools were open.

Toledo city schools were lucky. Most area schools closed for longer periods. The teachers' union, the school board and the superintendent resisted a general closing of four weeks that was being demanded by the company. Daily threats of a total shut off of gas continued until finally the school district purchased two gas wells near Coshocton, Ohio, at $3.00 per thousand cubic feet.

Now area schools are purchasing natural gas from Toledo Public Schools. Toledo students went back to classes with thermostats set at 62 degrees. School will end on June 24. Ironically, many of these students are sitting in classrooms with temperatures between 95 and 100 degrees. There is no hope of improvement. Next fall schools will again close early because money to operate through the calendar year is nonexistent. We hold no hope of ever again seeing classrooms warm enough to meet reasonable environmental or educational standards.

Alternate school calendars are under consideration to accommodate the gas company. Students are left without summer jobs. Teachers will fare little better since most must work in the summer, or complete graduate work, in order to survive today's inflationary economy. The State of Ohio has no firm plan to come to the assistance of its hard pressed public schools. Continued hardship is foreseen indefinitely into the future.

The Columbia Gas System has brought its share of misery and havoc to Toledo children and their parents. Throughout it all, the company has shown a callous disregard for the suffering inflicted. Its record as a public utility could hardly be worse, although one must remember that Toledoans felt that way about the company last year, and this year was worse.

Columbia sold gas outside Ohio this fall and in the fall of 1975. It boldly asked industry and school officials to write to the members of Congress, and demand that prices be deregulated. It threatened that already short allocations would get worse if prices were not deregulated, and it made good that threat.

The information and documents that follow show clearly that Columbia used the schools as leverage to force higher gas prices. The costs and energy saving techniques employed early by the school system are presented. The hardships of parents and students are detailed. And finally, the fact that the federal government's own Environmental Protection Agency mandated conversion from coal to alternative fuels by January 1, 1975, and stipulated that the school system would be fined if it did not comply, shows an almost total lack of sympathy, direction or consistency in federal energy policy. Would anyone want to bet that emerging federal energy policy will recognize the special problems of American classrooms?

This presentation is made today without much confidence that anything will be done to correct these energy problems which must be added to an extensive list of school troubles. For the most part it is too late, especially when viewed within the context of money shortages, integration problems and school violence. The Toledo system does not have money enough to escape the natural gas squeeze, to pay for the damage already done, or time to work out solutions before the parents give up. Most other Ohio urban schools are facing similar severe circumstances.

The combination of financial woes, precipitous integration orders by HEW and Columbia Gas System's almost total disregard for a fragile public institution are more a burden than our citizens reasonably can be expected to bear.

Curtailment and Deregulation

From 1971 through 1974 the Toledo Board of Education completed an extensive and costly conversion from coal fired boilers to gas fired boilers at the order of the Environmental Protection Agency. Columbia Gas of Ohio assured school officials that supplies would be adequate for the sixty-two schools involved. At the start of the 1973-74 school year, an adequate gas supply was assumed. Schools were warm and a costly fine, threatened by EPA, had been avoided.

Just as the last schools were being converted, the system was notified by fuel oil distributors and Columbia Gas of Ohio that total supplies contracted for could not be delivered and curtailments were necessary. Fuel oil prices had risen sharply. Ten schools were heated by this fuel, and on January 22, 1974, the Toledo Board of Education was informed by the school administration that the first energy conservation measures had been taken. Room thermostats were set at 68 degrees. Hallways were maintained at 65 degrees. Heat was further reduced at 3:30 p.m. each day. The order affected all schools. Many of the buildings were old and complaints of discomfort came immediately from parents, students and teachers.

Columbia, in a letter dated December 31, 1974, pointed out that the "continued worsening of the gas supply has made it necessary to impose severe limitations upon the supply of gas by all non-domestic customers." The letter concluded by asking cooperation "as well as your support for conservation, deregulation of the new supplies of gas and other measures designed to alleviate such emergency." Later correspondence would more pointedly ask school officials to write to Congress to demand deregulation of natural gas interstate prices.

Ohio's largest gas supplier is Columbia Gas Transmission System which supplies about 70% of Ohio's gas. Effective January 1, 1975, Columbia Transmission reduced supplies to its distributor companies such as Toledo's Columbia Gas of Ohio by 22%. It has been estimated that 50% of Ohio's 7000 industrial end users were affected. The first industrial layoffs were recorded shortly thereafter. In Toledo, the first effects were felt by the glass industry.

Toledo schools were informed on January 21, 1975, that allocation of gas was to be cut to 60% of normal supply during the heating season, and 85% in the non-heating season. Beginning in April, 1975, a $10.00 per MCF penalty would be assessed for overruns. Columbia also warned that service could be terminated until curtailment levels were met.

The company had applied to the Ohio PUCO for permission to modify curtailment policies by extending them to commercial and small industrial customers, including schools. The penalty payment was submitted to the PUCO for approval. Columbia met with school officials locally and at the state level to explain its allocation system and gave energy saving suggestions.

All of this occurred at the time the president of the Columbia Gas System, B.J. Clarke, was telling Congressmen that "the gas supply will worsen until potential reserves which we are confident exist are developed. This will not occur until necessary incentives, such as the decontrol of

new wellhead gas prices, are provided. . . . Your support in Congress to immediately declare a natural gas emergency, and pass legislation to decontrol the price of new gas at the wellhead," was requested of Ohio Congressman Charles Mosher.

Clarke complained about low prices and suggested that many gas fields "are in advanced stages of depletion," a notion highly suspect in light of subsequent Congressional and FPC inquiries.

State and local school officials immediately began to devise ways to meet the new allocation cuts. Columbia did permit most school districts, including Toledo, to spread their allocations over all buildings. Toledo had twenty-five schools that were affected by the 40% cut back. By spreading the remaining allocation, it was possible to achieve a 20% to 25% district-wide allocation result.

While thermostats were ordered set at 68 degrees, seat temperatures ranged 5 to 8 degrees colder. Old schools were hard to maintain at any fixed degree. Many classrooms suffered through temperatures in the fifty degree range. Buildings were not brought to temperature on Mondays until only an hour before classes were scheduled to begin. Heat was shut off at the close of school, and then one hour before the close of school. Most students wore tennis shoes and short sleeved T-shirts to school and shivered through the day. Conditions would get worse.

On February 10, 1975, the Ohio PUCO held its first hearing on the Columbia allocation plan and penalty rates. Our union intervened in the case. Nearly 400 school people were in attendance and the meeting site had to be changed. PUCO meetings had not drawn much attention before. I testified personally - an unusual experience since I had not before attended a PUCO meeting. My testimony, while unpopular with gas company attorneys, was met with applause by the audience. The school board instructed its attorney to attend the hearing, but it was later discovered that he also was the attorney for Columbia Gas of Ohio. He did not appear.

One farmer did appear much to the chagrin of company officials. He had a gas well and he asked the hearing officer, in his best southern Ohio drawl, why he couldn't get Columbia to buy his gas. Between us we received the warm congratulations of the audience, but we got neither gas nor relief. I had asked for schools to be placed in an allocation category with hospitals. That request was ignored, too. A little over a year later the PUCO made permanent an order approving the new restricted allocation system and penalty rates for usage in excess of the allocations.

In frustration I later wrote to the three commissioners and invited them to hold a future hearing in one of our cold classrooms in Toledo. The chairman, C. Luther Heckman, wrote back a kind reply in which he assured me that he was getting a good idea about gas curtailments and the schools from his wife, who was a teacher. Considering "the constraints of my position," he said, "I will certainly do my best to eliminate ... undesirable effects of gas shortages on education in this state." The "constraints" turned out to be pretty severe as I look back on it, because the chairman and the governor resorted to a prayer meeting in the statehouse rotunda to ask for warmer weather this winter - their only noticeable move against Columbia Gas. The plea was dismissed out of hand.

In March, 1975, Columbia announced a series of rate "pass-through" increases and said curtailments would continue through the summer. On June 23, Columbia told the school district that industries could face a 100% curtailment, and urged by letter that the school board and parents could correct the gas shortage by writing to Congress to ask for deregulation of new gas at the wellhead.

Getting Cold

The 1975-76 school year in Toledo was marked by gas shortages and financial problems. Thermostats were cut back to 65 degrees and heat was provided only from 8:00 a.m. to 2:30 p.m. However, retail businesses operated normally, and many people began to question why children were freezing in school while shopping malls were warm.

Our union conducted a temperature survey of classrooms during December, 1976, and found environmental conditions in many rooms to be far from the 72 degrees recommended by HEW as ideal for education. Some were reported in the fifty degree range, and one school registered forty and fifty degree temperatures for a week. The outside temperatures for the period surveyed were relatively mild with some fifty degree days recorded.

What we were finding was that large, old schools could not be heated evenly when thermostats were set back. Students wore gloves and boots in many rooms. Teachers complained loudly about the conditions and over this second winter of supply cutbacks, the morale of the staff began to slip badly. Students also began to get the notion that school must not be very important to adults if each day they were permitted to shiver their way through classes.

Aggravating the problem was the defeat of a school operating levy in November, 1975. The system cut back drastically on supplies and materials for classrooms, and economized in many other areas. Obviously the cost of fuel had increased, as had all other supplies, and normal operations were simply impossible.

Another school levy was defeated in June, 1976, and a third in November, 1976. Schools ran out of money and closed on December 3.

Ohio requires that each of its school districts submit to the voters requests for increased operating millage on property. Toledo schools had maintained most of their student population over the years. Peak enrollment was 64,000 and that figure stands at 54,000 today, most of the reduction due to normal declining birth rates. Toledo is the only Ohio city with such a record.

But ample conditions existed to push the system into the same spiral of urban decay so prevalent in other areas. Parents were restive with cold schools. (Toledo had cut temperatures long before neighboring schools.) Students brought homework and tests home on back sides of discarded business order forms because adequate paper could not be purchased. HEW was demanding that staff integration be speeded up. (HEW officials have never spoken to teacher representatives.) Higher property taxes were being resisted by voters. And Ohio failed to fund its urban schools properly when it adopted

an "equal yield" state aid formula, forcing even greater reliance on the property tax. Toledo schools have not had a property tax approval since 1968, and the prospects for approval in the future are virtually nil.

These factors were very much on the minds of parents and citizens as the 1976-77 school year commenced.

Coping

There are over 4000 school buildings in Ohio. Seventy-three percent of them heat with natural gas. Only 8% have alternative fuel capabilities. Columbia supplies nearly half of the school districts, and 56 of Ohio's 88 counties.

Every school system supplied by Columbia has either closed its schools this winter for varying periods of time, shortened its school day or instituted split sessions with students in gas fired schools moved to buildings with alternative fuels. Industries and some schools had their supplies shut off entirely by the company. At one point the governor ordered the Dayton City Schools closed only to find out that he lacked such statutory authority.

Columbus City Schools closed for over three weeks. Students were brought in one day each week to receive homework assignments. Lesson plans were published in a Columbus newspaper. Students met in restaurants, banks, homes and one teacher I know met her students in the back room of a bar.

Beginning the day after Christmas, the temperature remained below freezing throughout the state until February 8. January's average temperature in Toledo was 9.7 degrees. Wind chill factors dropped regularly to -30 degrees and worse.

Columbia Gas of Ohio sold synthetic gas manufactured at Green Springs, Ohio to Washington, D.C. throughout the heating season. A Columbia Transmission spokesman said, "It's for whoever wants it." Columbia was offered 14 billion cubic feet of gas last fall, but failed to purchase the gas partly, if not wholly, to spite the state legislature which had refused to allow the additional cost of a 1975 emergency purchase to be spread to residential as well as industrial customers. Marvin White, Columbia Gas of Ohio board chairman, said, "Any way you look at it, if it were not for that piece of legislation, curtailment in Ohio would not be severe today." His remark was made on January 5, before most schools were forced to close.

White further stated that Columbia had tried to buy gas but needed a private company to sign a contract in advance to take the additional supply. But a member of Ohio's PUCO pointed out that some forty companies had signed up but were never supplied the gas. East Ohio Gas Company, which supplies most of the rest of the state's needs, did not experience shortages.

Columbia Gas Transmission also sold considerable amounts of supply away from its Ohio distributors during October, 1976, thereby sealing the fate of schools and industries in the state.

For whatever reason, school systems and industries were notified that a crisis existed and beginning February 1, 1977, all industrial and commercial users using 1,000,000 cubic feet a month were to be cut to 85% of their supplies, which had already been curtailed previously. Those who had alternative capabilities already, had been shut off completely. Statewide, some 1650 industrial and 13,300 commercial, including schools, were affected either by total shut-offs or by severe curtailments.

In Toledo, eighteen schools were ordered cut back 85% from an already curtailed supply. Forty-six smaller schools were cut 30%. Interestingly, the schools were notified first among commercial classed users, mostly by telephone, that drastic curtailments would have to be effected immediately. While there is no documentary record, local gas company officials demanded that the school system close all its gas fired schools until the first week of March, a period of six weeks. The request was firmly refused. Most other Ohio districts experienced similar pressure. Many caved in and closed.

Columbia also went to the PUCO and requested that all unused allocations be returned to the system for general use. Such an order by the PUCO would have meant that past conservation efforts were in vain. Toledo's school effort had three years of conservation experience, even though most of it had been at the expense of the students. The order was not acted on after federal reallocation programs began to ease the situation.

On February 1, the northwest district manager for Columbia, John Pickens, sent a telegram to the Toledo school superintendent warning him that all gas would be shut off (after a 24 hour notice) unless the system closed. No mention was made of the fact that an appeal to the PUCO could delay such action. All large schools in the state were ordered to cut back to "maintenance levels" for at least a week. One Toledo high school was checked that weekend and found to be in the high forty temperature range, and school officials were told to drop the temperature further. By Friday, February 4, the schools had been closed seven days during January and February making a total of twenty days missed since December 3. It would be Wednesday of the following week, the 9th, before a normal schedule resumed.

Students had been deprived of a normal schedule on three additional days. Some students on these days were allowed to remain home, the rest were subjected to 20 minute class periods huddled in 30 to 40 degree cold. All of Toledo's sixty-four gas fired buildings were affected -- about 75% of the total enrollment.

Sports schedules were a mess. The girls' varsity programs never did recover. Many students in inner-city schools just didn't come to school even on the days when they were open. Elementary classes of ten or fewer were not uncommon. High school and junior high pupils were tremendously affected. Attitudes toward school, not good to begin with, deteriorated. By February 9, there had been only fifteen normal days of school since December 3, and those days had been spent freezing. Extracurricular activities ground to a halt. Semester exams were cancelled. Many teachers had only one second quarter grade in their book on which to judge student progress. Most students, teachers and parents simply gave up.

The state, faced with massive and extended closing, enacted a law to reduce the mandatory school year by fifteen days. These "energy days" simply would not be made up. Toledo would still hold sessions until June 24, however, to make up the thirteen days when operations ceased in December due to insufficient funds. The 160 day school year is now a permanent feature of school law, just as "calamity" or "snow days" used to be. In Ohio we feel very much pinched between shortened school years on one hand, and higher gas prices on the other.

Conclusion and Suggestions

Schools would have been closed even more than the twenty days already recorded had it not been for the purchase of a gas well announced February 8. A capped, but piped, well needed only a meter. The price was $3.00 per thousand cubic feet, up from the $1.90 price of regulated gas the schools were paying. In five years the regular cost of gas had risen over 100%. Fuel oil was up 216%. Electricity 78%. The $3.00 price could not be afforded, but the choice was having school, or not having school. The public and news media supported the acquisition, although neither had given much support to raising new revenues.

Vaught Oil, the owner of the well, under pressure from the Federal Power Commission, then reduced the price to $2.50, supposedly because the Toledo system had agreed to sell its surplus to neighboring schools. The total purchase amounted to 45 million cubic feet with 25.8 million slated for area schools. Even so, one Toledo area district did not reopen its schools until February 28.

Damage to schools was extensive. Over $50,000 in damage was recorded in Toledo schools alone. More will become evident as warm weather occurs and roof leaks appear.

The final irony is that taking children out of buildings eliminated body heat, and it is estimated that fuel savings were minimal as a result. Further, it should be remembered that pupils at home open doors and cause substantial heat loss. And just across the state line in Michigan students were in school and warm.

Columbia had at best been guilty of incredibly bad management, but most felt the Columbia Gas System, and especially its Ohio distributors, made an all-out effort to force price deregulation, and was determined to prove to the legislature that its prohibition of pass-through costs for emergency supplies was unwarranted. Although Columbia probably would deny it, schools were major targets in an effort to impress upon people that gas was in short supply, and that the problem could not be corrected without deregulation. An extensive advertising campaign has been waged in the state over the past three years (since oil producers succeeded in driving up the price of motor fuel and oil) to gain public support for deregulation. The cost of the ads is then charged back to the consumer, courtesy of the legislature and the PUCO.

Curtailments appear to be a permanent feature of school life. Cold classrooms will continue, if for no other reason than the Toledo schools

do not have the estimated $7,500,000 necessary to convert to coal, even if the EPA would permit it. The costs of fuel are already beyond what the district can afford, especially when one considers that the schools will have to close some time in November this year when available funds are again depleted. The forty-ninth largest public school district in the nation has been brought to its knees.

Toledo area superintendents are attempting to start school on August 15, and break for over a month in December and January in order to find ways to afford fuel and escape the clutches of Columbia. Buildings are not equipped for hot weather. There is just no end in sight to student discomfort.

Today, Ohio's urban school systems are not only battered, they are virtually without hope. Ohio ranks first in public aid to private schools. An amount equal to the state's lottery receipts is turned over to these private schools each year and seven public systems closed their doors for lack of funds. Property tax is the major source of local operating funds. The state is far short of contributing an equal share to local expenses. (In Toledo, 35% of the $72 million budget comes from the state.) Each school is required to provide a meal. Schools are the largest caterer in their communities. Private students are transported at public expense. Courses and class sizes are mandated in Columbus and paid for locally. The system just isn't working.

In conclusion, there are some things that Congress might do to give some long range assistance to schools afflicted by the energy crisis.

* Fund research for cleaning sulfur dioxide emissions from high sulfur content coal that Ohio possesses in abundance.

* Establish a national gas allocation system that requires interstate gas to be distributed to schools and hospitals in "human needs" categories, with fixed, economical rates.

* Fund conversion of gas fired boilers in schools to alternative fuels. Establish federal aid to schools to cover the costs of insulation and/or damage resulting from insufficient fuel.

* Establish a separate cabinet level department of energy with a division for hospitals and schools.

* Impose an excess profits tax on companies that profited from the shortages. In Ohio, Columbia obviously diverted much fuel from lower rated commercial and industrial end users to higher rated residential users.

* Order an exemption to EPA emission standards for high sulfur coal for schools. Place production and pricing of coal under a federal regulation agency with teeth.

* Establish a National Energy Information System which when fully developed will provide a comprehensive and authoritative source of information. One of the major inadequacies in the energy field has been the lack of basic facts needed to make intelligent analysis and critical decisions. In the past the major energy companies have been unwilling to provide complete and detailed information with regard to various facets of their operations.

* Grant money earmarked to pay for conservation measures and full conversion costs. (The Toledo school system did recently receive $4.17 million in Economic Development Administration funds for conservation projects.)

It is not enough that we sit here today and discuss our role in educating future citizens about the energy crisis. Certainly that must be done if we can get some hard data about how serious the problem is. However, considering the fact that Congress, the Federal Power Commission and state utility commissions must rely principally on statistics supplied by the petroleum industry itself, we should not kid ourselves about how easily school people can be used as propagandists for the industry - or for other strongly held viewpoints for that matter.

Public schools have the responsibility to be at least skeptical of energy policies that tie solutions to higher prices. Indeed, in my view, as the supply shortens, the need for strict governmental controls increases simply because fuel is so vital to our national economy. If deregulation of price is the answer, our citizens, and schools, will run out of money to buy fuel considerably before the fuel supply is exhausted.

There can be little doubt that we do have a responsibility to teach the mechanics of fuel conservation. That can be done and everyone will benefit regardless of their vested interest in the energy crisis.

Finally, schools need to forcefully demand special considerations from Congress, the Federal Power Commission and state legislatures in allocation and pricing policies, and we have every reason to do so. Public schools are already in varying degrees of decay; some beyond repair, most financially starved and generally beleaguered on all sides. We cannot afford to bear the brunt of pricing and allocation policies currently in effect. It's as simple as that. We can't afford it, and we can't see any hope of being able to afford inflationary fuel costs any time in the future. And we cannot continue to allow students to sit in classroom environments so incredibly cold that the learning process becomes ludicrous. When parents are weighing the merits of public versus private schooling, we should not be asked to put our worst foot forward.

Certainly several well-defined and tenaciously pursued goals, such as special allocation priorities for schools and hospitals, developed by representatives of the educational community can make a difference because the public will respond to these needs. I trust this conference will be a significant step in that direction.

## AMERICAN VOCATIONAL ASSOCIATION

Charles O. Whitehead, vice president
American Vocational Association
Memphis, Tennessee

The energy dilemma will, like Sputnik and President Kennedy's, "we will put a man on the moon in this decade---," cause drastic changes in the role and responsibilities of vocational education. Vocational education must meet the changing job market requirements. It must: find or develop the expertise among its own faculty and staff; retool many of its own shops and laboratories; revise curricula to produce the qualified worker for the new jobs and new task; and develop retraining to cross-train, update, and upgrade the vast number of employed workers who will be affected by changes in the labor market.

I call your attention to three areas of employment and ask your consideration of their effect on the task facing vocational education:

1. In the automobile industry if the internal combustion engine is replaced by an electric motor, what happens to the thousands of automotive mechanic training programs---and the millions of automobile mechanics?

2. Construction trades will have new practices, new materials---to say nothing of the solar or the geothermal energy resources.

3. Proliferation of nuclear and breeder reactor power plants is upon us. What is our source of operators, maintenance and safety personnel and the highly-skilled paraprofessional, such as the nuclear engineering technician required for this expanding energy source.

Now multiply that by the hundreds of areas in vocational-technicial education.

Like pre-Sputnik we are dependent in the current energy dilemma on industry growing its own through years of experience, on military training and experience, plus a few vocational-technical educational programs to meet the new needs of the work force in these areas. But like Sputnik and "putting the man on the moon," that dependency is no longer adequate. How many of us recall the real reason the National Defense Education Act was passed---and its effect on vocational education? Is such a stimulus for energy education necessary---or do we need to use changes in current federal

education programs to provide the stimulus? I do know that changes brought about by the energy dilemma will be only as effective as the operator, the craftsman, the serviceman, and the paraprofessional can make them. I remind you of your dilemma with getting the American satellite in orbit until the scientist, engineering technician, craftsman team of the Army's Redstone Arsenal was finally given the go-ahead to use their equipment and their know-how to save whatever face we had left.

Vocational education is also aware of needed changes in education's physical plants and in the design of new plants. It also is concerned about the habits and resistance to change of faculty, staff, students, and parents that hinders closing schools for two months during the dead of winter in the North or the heat of summer in the South. But since vocational education is most often housed in educational complexes that offer many types of education (high schools, community colleges, colleges, and universities) vocational education will lend its support and cooperation to the administration of these educational systems, and to their efforts to meet the challenges posed to education. This support could include the application of the expertise of the vocational educator to the technical problems caused by the dilemma, as well as their support of the modification of the educational mores of faculty, staff, students and parents need to support change.

And where vocational education is a separate package it will assume both the above plus the total administrative responsibility for the needed changes---and as in the case of NDEA and the space age, lead education into a new educational era.

## ASSOCIATION FOR SUPERVISION AND CURRICULUM DEVELOPMENT

Gordon Cawelti, executive director
Association for Supervision and Curriculum Development
Washington, D.C.

My remarks are based on an assumption about what the conference might lead to--increased federal involvement, possible state (that is regional lab) and office of education or state departments of education involvement. I want to start with the contention that in many respects federal efforts in the curriculum area have resulted in what I refer to as a patchwork curriculum, and that we are now possibly very near the point of curriculum overload in the precollegiate area because of a whole variety of responses to very legitimate social concerns.

Many years ago, for example, at Columbia Professor Harold Rugg suggested that schools should respond to social concerns, and he became labeled a pinko by the American Legion, among others, and was virtually run out of the country, which was saying that schools should not respond to social concerns. Today we see the federal government funding a variety of programs which respond in that way. I'd like to start with a few slides

to show you what I mean by this curriculum overload or the patchwork curriculum. You've heard this story. Federal funds have provided a small series of grants in response to the very important need of multicultural education to encourage a more pluralistic approach in our society. That clearly is a response to a social need. Environmental education, related to our topic here, is funded by the federal government. The federal government funds drug education. Consumer education, I think, is funded. Death education is another add-on since some think that it's important.

By the way, it has always been interesting to me to see the discrepancy between sex education and death education. When I was a superintendent we had a grand jury investigation when we introduced sex education. I haven't heard that kind of controversy surrounding death education. Apparently you can deal with how we leave but don't fuss with the plumbing whereby we come. Other pieces of the participants' curriculum include aesthetic education, career education, leisure education and moral education.

Larry Kohlberg says that that's not a separate course, you just sort of infuse that into all the subjects. That's what Ken Hoyt says about career education, and we've already heard that this is what you do, you just infuse in everybody a teacher of energy and moral and career education. Global studies is being advocated very strongly by a large number of organizations as a necessity in the present curriculum; therefore add on something somewhere somehow. There's sex for those who were waiting, and now leisure education--I've been on a panel that is hard at work at that. The National Parks and Recreation Department has a good project in leisure education.

Now we come to a new one that we need to respond to because we're having high costs, insufficient energy. That creates what I refer to as the patchwork curriculum. Where do you stop? Are we at a point of overload? That's the issue I want to toss up to you. We need some kind of consolidation of the curriculum, because I frankly don't believe that the idea that everybody is a reading teacher has ever worked very well. Something that is everybody's responsibility is nobody's. We need to have a clear identification of where in the curriculum these various kinds of concerns can be handled. I have proposed a kind of cluster like this, where learning skills are a whole series of experiences all kids have all the way through school. You have one series of experiences in health, physical education, and leisure, that everybody ought to have every year rather than just patching on something now and then, and all the people in the school and community who can add something to that help with it. That's where drug education goes and sex education and leisure and fitness education and everything else ought to go. As for career education, which doesn't fit in very well, I for one don't believe it is the organizing element of public education--that all of education centers around career education--some do, I don't. It's a piece of the curriculum, but it's not the organizing element part. I think Freeman Butt's analysis which puts civicism (as he calls it) as the center organizing element of public education in America is a much more compelling argument than either career education or cultural pluralism. I would argue very strongly that the organizing element is civicism or the education of a responsible citizen. Cultural study is a distinct need and is usually underrepresented in the curriculum. The aesthetic education

program that one of the labs represented here did, started from studies that showed that 10 or 15 percent of the graduates of public schools haven't had any credit whatsoever in the arts. I think here is where you use the arts to teach about a few important concepts that we want to transmit about our culture.

Finally, we have societal studies--and this is where I believe we should develop a curriculum which systematically exposes youngsters to information and attitude awareness of all kinds. We should use whatever teachers have that capability, whether they are science or social studies teachers, or people in the community. So I guess my point is that if there is additional federal money to be spent, what we need now is help in the identification of the key concepts. And that involves a model that has been much used which has the appropriate mix of scholars and public school teachers working on curriculum development. Bruner and others have clearly demonstrated that there are some concepts which are more useful in teaching than others, and we should certainly be able to assume there are some concepts about our ecosystem, about energy or whatever, which are more important, more useful and have a broader application than others.

## COUNCIL OF CHIEF STATE SCHOOL OFFICERS

Calvin E. Anderson, energy project director
Colorado Department of Education
Denver, Colorado

"Words! Words! Words! I'm so sick of words." Isn't that what Eliza Doolittle says in "My Fair Lady?" Well, I echo her sentiments. Words! Words! Words! This is mostly what we are getting in this whole area of energy and energy curriculum. Never has so much been promised and so little delivered.

Three years ago in Colorado a group of 15 teachers put together--in one week, and with no extra pay-- a K-12 energy curriculum guide. I'm very proud to say it is still considered one of the finest energy curriculum guides in the country and only two weeks ago an additional state requested permission to reprint it. Why is it good? Because it was created by classroom teachers to be used by classroom teachers. It contains the essentials of energy development and conservation with practical activities and a high degree of classroom usability.

How was that possible? Local school districts loaned us the talent and these very insightful people did not reinvent the wheel. They merely put relevant material in focus. That was three years ago. These were not words--this was action.

Recently, the federal government gave all states energy conservation money. If it was the intent of Congress to use a substantial portion of these funds to educate future generations on the need for good energy

management, I suggest the bureaucratic guidelines stopped this. Even the special funding for energy conservation in education (EPCA) has been misplaced in many states and its eventual impact on the education of the American is, at best, very suspect.

These are more of the "words, words, words" that are substituted for action.

With the lack of federal support for a continuing sound energy educational program, what can we as professional organizations do to fulfill our roles as educational leaders? I see five areas of immediate concern where energy education could be effective:

First, we must unite in communicating our ideas and concerns in energy education. This meeting is a good start. We must be willing to assist each other and build on each other's progress. We have the nucleus of this network now and a number of states and professional organizations are keeping in touch and updating each other and sharing materials. But we want you all to join us. We don't have money--but we do have the interest.

Second, we must be less concerned about the historical causes of the energy problem and provide viable options and solutions. Let us not stop dreaming about the year 2000, but let's put increasing emphasis on 1978, '79, and '80.

Third, let us motivate teachers to include energy education in all curriculum areas to enhance student awareness of the problem. "Add-on" courses have never been popular with teachers, but placing an emphasis on energy education in math, English, career education, and in every curricular nook and cranny is one positive answer. For instance, students can read electrical meters in math; discover aspects of energy conservation related to many professions in career ed, and study the economic impact in social studies. The possibilities are endless. Energy education will fit and it does have relevance!

Fourth, let us limit the curricular research. What needs to be done is to take existing know-how that many of us have developed in various parts of the country and put it to practical application. What we don't need is more delay in getting it done.

Fifth, let us put forth a plan that creates an energy action force in every region of every state. A good beginning for this action force is to use the school as a symbol of a good energy laboratory. This means using the school as a living curriculum and extending it into home and businesses of the community. By using the resources of the schools we can train senior citizens, boy and girl scouts, members of the 4-H clubs and local service groups to make their communities <u>living energy laboratories</u>.

Too often we treat wise energy usage as the province of a special few. If we are to resolve our energy dilemma, then we must develop case studies on these community action laboratories and constantly evaluate their effectiveness.

We in education have the rare opportunity to affect history. We must not fail. If, indeed (as President Carter stated) the energy problem is a moral equivalent to war, then we in education must organize for the battle before us. In Colorado we have attempted to do this, and we have had some excellent results. We have been able to save school districts money on their energy bills and provide the students with instructional materials.

Here are only three of hundreds of examples of what we have uncovered in some of our school districts:

In one district we determined that when they turned on their football lights it cost them $400. They are considering day games.

In another school we found they could replace the incandescent gym lights with mercury vapors and they would not only get a much brighter gym but would save $700 the first year, after installation.

And our continuing need to train operating personnel was made abundantly clear when we discovered a custodian oiling the thermostats weekly which threw the entire system out of balance.

In Colorado, to provide an effective energy awareness program, we provide, on call, energy training audits in which we instruct people in good energy management.

Colleges, universities, and public utilities are an integral part of our energy awareness program including the development of classroom strategies.

Working against a largely apathetic public, we are making small but significant gains in this vital educational process. Where there has been support by those in charge, the results have been dramatic.

We welcome any and all federal agencies to join us in our education of students, school personnel, and citizens on effective use of energy and conservation--we would even welcome some funding. Those of you present who remember the pioneering efforts of the Interstate Energy Conservation Leadership workshop series put on by five states, will remember that such a network can work, can have practical results, and can lead to quality energy educational programs.

I will volunteer the Colorado Department of Education as a focal point in such an activity.

To say that we must educate ourselves for good energy usage or perish is a little more melodramatic than the facts warrant. To say we must have a strong energy education program for our children or watch a steep decline in our living standard is more realistic.

The rising costs of energy are being treated unrealistically by educators. This cost is affecting the education of our children. This silent crisis will prevent the introduction of any new programs unless it is dealt with at once.

In 1976 this rising cost of energy in the schools was equivalent to the potential of 43,000 teaching positions in the United States.

Of what value is a well-developed energy education program if there is no one to teach it?

Energy conservation has now become education conversation. The lamp of knowledge burns oil and without it, it may go out.

So let us have an end to the words. The role of our state department of education--and yours--is clear. We must take the leadership for a positive energy education program and get on with it. The others will follow.

## COUNCIL OF THE GREAT CITY SCHOOLS

Edward S. Foster, Jr., member
Toledo Board of Education
Toledo, Ohio

The purpose of this conference must be to illuminate the cataclysmic events of our day--and to anticipate those of tomorrow so that we may develop plans of action and not merely be forced to react to events as they occur. Hopefully we can develop some alternative programs so that we can have some flexibility as we are forced to deal with the unpredictable aspects of our future problems. One example of such unpredictability would be the weather.

For schools there must be two aspects in this planning:

1. Develop plans and establish priorities for operating a continuing educational function in times of limited resources.

2. The development of a curriculum which will prepare the youth of today to live in the times of change we can see looming on the near horizon.

A recent 2-1/2 year study by the Workshop on Alternative Energy Strategies at MIT reported: "The free world must drastically curtail the growth of energy use and move massively out of oil into other fuels with a wartime urgency. Otherwise we face foreseeable catastrophe. The margin between success and failure in the 1985-2000 period is slim."

Certainly, as we look ahead, we can see energy being a near-term focus of confrontation and conflict domestically and internationally. In 1973 we imported something less than one-third of our petroleum requirements. A recent Transportation Department report stated that we used gasoline at an average rate of 7.1 mb/day (million barrels per day) in 1976--a 4.9 percent increase over 1975 usage. This increase in the rate of usage will give a doubling time of about 14.5 years. This comes at a time when many are estimating that oil demand could exceed supply before 1985.

However great the impact of energy may be, it would be a mistake to consider this the only problem area we must confront in the near future. The problems we face are much broader: We face a total worldwide resource shortage and imbalance. In a series of articles in the Bulletin of the Atomic Scientists (Jan., Feb. & Mar., 1976), Emile Benoit asked the question: "In the coming age of shortages, can America last another 200 years?" He pointed out that the "age of plenty" resulted from two events: 1) The opening up of vast new farmlands in the new world. 2) The large-scale tapping of fossil fuels which gave large amounts of inexpensive, concentrated energy. However, in spite of the advances made by a few developed countries, the rapid growth of population has produced more half-starving, illiterate and ill people in the world. A World Bank study indicated that there are some 800 million people subsisting on the equivalent of 30 cents a day.

However, in spite of its limited scope, the energy dilemma does seem to have a couple of virtues. It is more imminent and recently there seems to be more public awareness that a problem does exist--especially in areas which experienced a bitter cold winter in 1976-77. The virtues seem to end here, though, because a large segment of the public--and apparently some politicians--seem to be still possessed with an illusion of abundance in the remaining supplies of coal and oil. And even among those who profess to see a problem, there is little consensus on how to confront and solve the energy problem effectively.

From the point of view of those responsible for operating schools, one of the first matters to be decided must be the priority which schools and education will be given in a time of crisis. At a time when we have a declining birthrate, workers are retiring earlier and people are living longer in the U.S., schools stand directly between today and tomorrow. Through education, workers can be made more productive--something very necessary in a gerontocracy where a smaller work force must support a larger total population.

Any judgment on priorities must be made on some sort of a cost-benefit basis. Past performances must also be considered. Since I am more familiar with Toledo and Ohio, I will rely heavily on statistics from this area.

More effective use of fuels--and in Ohio we were most concerned with natural gas--can be made by changes in heating routines and by building renovations aimed at energy use reduction. When comparing the 1974-75 heating season with the 1972-73 base year allocations, the following typical fuel savings were realized:

| | |
|---|---|
| Columbus City Schools | 21.0% |
| Elyria City Schools | 27.8% |
| Euclid City Schools | 19.6% |
| Washington Local (Toledo) | 24.5% |
| Toledo City Schools | 25.7% |

(The two heating seasons were roughly comparable weatherwise.) This is a pretty good record.

From the point of view of total gas usage, we find this sort of data:

Columbia Gas of Northwest Ohio (1975 data)

| Type of usage | Percent of total load | Ratio of Res./other |
|---|---|---|
| Residential | 43.1 | 1.0 |
| Commercial | 12.7 | 3.4 |
| Industrial | 41.8 | 1.3 |
| Educational | 2.4 | 18.3 |

One day of residential consumption = 18.3 days of educational usage
Thirty-day total school shutdown = 1.64 days residential usage
= 2.13 days commercial usage

Dayton Power and Light (1974 data)

| Type of usage | Percent of total load | Ratio of Res./other |
|---|---|---|
| Residential | 49.8 | 1.0 |
| Commercial | 15.8 | 3.15 |
| Industrial | 33.9 | 1.47 |
| Educational | 0.5 | 102.3 |

One day of residential consumption = 102.3 days educational usage
Thirty-day total school shutdown = 0.3 day of residential use
= 7 hours residential use
= 10.5 hours industrial use

East Ohio Gas Company (1975 data)

| Type of usage | Percent of total load | Ratio of Res./other |
|---|---|---|
| Residential | 48.5 | 1.0 |
| Commercial | 16.9 | 2.9 |
| Industrial | 32.7 | 1.5 |
| Education | 1.9 | 25.5 |

One day residential use = 25.5 days school use

Thirty-day total school shutdown = 1.2 days residential consumption
= 1.8 days industrial consumption

From this data it can be seen that 30 days total shutdown of schools would produce fairly minor changes in total gas availability.

Moreover, most schools are not designed and constructed for easy cold-weather shutdown. Plumbing was installed with the assumption that schools would be used in the winter--and thus heated. In Toledo, if we were to totally close down our large high schools, we would have to blow water out of many lines--or put antifreeze in these lines. We estimate the cost at a minimum of $10,000 to $20,000 per building.

The alternative to total shutdown sould be to keep buildings heated to a maintenance level of say 45° F (7° C). It is difficult to maintain

this temperature uniformly over large older buildings and our experience in Toledo during shutdowns the past winter was that waterlines near outside walls on the windward side of buildings were subject to freezing and in two high schools a total of over $50,000 damage was done to such lines.

The body heat supplied by students and staff, heat from lights, motors, ovens, etc. also contribute significantly in heating an occupied building. Toledo City Schools were closed down for financial reasons almost all of December, 1976 and heated only to the maintenance level of 45° F. They were open for normal operations during December, 1975. Comparative fuel use data shows:

December, 1975--Schools open --32,081 MCF gas usage with 1015 degree days recorded

December, 1976--Schools closed--42,795 MCF gas usage with 1214 degree days recorded

Thus, with only 19.6 percent more degree days, 33.4 percent more fuel was required to maintain a temperature of 45° F. This would suggest that closing schools, but holding buildings at a maintenance level saves very little heating fuel. In addition, this does not take into account the increased use of residential fuel due to the additional traffic in and out of houses when the children are home. A study made by the son of one of our Toledo architects which checked the practices used in thermostat settings when schools were open and closed also indicated that closing schools was at best a marginal fuel saving operation.

On the basis of energy saving practices and also energy use data for schools as a fraction of total energy usage, it would seem that radical changes in the school calendar would not be productive as an energy saving technique. Since schools do play such a vital role in our society, it would seem that normal school operations would be indicated except in very dire emergencies.

The problem of developing an appropriate curriculum still remains. Schools must develop educational programs stressing resource conservation. Eventually this training must be integrated into the curriculum at all levels--starting with the youngest students and continuing through graduation. Schools must recognize and help the public to understand the implications of a world of finite resources and of the United States as a have-not natural resource country. There must be a recognition of the consequent limitations on economic growth as we know it today.

However, schools cannot operate or educate in a vacuum. Strong and positive leadership must come from the national administration and Congress to set the proper national atmosphere for schools to educate the general public to these newly emerging realities. At best, it will be very difficult to bring the general public to realize that a national goal of resource conservation cannot be accomplished by someone else's sacrifices. If the problems of resource conservation are to be solved, the general public must accept the fact that sacrifices will be required of all segments of our society.

It is equally difficult to get the public to realize that some necessary measures are really not sacrifices, but at the most inconveniences. For instance, if fuel economy in cars were increased to 28 mi/gal through better design and maintaining the 55 mph speed limit, about 1.2 mb/day of petroleum could be saved. All that is required to accomplish this is to take more time in travel and to accept smaller, less luxurious and, perhaps, slightly less comfortable cars.

Ultimately, our economic and social salvation will not be accomplished by conservation alone. While very necessary in the short run, conservation only lengthens the period of utilization of available resources--it does not increase the total supply. Conservation measures will enable us to use the fossil and nuclear fuels and our other nonrenewable resources to buy time for the development of new renewable sources of energy and other resources.

Ultimately we must develop processes for using solar energy both as an energy source and as a means of developing new supplies of raw materials. In addition, these new processes must be developed in such a way that they do not despoil the environment. In this process of developing new resources and learning more efficient ways for the utilization of these resources, public education can and must play a leading role.

To be able to adequately perform their educational and developmental functions, urban school systems must have financial support from state and federal sources. There must be general fund support as well as continued participation in state and national economic incentive programs designed to encourage conservation and the development of new energy sources.

## FORUM FOR THE ADVANCEMENT OF STUDENTS IN SCIENCE AND TECHNOLOGY

Alan Ladwig, president
Forum for the Advancement of Students in Science and Technology
Washington, D.C.

Before getting into my remarks, I'd like to take a moment to explain the purpose of FASST for those of you who are unfamiliar with our program. FASST is a nonprofit, educational organization working to increase student understanding of science issues, primarily in the fields of aerospace, energy/environment, and biomedical technologies.

With the increasing importance placed on science and technology in solving world problems, it is vital that students have a clear awareness of the issues involved. To help expand this awareness, FASST works with both technical and nontechnical students to demonstrate our available options, and the social implications involved in various science issues. Our programs include FASST NEWS, a quarterly tabloid; FASST TRACKS, a membership newsletter; a news service for editors of the educational and campus press; conferences and workshops; and sponsorship of student class projects and internships. FASST is an affiliate of the American Association for the Advancement of Science (AAAS) and the Alliance of Environmental Education.

In discussing what I think our role and responsibilities are in terms of energy education, I will be sharing the views of how a national organization for students sees its role. We see our role to be supplemental to the work a student does in the classroom and not as activities to replace what teachers are doing. Because we are working at the national level and have the opportunities to monitor events relevant to energy, we are able to come across information and programs that can supplement what the student learns in school, as well as give the student experiences in the "real world."

Secondly, I believe our role is to discuss energy with a nonadvocate approach. I am sure that if you have had the opportunity to attend many energy conferences, you have been exposed to numerous advocates of one sort or another. One group of people tells you one thing about a particular energy situation, while the next speaker says just the opposite. It is up to those of us in the education field to try to bring order out of this chaos and help the student learn how to evaluate this large amount of--what is often contradictory--material and to help them develop a framework on which to make decisions.

Thirdly, we see our role to be kept informed of the growing edge of energy research. The rapid advancement of energy research, and the discussions by Congress of the National Energy Plan lead to new developments and new information which often takes time to filter to teachers and students. Therefore, we see it as our responsibility to be aware of these developments and disseminate this information through our communications network.

A fourth responsibility is to place energy in a proper perspective. It is not just another discipline--it is something that surrounds every aspect of our life. We must develop programs and opportunities that will reflect energy through a systems approach.

Our fifth and final responsibility is to know our audience and to know what attitudes they have regarding energy. Perhaps instead of running around the country to conferences and listening to "energy experts," we should be listening to our students and discover what they know about energy and how we can best help them learn more. In order to get to know our own membership, FASST has taken a survey regarding the proposed national energy plan. This survey was distributed to all of our 1,200 members, with a 26% return rate. The results of the survey are reported in the press release here on the front table. A similar survey will be given to the delegates of the 30th National Student Congress--an organization of student body presidents and officers. We will then be able to see if there is any significant difference between the attitudes of students who have an expressed interest in science and those who do not necessarily have such interests.

Time will not permit me to review the entire survey, but there are a couple of questions that will be of direct interest to educators. When we asked what had been their most authoritative and credible source for energy information, publications of societies and associations ranked number one, followed by newspapers; general magazines; government agencies; classes and textbooks; conferences; and industries and trade associations ranked seventh. When we asked them about their awareness of energy economics, 40% said their understanding was "good", 48% said "fair", and 12% said "poor". 80% of the

respondents thought FASST should be doing something in the way of an education program on energy economics.

I would like to close with three specific recommendations that you may find helpful for your energy education programs. I have here three covers from recent issues of the FUTURIST magazine. One cover shows an "appropriate technology" type of environment; the second shows a floating city over an Arizona desert; and the third shows the space colonization concept proposed by Professor Gerald O'Neil. We mention these because we have found that many people take energy for granted and do not really understand, for example, what the energy requirements would be for habitats such as the ones on the FUTURIST covers. A class project might be to have the student select one of the scenarios described above and determine what type of energy system could be developed to maintain the society.

Another teaching aid that FASST has had much success with is the ERDA Energy/Environment simulator. We have demonstrated this device to thousands of students. The device puts the student in direct control of energy production and allocation, making the person playing the "game" an energy czar. It does an excellent job in explaining supply, demand, and what types of trade-offs must be made to meet our energy needs.

The final resource that I would like to recommend is the Energy Display System developed by the Center for Strategic and International Studies. This three-dimensional display was designed to help people from all backgrounds to understand the energy situation--past, present, and future. The charts and graphs on the plexiglass sheets give the student a very real perspective of where energy comes from and how it is used.

In closing I would like to invite you to take our materials from the front table and learn more about our organization. We are interested in establishing more communication with professors and teachers and hope that you will find our materials of interest.

## NATIONAL ASSOCIATION OF SECONDARY SCHOOL PRINCIPALS

Richard E. Bamberger, supervising principal
Schodack Central Schools
Castleton-on-Hudson, New York

There is an old saying in education that it takes about 50 years to bring about a complete change in schools after a new idea has been introduced. Although this saying is obviously an exaggeration, it does set the tone for my discussion concerning education to confront the energy dilemma.

Three factors make it difficult to educate people concerning the energy dilemma. First is the knowledge that educating people to change their values is the most difficult kind of education. Second, we must consider the continuing lack of agreement about the immediate existence of

an energy crisis and its severity. And third, changes run counter to the traditional education which the parents and grandparents in a community experienced in school. And people expect schools to be like the schools they went to.

Making a change in any traditional curriculum is difficult enough, but what is even more difficult is to bring about a change in the values of people. When we discuss the role of education in confronting the energy problem, we must talk about encouraging the majority of people to re-examine and change their values. For instance, people must examine whether or not it is necessary to live in the suburbs and drive to work alone in an energy-inefficient car. Is it necessary to live in a single house in the suburbs? Is it indeed a right for a man and woman to have as many children as they want, or will the knowledge of the problems in energy bring about a lasting change in family size as is suggested in the book Moment in the Sun? Will people change their desire for and use of energy-wasteful appliances? And, will people change their habits of going away hundreds and even thousands of miles on vacation to get away from it all? Can we really teach people about the future so that they will experience a vicarious future shock before the absolute future shock of loss of energy which many experts are predicting?

Another question we must consider is whether or not there really is an energy crisis. According to a full page of the May 27 issue of the Wall Street Journal, this question is a very real one. An article covering several columns of that page was called "Selected Readings on Energy." The article begins with this statement: "The following is a selection of readings on the alleged energy crisis." Each of the selected readings stated categorically that there is no energy crisis or presented serious questions about the energy crisis. I must point out that a few stated that the crisis would be averted if the price ceilings on oil and natural gas were eliminated. On June 8, another article in the Wall Street Journal by the director of the Cornell University Center for Radiophysics and Space Research presents the possibility that if the carbon which exists in the world has come from hydrocarbon gases and oils in the interior of the earth, that we would have an equivalent of a fuel supply that would last 20 million years at our present rate of fuel consumption. Although the technical aspects of this article escape me, a nonscientist, I use this illustration only to show that there is not unanimous agreement that there is an energy problem. Add to this the full-page local newspaper ads and the television commercials which glamorize and popularize the large energy-inefficient cars as if the need for energy conservation is the figment of the intellectual's imagination. We then see that indeed many people question the existence of an energy problem as is demonstrated by the increase in sales of these large cars.

The third problem to consider in bringing about change is the fact that people, by and large, expect schools to be the same as the schools they attended. The current backlash of opinion concerning such things as electives, driver education, sex education, and other programs causes people in small, conservative, rural areas to proclaim that the schools are really not teaching what they should be teaching--the basics (reading, writing, and math). Aside from the obvious lighthouse school districts

in the United States, there are the many rural school districts and decaying inner city districts in which education is at a standstill or has become just a matter of babysitting and keeping students quiet. So when we talk about changing a curriculum, we must recognize that there are many difficulties and much resistance working against change.

One more pessimistic point of view before we look ahead with some hope: The energy program which President Carter proposed to Congress is not really an energy program, but rather the first step in a program of conservation, in tune with what the majority of us at this conference believe--that we must conserve energy, that it cannot last forever. But we all know what is happening to that program. Several sections of it are apparently dead or in serious trouble because they are controversial and because there has been much lobbying against certain aspects of the program--for instance, the failure of incentives for buying non-gas-guzzling cars.

After all this pessimism, I do believe that it is possible to develop programs in schools which can effect changes in people. Our school, Maple Hill High School in Castleton-on-Hudson, New York, has a good example of that kind of program. With the help of a $30,000 grant from the federal government, our high school planned a course in environmental studies. As principal of the high school at that time, I worked closely with four teachers from various disciplines to develop the concept for the program which we documented in our proposal for federal funding. The project summary says in part:

"Basically, the ecology project proposal intends to familiarize high school students with the ecological characteristics and problems of the immediate community of Castleton-on-Hudson, the adjacent river, nearby urban and rural areas. The course will be granted three academic credits by the local high school, will begin for the first time in the summer of 1972, and will combine the disciplines of the science, social studies, health and English departments of the high school. The emphasis of the course will be on the fieldwork which will take students out of formal classroom situations and require them to actually involve themselves with their environment. Basic field experiences will include a semi-wilderness camping experience, studies of the Hudson River, direct encounters with urban blight and community action projects to encourage such practices as waste recycling, zoning and sewerage facilities for the town. Other projects of equal importance will be air pollution studies, soil studies and solid waste disposal studies. Academically, the students will read widely in ecological literature, political action literature and ecological science and experimentation. Furthermore, we anticipate that students will benefit from direct contact with consultants who are experts in specialized areas of ecological interest. The combination of fieldwork and academic study will produce students who will be able to work with community groups as leaders, teachers, and political activists. The ultimate goal of the project is to change ecological values and practices of the students and the community and to bring the students to an appreciation of their surroundings through direct experience in sound ecological experimentation, practice and politics."

The philosophical basis for the course emphasized a change from the traditional classroom to a project-oriented program and was described in the proposal as follows:

| TO MOVE FROM - | TO MOVE TO - |
|---|---|
| -40-minute classes | -at least one 120-minute class per day |
| -class emphasizing one discipline | -class utilizing four disciplines, social studies, science, health, humanities |
| -teaching techniques dominated by texts | -learning situation enriched by consultations with experts in areas such as preservation of forever-wild areas; impact of recreation on wooded areas and animal and plant life; the psychological effects of noise on humans; food additives; taxation structures concerning industries, rental properties, mobile homes; present condition of water resources in the Castleton-Schodack area; architecture and renovative building; the legislation that exists concerning the environment; multiple housing developments; community development |
| -classes dominated by teacher talk | -teachers assuming the role of learner |
| -learning confined to the interior of the school building or grounds | -fieldwork in Castleton and its environs comprising 33 to 50% of the course |
| -students studying material alien to their surroundings such as taigas and tundra | -all projects directly related to the students' immediate environs and concerns |
| -investigations that are artificial and contrived (such as protozoan success in an aquarium) | -investigations suggested and identified by students, and community participants which are related to the community's ecological problems |
| -all class members doing the same work at the same time | -learners extensively involved in projects on individual or small group basis |
| -classroom discussion of political process | -learner involvement in local politics by attending town board meetings and reporting to the Mayor's office on project progress<br>-joining with town people to form political pressure groups |

| | |
|---|---|
| -textbook learning on legal process | -learning to use the law, and to interpret the law and to write laws on the expert advice of our local officials and State Senator who reside within the community |
| -being told about responsible citizenship | -taking responsible political action by running a campaign for the improvement of the local environmental tragedies |
| -being unaware of retail practices which are ecologically and economically unsound (disposable bottles, packages packed inside packages to be packed inside bags) | -becoming ecologically enlightened consumers (we pay for all the packaging and so-called conveniences) |
| -holding opinions without foundation | -reading relevant materials which discuss the diminishing qualities of life |
| -beliefs that all change and growth is good | -dangers of megalopolis and mass societies |
| -engaging in mindless recreation | -creative use of human talent and natural resources |
| -the idea that present establishment is evil | -investigations of so-called utopian philosophies, their good and bad features<br>-investigations of how present establishment can be made to work for good |
| -beliefs that government agencies must do all | -realization that 30 people can change their community |
| -belief in truth in advertising and mass media | -dangers of thought control |
| -courses that "end in June" | -providing lasting experience on the process involved in solving human problems |
| -a course of limited impact | -a course which by its design will dramatically affect the teachers, community members, students and most importantly serve as a model for towns and locales which have similar environmental problems because of proximity to dense population areas |

With this philosophical approach to the course and with federal funding, we began the course in August, 1972, with a week-long camping conference in the Adirondacks near Lake Placid, at which time we helped to

set the goals with the students. Accomplishments that year when there was obviously a Hawthorne effect, and in succeeding years have brought us to the realization that we can effect change in people's values by involving people in experiential situations after they have gained a degree of cognitive understandings. We were not totally successful in this respect, but clearly our success was greater because of this course than it would have been in the typical classroom.

The accomplishments of the class are too numerous to detail. Some examples of its success should be mentioned. The class has sustained a recycling program for five years. Once a month paper, glass, and metal are recycled at the high school. This recycling program is the only one in the Albany, New York area at the present time. The class continues water and soil testing for local residents and monitors the local streams and the Hudson River. The class has held membership on The Capital District Transportation Study Bicyle Task Force, the Schodack Conservation Advisory Council and several other environmental planning groups. Members of the class teach environmental studies in the district's elementary schools. The class has worked for several years to construct a mini-park on a hill overlooking the Hudson River, a study-eating area outside Maple Hill High School, and several nature trails in the wooded areas around two of the district's schools. The class publishes a quarterly newspaper on environmental problems which is mailed to all community homes. The members of the class have also prepared numerous slide and videotape programs on local environmental problems for presentation to local groups.

I am saying what is obvious to you, that we learn by doing instead of learning only by reading, listening, and seeing. But I must also add that it is very difficult in a public school system to put into effect the kind of curriculum which we believe is most effective. The problems involved in the environmental studies course were and are many. It has been and is still difficult to get the majority of students, and sometimes even teachers, to attend those evening meetings, to do the extra bit of work after school, to make arrangements for that bus to take the people on a field trip, to get that speaker to come to a small school many miles from his place of operation when there is no expense money for an honorarium, and to get people actively involved in projects which cannot be solved or accomplished overnight. To make a program such as this effective requires great dedication on the part of teachers, a very supportive administration and hopefully board of education, and extra money. These three elements--money, supportive administration, and dedicated teachers--are difficult to find and keep together because something like our course in environmental studies and something like energy education are controversial and we all know that controversy shortens the tenure of administrators, cools the enthusiasm of some teachers, and dries up the source of money. Programs like ours don't happen in all school districts, and will require great local, state and federal support.

To make even a beginning in educating people concerning energy will require money. I believe it is obvious that the federal government must financially support energy education. One way it can support energy education is by sponsoring a series of summer institutes throughout the nation similar to those set up by the National Science Foundation in the

last decade to help retrain teachers from all levels and from all disciplines so that they would be able to infuse units concerning the energy problem in their own classrooms. Administrators must also be educated to the problem in these institutes. Other community and youth leaders from such organizations as 4-H, scouting, and county extension, would profit from these summer institutes. The New York State Education Department has developed infusion curriculum units concerning the environment and energy. Teachers from our school were among those from six school systems in New York State who wrote these infusion units, and in addition to the separate course in environment studies, many teachers in our school are using these infusion units in their classes. But these curriculum units are gathering dust on shelves in many schools. This program of summer institutes would be a beginning and would spur people on to use units already developed. Even though these summer institutes would be a hit and miss program, they would establish the Carter administration's and hopefully Congress' dedication to the idea of energy education.

But in order to do a more thorough and as complete a job as possible in the field of energy education, I recommend that the federal government set up a Comprehensive Employment and Training Act program for teachers who would become teachers of energy. This program, which would be like the CETA program, would provide higher salaries than that program, and would provide employment for many professionals who are currently unemployed in the United States. These people would be trained in energy education centers which would be set up in various centers throughout the United States. This training would take place only after a school district in the United States had requested such a program and had selected a teacher from among a list provided by its local county. After the school district had selected a person, he or she would be trained at one of these centers and then would spend the next two academic years within the school system teaching teachers, students, parents, and community groups about the energy problem. In addition, this coordinator would be required to set up special programs involving teachers, students, parents, and people from the community so that the impact on these people would be greater. Studying the cost of commuting, the cost of heating poorly insulated homes, the cost of living in separate dwellings, the cost of going on far distant vacations, the cost of architecturally energy-expensive schools and other public buildings are just a few of the experimental situations which could be addressed by groups within a school community. This coordinator would be the gadfly to sting people into awareness and involvement in the problems of energy use. The cost of such a program seems enormous and it is, but in comparison with unemployment costs, welfare costs, public works costs, and CETA costs, it does not seem so great. With such a massive program in the United States, we could have perhaps a greater impact on education than was accomplished in the area of the teaching of science in the last decade. The combination of federal commitment in the form of money and local involvement is a combination which has the greatest chance of success in addressing the present energy dilemma.

## NATIONAL CONGRESS OF PARENTS AND TEACHERS

Ann P. Kahn, secretary
National Congress of Parents and Teachers
Chicago, Illinois

Two questions are uppermost in the minds of most parents: In the coming years, will schools be able to maintain complete educational programs without the widespread and severe interruptions and school closings which we experienced last winter? Also, can schools reduce the alarming increase in energy costs that are consuming an ever-increasing portion of the educational budget? Neither can be answered positively, unless supplementary federal funds are available to help local school systems adapt present and future physical plants for greater energy- and cost-conserving controls.

During last winter's fuel crisis, schools provided one of the prime paths to public consciousness-raising on energy conservation. Temperatures were lowered drastically in schools, even when shopping centers proceeded with business as usual; parents were reminded to dress children in heavier clothing so that they would be comfortable in cooler classrooms; schools took seriously the need to keep doors and windows closed, to switch off lights and to be sure that areas like hallways were kept at minimum lighting levels, consistent only with safety. The constant dialogue about energy savings between families and schools made parents aware of the need to conserve energy in their own homes. And yet parents still saw considerable interruption of school programs in many parts of the country, and a loss of school days that has been difficult to make up. We became aware of a challenge to find ways of using less energy and still being able to keep the schools operating so children would not fall behind in their education. The greatest barrier to meeting that challenge is the skyrocketing cost of energy.

The American School Board Journal, in a recent survey, found that school districts at the end of only seven months of the year had already exhausted their yearly utilities budget and that even using school conservation measures in which thermostats were lowered to 65 degrees in the daytime and 55 degrees in the evening, costs rose in some systems more than 150 percent. A study by the American Association of School Administrators indicated that the rise in fuel costs between 1972-73 and 1974-75 alone represented sufficient funds to cover about 43,000 teaching positions.

Parents and taxpayers are feeling the impact of rising fuel costs at a time when inflation is severely straining the ability of local school systems to adequately fund even the normal school budgets. Costs for all education budgets continue to rise, and at the same time, over half the proposed school bond referenda are being defeated. Pressures of rising school energy costs are occurring at the same time taxpayers are attempting to meet these same economic pressures on their family budgets, and school systems are, therefore, unable to make up the differences by voting additional local tax revenues. As a result, parents and school boards have become aware that funds intended for classroom use are diverted, by necessity, into energy costs. And there seems to be no end in sight.

Further aggravating the problem is the declining enrollment in many school districts, resulting in less construction of new and more energy-efficient plants. Instead, schools face this energy cost crisis burdened by older buildings with inefficient heating systems, little or poor insulation, aging and unresponsive temperature controls, and a myriad of other problems which are wasting both energy and educational funds.

Direct assistance to school districts is needed to enable them to restore energy efficiency in their school buildings and thereby to cope with the continual drain on educational funds now being siphoned off into utility costs. School efforts to update older facilities for greater energy efficiency cannot take priority over educational needs, but the financial future is grim unless schools can put energy needs and costs into reasonable perspective.

There are some areas where demonstration grants and additional research ought to be considered. It seems clear that more flexible patterns in school scheduling are in order to reflect local climates and energy demands. The present patterns were born out of a response of school systems to agrarian needs to have children at home to help during the growing season, and reflect times, now past, when energy was abundant. Neither fact is true nationwide any longer. A conscious effort should be made to feed these altered circumstances into the determination of school scheduling so that we are using school plants during the times which require the least energy resources. Total school time requirements can reflect local climate conditions when the least heating or cooling is required. Some systems have changed their dates of opening and closing, as well as vacation periods, and this should be further encouraged as a responsible use of limited energy resources. Our life-styles must adjust to a period of scarcity and high cost rather than abundance and waste. We need new long-term patterns of energy usage, and at the same time, deal with the immediate crisis situation.

As parents and as school policy makers, we need better data on which to base our decisions regarding school use of energy. Is it cost or energy saving to close schools during harsh winter? Some of the data coming out of last winter's school closings indicate that no appreciable energy saving was made by heating at minimum operational levels schools that were empty of "body heat." In areas where there is a push for year-round use of schools, there is no clear data that relates energy usage and costs to this approach. Some of the federal legislation being considered puts schools in a low priority level should a severe shortage emerge again this winter, yet it is questionable whether most citizens would rank school facilities beneath these higher priority uses.

If parents and children are aware of and truly believe the predictions of energy shortages we face as a nation, we will be making a big step forward in the solving of that problem. But we continue to hear conflicting predictions and see continuing commercial emphasis on the use of energy for much more frivolous purposes. Schools and parents will accept the seriousness of the situation only when the problem is honestly defined and the proposed solutions nationally applied.

NATIONAL EDUCATION ASSOCIATION

A. Donald Blakeslee, co-chair
Standing Committee on Instruction
and Professional Development
National Education Association
Washington, D.C.

As I sat and pondered the assigned topic, "Practitioners Discuss Their Role and Responsibilities" in the energy dilemma, I couldn't help being a little pessimistic. In my mind, I quickly reviewed the past five years or so and considered the topics that have come down that proverbial pike and headed straight toward teachers and administrators in the K-12 sector of the education picture.

My list started with modern math and included bilingual-bicultural education, accountability, behavioral objectives (cognitive, psycho-motor and affective), mainstreaming, integration, alternative schools, open classrooms, "back to the basics," ungraded schools, career education and experience-based career education, environmental education, in-service education, child abuse, drug abuse, functional illiteracy, drop-outs, push-outs, Title IX, Title III, Title I, performance-based education, sex education and early childhood education. I stopped. I thought that in view of all these aforementioned items, perhaps I had best just come to this conference and say to all the great minds and planners here assembled, "Get in line, fellas!" or, "Hey, just pass us by on this one, okay? We're already pretty busy."

However, I knew that such a response would not nor could it suffice because, after all, the institution of public education in this country must be responsive to the demands of the society which sustains it and which it seeks to serve. True, perhaps the American public may not be screaming yet for energy education, but it generally takes a while for the public to make known its feelings and register its demands upon its schools.

Anyone who has taken even the slightest opportunity to consider it knows that energy is indeed a dilemma and sooner or later the public will be heard on the subject and ultimately the schools. In addition, even though the present public hasn't gotten as excited as it might, we in public education by the nature of the clients we serve--the children--must cast an eye toward the future and that means coping with the energy dilemma.

It would be most presumptive on my part to attempt to describe as an individual or say what the role of the practitioners in public education, K-12, should be in facing the energy dilemma. It would also be rather ironic, since my everyday life as a practitioner is pervaded not with a shortage of energy resources but an abundance, as energy developers bring to my school system overcrowded classrooms and a highly transient student population as they change the landscape of Wyoming in search of coal, uranium, oil and gas.

Consequently, I have but words of caution from a K-12 point of view which I can voice to this assembled group and anyone else who will be involved in defining the role of the K-12 segment of education as we all face the energy dilemma.

First, the public schools cannot nor should they accept the burden of this problem alone. The "dilemma" is too large. The complexity of life in America today cannot be denied and certainly the public schools as presently structured, managed and financed are already taxed almost to the breaking point in the face of the demands placed upon them as I inferred in my partial laundry list in my opening comments.

Consequently, any role defined for public schools must face the reality of the existing situation and either be compatible with that reality or include provision for certain restructuring for the implementation of that role. When education is mentioned in almost any context, the American public all too often thinks only of the K-12 segment of education and piles one expectation upon another. Hopefully, any plans for meeting the energy dilemma will carry this message.

Second, if the years of attempts at innovation and change in public schools have done anything except spend money and frustrate, they have taught one simple fact. That is this: If any plan of action is to impact upon children or be most effective in the classrooms of this country, classroom teachers must be involved in those plans from inception through development and evaluation. This seems so very fundamental to me but it so often escapes the thoughts of others. Classroom teachers have expertise. They can conceptualize. They can contribute from their rather important grandstand seat.

Before any planners or whoever it is that will be defining the role of education in the energy dilemma do their thing, I strongly suggest they go spend a day or even an hour in a third grade classroom or a high school chemistry class and see what it is like now--not how they remember it. While you are there ask the teachers how they would approach the energy dilemma and what they think their role is. If they have time between their teaching duties, playground duties, collecting money duties, curriculum meetings, meetings to develop criteria for performance-based education, meetings with parents, in-service meetings, they will tell you.

Third, I personally see no plan of action in facing "the dilemma" that doesn't call for some sort of confrontation between [redacted] evaluation of our society's current values which have been acquired from an energy-rich past and those values necessary for life in a limited energy future. To most of you it is not news that the whole matter of values and public education has been and can be a rather sticky subject. Existing efforts at value clarification are really quite meager cast against the total picture. Consequently, if the role of public education, K-12, is to include examination of values, let our colleagues in teacher preparation be alert to the need as they examine their role in preparing new teachers and aiding in the professional development of others.

Futhermore, if value examination leads to change; someone might prepare the American public to accept public education as a change agent and, perhaps again, our colleagues in teacher preparation might give some thought to including some work on change and its dynamics. (Speaking of change, someone said the other day that perhaps in the energy-short days ahead we won't even be able to generate a future shock.)

My fourth and final word of caution from a K-12 teacher's point of view is really rather mundane. When the role of the K-12 practitioner is defined, I hope it won't be (but I suppose it will have to be) communicated to me by tons of paper which I will have to find time to read and I hope it isn't communicated to me by using such terms as "systemic approach" or "net energy analysis" or "holistic lifestyle accounting." If it is, I'm afraid I won't give you a "good 10-4" because I'm busy trying to find out what's the "pits" and who's a "fox." I make no apologies for that because my job is communicating with kids. With that in mind, I would also hope that if the development of instructional materials is to be a part of the approach to the dilemma, such materials would only be developed with intensive classroom teacher involvement using multi-media approaches and reflect the best research we have available regarding the preparation of such materials.

Public schools and teachers can play a significant role in meeting the energy crisis but they can do so successfully only if that role is developed properly and not dumped on them by either legislative or judicial action without benefit of adequate resources and time to prepare for implementation. Their contribution can be of note if they are given the time and resources to help develop it in conjunction with the efforts of the many other forces which shape values, attitudes and opinions in our society.

The National Education Association, which I represent at this conference, as early as 1973 had a task force of teachers appointed to develop lesson plans, teaching guides and other instructional materials related to the energy crisis. As late as last month, the N.E.A. Board of Directors called for a national energy policy and called on all of its affiliates to become involved in energy legislation. The N.E.A. stands ready to help in definition of the role and responsibilities of the practitioners in confronting the energy dilemma.

## NATIONAL SCHOOL BOARDS ASSOCIATION

Nick Maravell, legislative assistant
National School Boards Association
Washington, D.C.

I'm not going to repeat what was just said before, and I'm going to totally deviate from my previously prepared remarks. The abstract you have pretty much summarizes the statements I was going to make, plus I have here some testimony that the president of our association delivered before the Senate Subcommittee on Energy Conservation and Regulation. This will speak more to the questions that I am going to be addressing right now. It's very short and very direct and to the point, so you may want to take a copy of that before you leave.

Just to put in perspective the remarks I'm going to be making now, I'm going to throw some figures out to you. There are about 4 billion square feet of elementary/secondary classroom instructional area. There are about 2 billion square feet of area for the higher education institutions for post-secondary in general. Adding that together, you get about 6 billion square

feet of educational facilities in America, and as you all well know, these have to be ventilated, heated, cooled, lighted, etc. From some studies that have been done and from talking to professional contractors in the area of energy conservation, I've come up with my own little figures as to what it costs in a sort of ballpark figure to retrofit or improve the energy conservation of school facilities. The figures I'm going to talk about from now on are going to refer almost exclusively to elementary/secondary education. Higher education has slightly different requirements due to the different nature of the buildings.

Between one and two dollars per square foot is about what you can roughly judge would be the cost of retrofitting. Now this is a very, very rough figure because, are you going for a three-year payback period, or are you going to go for a 20 year payback period? The more money you put in, the longer you wait, but the better payoff in the final analysis. Let's say you're going for a short to medium range. You're talking about one to two dollars per square foot. Now AASA, through some FEA contracts, has done some work in this area at 10 school sites. The Mechanical Contractors Association of America has done some rough estimates and this is what I'm basing my figures on. Some of the data I have is a couple of years old so I sort of upped it a bit to take into account the fact that energy prices have increased, which means now that it's more cost effective to retrofit, and because of inflation. Think in terms of one to two dollars per square foot.

Well, now let's do some little quick multiplication. If you have for elementary/secondary schools about [redacted] billion square feet, you're talking roughly $4 to $8 billion of energy conservation expenditures required to retrofit all of those buildings. Now, right now I guess roughly education expenditures are up to about $60 billion a year for elementary/secondary, that's a very rough figure. $4 to $8 billion is a significant percentage of what's currently being spent. Now I'm going to start relating all this to the federal legislation and what the federal government is planning to do and what they have done to date. This is going to be very brief and if there are any questions at the end, I'll be happy to answer any questions.

Right now the federal government is talking about establishing a matching grant program to help schools cover the cost of energy retrofit. The administration's proposal talks about a 40 percent federal share and the Congress is probably talking about a 50 percent figure, because that's probably going to be the figure that's going to be passed into law. So if we're talking about elementary/secondary schools needing somewhere between $4 and $8 billion for their energy retrofit, if all schools are going to be served -- now you have to realize that certain schools are going to require more, certain schools won't require anything, so we're really talking rough figures here -- that means the federal appropriations would have to be somewhere between $2 and $4 billion in order to retrofit all of the elementary/secondary schools.

Now let me give a very brief sort of status report as to what's happening right now at the federal level and how it sort of developed. The FEA started getting into the area of energy conservation in schools quite a while ago, back in '73 I think it was, and there are other people in the Educational

Facilities Laboratory that were working on it even prior to that time. Well, FEA got together with EFL (Educational Facilities Laboratory) and gave them a contract and they developed the Public School Energy Conservation Service, which many of you might be familiar with. It's a computerized energy audit system. What it allows you to do is to fill out some printed forms, send them in to the central computer, the computer then analyzes the forms and tells you what you should be doing in terms of operation and maintenance. In other words, could you change a few switches or turn off some controls or put in a more sophisticated control system to save energy at relatively no cost. I mean we're not talking about capital improvements. It will then start to specify if you were to take all these operation/maintenance procedures into account that brings you up to your maximum efficiency without capital improvements, where should you then look for capital improvement, given the type of building you have, the nature of activities that occur in that building whether it's an athletic facility or classroom instruction, or auditorium or whatever it may be, and given the energy costs in that particular area. What your heating and cooling is, what your electricity, gas, oil, coal, etc., and sort of feed these things all in. The turn around time is not too long with this, because it is a computerized system. I guess the mail is more of a turn around time because you've got to send it off to the West coast, but the cost is extremely low. For $30 you can run this survey on every elementary school, $50 per secondary school. It's a relatively small investment to get your first rough cut judgment as to what you need to do for your school facilities.

FEA has also given out a contract to AASA, the Administrators' Association, and they selected 10 school sites in each of the 10 Federal regions and they did some intensive studies to decide what was needed and what wasn't needed and developed some cost estimates and some summary information as to the type of savings that could be realized by changing the physical plant by making capital improvements.

I'm going to have to cut my remarks very short, I have one minute. Okay. In one minute let me suggest that you take some action in terms of the appropriations situation. Right now Senator Pell has a bill that he is waiting to bring up to the floor. The situation is very complicated right now, and there are a number of energy committees with jurisdiction over federal legislation. There's the Interstate and Foreign Commerce Committee in the House; there's the Education and Labor Committee in the House; there's the Energy and Natural Resources Committee in the Senate; and then there's the Human Resources Committee in the Senate. They're having a problem getting this all together and they've got various approaches.

In addition to that, the White House proposal, which comes out of the Schlesinger energy group, is really just an energy proposal and any impact that this has on education is really secondary to their primary concerns which are economic and international relations. We have met several times with the White House and this has become crystal clear; that the energy people in the White House are not viewing assistance to the schools as a way of improving education and keeping the schools open. They're viewing it as a way to accomplish a total economic and international energy situation.

What I would suggest any of you to do here would be to talk to your federal legislators; invite them to your schools, invite the press along, show them what your energy problems are, collect a little information, get your business managers to find out what your energy costs were for the last 3 years and show what's going on. Maybe talk about some of the improvements you'd like to make if you had the money to do it. Talk about the problems of raising money. Talk about the bond issues.

So I think those are the sort of things you could do in order to try to elevate the appropriation level in order to get more money out to the schools. Right now the White House proposal sets the maximum appropriation at $900 million divided up along public and private schools, universities and hospitals. Out of this, schools might get $100 million a year. The Pell bill would put that at $1.5 billion over 3 years for elementary/secondary and post-secondary institutions. I would say that if you could do anything, argue for more money.

## SESSION VIII: POLITICS OF ENERGY EDUCATION

Senator Clairborne Pell, chairman, Human Resources Committee's Subcommittee on Education, Arts, and Humanities in the U. S. Senate, gave a major luncheon address. Senator Pell authored the "School Energy Assistance Bill" that provides funding to schools to offset rising energy costs and to retrofit buildings to conserve energy.

Senator Pell said the primary energy educators are the family unit. The education community, representing some of the worst offenses in energy waste, should be working in conjunction with the local communities in resolving the energy dilemma. Noting public apathy toward the energy crisis and the continual increase in consumer consumption patterns, Pell noted: "Our progress is still more symbolic than fundamental." He concluded that the energy battle "needs to be fought in public debate and in the media, not in academia."

Senator Claiborne Pell, chairman, Human Resources Committee's Subcommittee on Education, Arts, and Humanities, U.S. Senate

With all the talk there is now about the energy crisis it's easy to think we're finally coming to grips with the problem. In the past years, especially, this concern has developed into a major issue. The press has heavily covered energy news and every aspect of our life has been changed in some way by this new concern. That is the reason for our being here today. We're concerned about what education can do to adjust to the changing energy scene.

We have many difficulties before us on the way to change, and I would like to talk about them before I talk about what we can do. There are so many problems, and they are so serious, that I'm not sure how effective educators will be in dealing with the energy crisis.

First of all, the roots of the energy crisis run deep. This crisis developed largely because energy was taken for granted for so long. While we were not thinking, the pressures just grew until they exploded. Population growth and industrial development are the major elements. In 1930 there were two billion people on the Earth, and by 1960 there were three billion. Following the trend, in the year 2000 we will have six billion inhabitants on the globe. Our energy consumption has multiplied at an even greater rate. This is, simply, the genesis of the problem.

There is a terrible mathematics at work here. These figures have been clear for a long time; yet, only now are educators beginning to realize the profound nature of the energy crisis.

Only now are we hearing the warnings. Educators are worrying about the strains each new winter will put on already shaky school budgets. We've heard stories about schools closing down because of the harsh winter, some permanently. It's an uncomforting picture. Then not only do we hear about the physical consequences of the energy crisis, but people are talking about the philosophical changes that energy shortages will bring. We may wake up tomorrow, as some predict, in an energy short world. That would require a new set of ideas because such a world would be a totally changed place from what we know.

What concerns me more than this type of speculation, though, is that we did not see this problem coming before it hit. Then again, since the nation and the world first felt the energy crunch, why is it that we have done so little? We must ask ourselves those questions. I can see how we did not foretell the problem. Nobody did. Yet in the years since the crisis developed why has no strong action been taken? We just haven't shown the organization or the desire to make hard decisions on the choices that must be made. Because of that lack of resolution our short-term prospects are grim.

Perhaps we've been slow to move because we've done relatively well. In spite of some hardships America has come out of each successive energy crisis on an even keel. Compared with other nations, we have weathered the storm extremely well. That has made the energy crisis bearable. In fact, next to the problems of other nations the picture for us seems almost rosy.

Then again, we have always relied on our power to buy, or our power to invent. That has been our way out of every crisis. It's almost the credo of the nation, that we can make our way through any problem just by working harder than before. That is how we're thinking now. But, it seems that soon we won't be able to buy enough energy at any price, and we won't have invented a way to replace the resources we've used. So, at last, the numbers we ignored for so long have caught up with us.

We are presented, then, with one of the clearest and most important decisions this nation has faced. We must learn a new way of doing things. We must carry on at work and at play without burning through our resources as we do now. We must learn frugality.

In spite of this great need, though; in spite of all our efforts, the political, economic, and social climate of this country is still against a national energy program. We can't seem to unify public opinion on this issue. I see small changes here and there, and there are the many economic consequences, but that is all. Our progress is still more symbolic than fundamental.

Responding to this challenge, many educators want to put us on the road towards a sound national policy by changing the nation's thinking. That is the principal behind energy education. As President Carter called on us to wage the moral equivalent of war so they want to inaugurate a new moral education. That brings us right against one of our biggest problems.

I have found that the strongest influence on young minds is the environment at home, not the environment in the classroom. Parents have more impact on education than do teachers. Over the years Congress has tried to disprove this fact, but our efforts on that line have proven nearly futile. We give students accelerated courses over two semesters, but they slide during the summer. We spend billions on richer schools and special studies, but we are still not sure of the results coming out of all that expense. We have especially failed to make up for the disadvantages children from the poorest and weakest families suffer. It is too much of a barrier to overcome.

What success will we have in teaching students frugality when the commercial world lives on the principle of bigger and better? What are our chances of competing with television, a largely wasteful thing in itself, which promotes excess to the nth degree.

Consider the average household. There will be one car, if not two or more owned by the family, the kitchen will be full of electrical appliances, and every aspect of home life will be eased by labor-saving conveniences like chain saws, power lawnmowers, and automatic dishwashers. This is true even with some of the poorest families which is why almost as many homes in the United States have television as have indoor plumbing.

It's not even enough that there are so many ways to waste energy because we are becoming even more proficient at it. Long ago we added a motor to the lawn mower so that it didn't have to be pushed by hand. Now we've added a seat, a gearbox, and wheels and the suburbanite can ride while he mows his front lawn. The crowning element is the automobile. Americans continue to buy oversized and luxurious cars. It's the national mania. We've only lately compounded the fault by overspending on recreational vehicles, vans and exotic cars loaded with conspicuous gimmicks; and in spite of rising fuel prices and government urgings, not to mention healthy promotional rebate programs, small cars don't sell. Even more and more sports are depending upon motorized vehicles today. Now snow-mobiling or dune-buggy riding are the rage, so instead of getting out and exercising our limbs we are sitting on our behinds instead.

Then, too, education has always been advertised as the way to the better life, and educators haven't been above promising material rewards. Because of that education has been seen as a way for students to learn what they need in order to get what they want. In other words, educators have helped make our society materialistic and wasteful. We may be reconsidering now, saying that less is better, but it's going to take a lot of work to make the change. Even then, I'm not sure if our constituency is going to buy the idea.

Because of these problems, I can't think that an extra hour a week or fifteen minutes a day in class will do much to overcome all that has gone before. So when I think of what schools can do to instruct people about energy, I can only think that we will fail if our efforts are limited to the classroom. This is a battle that needs to be fought in public debate and in the media, not in academia.

I have often argued that schools must get out and work with their communities; to combine the world of education with the world of work or to salt classroom theory with practical experience. Now, I'm saying that the contribution schools and colleges make to the public debate on energy will succeed only to the degree in which they involve themselves in the marketplace outside of the ivy-covered halls.

"Faith without good works is dead," Cervantes wrote. I would translate that to say that unless we make sure our work holds in the home and out on the street then we shall have done nothing. Unless we do that, and unless we set a good example by our acts, then we shall fail.

That raises the final and the most damaging question about our ability to lead the public debate on energy. Of all the sectors of our national life, of all the branches of the economy, education is one of the most energy-wasteful. Two years ago one of the federal energy agencies conducted a test of our cities. What they found was that the education industry was one of the worst offenders. I think most of us know this so the details need not be repeated. The principle, however, is extremely important.

If we are going to set ourselves as an example for others to follow, then we are going to have to do a lot better than we have done before because our record is terrible. We should, as the Bible says, remove the

plank from our own eye before we try to remove the speck from someone else's.

Instead of acting, though, we dabble and squabble over jurisdictional rights. In spite of the fact that we have had established energy committees for some three years now we have yet to pass one major piece of legislation. This is especially true of Congress, and brings us to yet another problem. I am painfully aware of this failure because legislation of my own, legislation to help schools conduct conservation projects and meet the energy crisis, has become mired in these arguments. I will pass over the subject by saying that I hope for better, and I hope that the chance we have to implement a national energy policy isn't destroyed through continued bickering.

With all this, a lethargic public, a poor record, and a failure of leadership, there is only one thing to do and that is the thought I must leave with you today. The educational community must see to its own house. We must do conservation work on our own and we must set an example, because it's time to put the energy score for education on a par with the rest of the nation. This type of work, simple conservation, is what will do education the most good. That is the intent of my legislative work, and that is the direction educators must take first. We need to do that just to stay on top financially. Then, if we have some success, we can take a look at the academic side of things. As long as we're an energy sick case, though, not many people are going to seek our advice on how to be energy healthy.

In the end it is not what we say that will help this country meet the energy crisis. It is, rather, what we do to meet the challenge that will have a lasting effect on students and upon the whole nation. I know we all want to lead the way through the problems that lie ahead. That's a very attractive idea. We all want to be the ones to point out the right road to follow. What the nation needs, though, is a working example of energy conservation. We must prove that academics can be practical and save energy. We need to graduate technicians and engineers to meet the crisis. Finally, we need new scientists to develop the sources of energy that will keep us going into the future.

As you conclude this conference then, think hard about the role you take. Don't limit your interest to talking about the glamorous ways in which education can be involved in the national energy debate. That's too easy. Instead, look to the quiet long-term effort which, though unglamorous and self-effacing, will take us into the future.

That is where our best hope lies, that is where the rewards are, and that should be the challenge we set before ourselves.

## SSESSION IX: CONFRONTING THE ENERGY DILEMMA

Several nationally known research and development experts described current instructional programs, and others under development, that are designed to assist educators in teaching about the complexities of the energy dilemma. Panel members included:

American Association of Publishers

Sturges S. Cary, editor-in-chief
School Division
Scholastic Magazine

Energy and Man's Environment

John C. Jones, president
Energy and Man's Environment
Portland, Oregon

and

Edward Dalton, regional program director

Far West Laboratory for Educational Research and Development

Bela H. Banathy, director
Instructional and Training System Program
Far West Laboratory for Educational Research and Development
San Francisco, California

Learning Research and Development Center

Audrey Champagne, co-director
Individualized Science Program
Learning Research and Development Center
University of Pittsburgh

National Science Teachers Association

John M. Fowler, director of special projects
National Science Teachers Association
Washington, D. C.

AMERICAN ASSOCIATION OF PUBLISHERS

Sturges S. Cary, Editor-In-Chief, School Division,
Scholastic Magazine

How to Get the Energy Message to Students: A Publisher's Case Study

I suppose Scholastic wouldn't have been invited here except upon the assumption that what we're doing about energy has some relevance to others' problems. I hope it will work out that way, but I'm not sure. No doubt all publishers think their own operations and problems are unique, but I submit Scholastic is a little uniquer than most. Our original business was classroom magazines only. On that stem was grafted the publication of paperback books for children; and after that, audiovisual materials and text and supplemental text products of various kinds, though in rather a small way compared to many colleagues here today. This peculiar publishing heritage is, I think, important in understanding the special way in which we respond to many subjects, including energy.

It's a triple-threat, eye-on-today, quick turnaround approach.

Triple-threat, because (depending on the decisions as to appropriateness made by a corps of jealously autonomous editors) our arsenal can bring to bear the firepower of up to 30 magazines--five book clubs--dozens of AV and text-type operations. Our newer science and social studies text products help carry the energy message. Our "Human Issues in Science" AV program has a four-filmstrip unit on energy, and our Science World Visuals include a set of eight energy puzzles.

Or take our American History text program for less able readers, American Adventures. It illustrates our magazine-orientation that permeates even our text products--keeping even history up-to-date and the ability to switch fast to newly developing social concerns. American Adventures came out originally in 1970. It had a section on environmental concerns, but energy was a minor part of it. By the 1974 revision, energy was in there with a short chapter of its own. This was updated a year or so ago with some of the newer ideas for augmenting energy supplies in the future. The section concluded: "One thing is certain. Nearly everyone has started thinking about energy." And the editors of American Adventures are thinking harder than ever about it too. They're right now in the midst of plans to re-do and enlarge the energy section for a new edition some months hence.

Another weapon in our arsenal is the National Institute of Student Opinion. Every couple of months it takes the pulse of some 25,000 secondary school students' opinions on matters both personal and public. September's set of poll questions will include a couple as to kids' feelings and actions relating to energy. Do our readers believe the energy crisis is for real? What's being done about energy in their own homes and localities?

NISO's questions go out to schools through our magazines, and then make stories for our magazines. And it is about our magazines that I will be mostly talking during the time I have left. In spite of our flexible,

relatively quick-shift capability in text products, we have to think at longer range there than the programs of our magazines. Each school year's magazine program is a different one, and all during the school year we can, and do, make switches in that program immediately when shifts in current affairs bring new problems to the fore. However, each year we establish certain baselines (partly to help the promotion department tell a consistent-sounding story) while leaving much flexibility in execution to editors, each of whom is responsible for a different kind of clientele. Since the selling window to schools (and about half our magazines are bought with some sort of school funds) is open chiefly from about February to May, the moment of truth in decision-making comes around Christmas time each year for the next school year. About that time last Christmas we had to lay out our basic magazine programs for the 1977-78 school year so our promotion people could have something to write about. We reached a pretty quick consensus on four main topics, especially for social studies:

1. Women's rights--because 1977-78 is International Women's Year with its state and national conferences.

2. Citizenship--because the National Council for the Social Studies is zeroing in this year on citizenship education, and also we have a new citizenship text program to sell.

3. Economics--where we've been pretty weak the past couple of years.

4. And at least equal to the others -- energy -- on our gut feeling that the spreading cancer of energy deficiencies in the years to come was likely to be among the biggest factors in the adult lives of our readers -- energy and what we do about it is the yardstick for measuring the rest of the 20th century, as one of our editors put it.

As news publications, our responsibility is not to crusade for a point of view, but to give as fair and balanced an explanation as we can of both, or all, reasonable attitudes in areas of public concern, recognizing (as our company editorial credo says) that "good citizens may honestly differ on important public questions."

On the other hand, by the very fact that we chose a topic for discussion, we are saying to our readers, "This is important." And in the case of energy, we aim to keep saying "This is important" by dealing with energy, not in one or two big lumps, but again and again throughout the school year, and in most of the magazines, beginning right with the first issues in September. I have spent a good deal of the past week reading copy for our various first issues, so I know--here's a fistful of the stuff right here.

But I'm a little ahead of the story. Having decided that energy would be promoted as a major subject matter component of our school year program, editors and writers prepared themselves in various ways. Our librarians began assembling energy materials--governmental, industry, etc. Last month we held a series of seminars on economics, and devoted one of the days entirely to the energy problem; among the specialists who joined us for this discussion was Don Duggan, a federal energy official who I see was on one of your programs yesterday.

So we decided to tell our kids about energy--a decision that meant nothing without working out, for each magazine, its own special way of developing the subject in the light of the readership and purposes of that particular publication. It's obviously a different approach for a second grader than a 10th grader, for a home economics class compared to a language arts class.

Perhaps the first problem is to capture the kids' interest--by relating energy to what he knows, and what fascinates him most. We aren't above name dropping to accomplish such a purpose. Search magazine plans a visit to Robert Redford's solar-energy ranch Senior Scholastic has laid its own set of energy questions before James Schlesinger as the basis for its first article and his picture is on the cover. The energy message isn't going to get through adequately in a classroom magazine, unless it's in forms that fit the educational purpose of the magazine. So we make energy "do work" in ways not included in its classical definition. We harness energy, as we would any other subject-matter topic, as a teaching tool. We teach all manners of social studies skills with energy, for example. A News Explorer story on the "Sunshine Kids" turns into a reading comprehension quiz. "Gas Hog" articles in the social studies magazines become chart-and-graph reading exercises. Search magazine's simulation game in governmental energy and development policies demands application of social science concepts to practical situations. Vocabulary building is the purpose of Newstime's word-game with energy-related words. Values are implicit and explicit in the energy situation. The primary grade magazines build conservation attitudes in showing kids how to use energy wisely in the home. For Voice, a language arts magazine, it's an opportunity to teach letter writing; kids will write in their thoughts on energy, to be published in the magazine's popular "Your Turn" column. Yes, there are even home economics skills, as Forecast explains the heat loss from "oven peeking."

An important skill is reading pictures for meaning and interpretation. And how else but through picture reading could you talk about energy to a brand-new first grader? The six-year-old may never even have heard the word "energy" and if he has heard it he has no real concept of what it's all about and even if he did it's very unlikely he could read the word, or hardly any other words you could print to explain it. But pictures help build concrete images to form the basis of energy concepts--pictures dealing with the child's own limited experience, suggesting that there's something in common about what makes a sailboat and a car and an electric train and a tricycle go. Of course the teacher has to help the child make this connection; and for this we have another weapon in our arsenal--the Teachers' Edition that accompanies every issue of every magazine, presenting background information and ideas for teaching about the topics at the particular grade level.

Our periodicals are above all news magazines--news magazines for children. So an important use of any subject matter, including energy, is the current affairs aspect. So the magazines tell about the Alaska pipeline, Carter's proposed Energy Department, new plans for harnessing of exotic forms of energy.

This varied activity will climax with major articles and special issues in most of the magazines on January 12. Why that date? Because the following week is Scholastic's self-proclaimed "Energy Week."

Energy Week will be the culmination of contests on energy subjects during the semester in various magazines, with the winners honored in the January 12 issues, and one winning school in each state getting special recognition during Energy Week as one terminal of a telephone hookup with a high Washington official. Also that week, kids will be encouraged to plan, with their teachers, for local conferences on their own school and community energy problems. They will invite, perhaps a local EPA official, the mayor, the head of a local utility, maybe a gas station operator, to present their views.

If all this works as we hope it will, we think the schools will not only remember Energy Week, but will have a lot of good ideas for follow-up study that will last for weeks or months to come.

# ENERGY AND MAN'S ENVIRONMENT

John C. Jones, president, Energy and Man's Environment, Portland, Oregon, with assistance from Edward A. Dalton,

## Building an Energy Education Program

I am pleased to have the opportunity to be here today, and present an overview of Energy & Man's Environment (EME).

During the past two days, we have heard many discussions of educational philosophy and speculation regarding the nature and content of energy education. I am pleased to present a practical, successful and existing energy education program; one which draws heavily upon proven knowledge of the teaching-learning process and is focused upon the practical needs of the classroom teacher. I've asked Edward Dalton, EME's Regional Program Director, to join me in this presentation. We hope our combined effort will contribute to an understanding of our regional program, and to your own energy education efforts.

Energy & Man's Environment is one of the nation's leading energy and conservation education programs. The goal of Energy & Man's Environment (EME) is to develop an energy-literate public; one which understands and practices the wise and efficient use of our resources. This important goal is to be accomplished by conducting and supporting a balanced and objective program for 85,000 teachers and administrators in the U.S. EME began in 1972, as a cooperative effort of state education agencies, the Northwest Public Power Association, and investor-owned electric utilities. Initiated in Washington, Oregon, and Idaho, EME now also serves educators in the states of Montana, Wyoming, Utah, Colorado, and Nevada.

Growing public awareness of the energy dilemma has resulted in an increasing demand for EME programs as teaching resources. During the past two years, EME sponsored more than 250 conferences, workshops, seminars, and special programs; each designed to provide an accurate and responsible view of the energy dilemma and its educational implications. Financial and professional support for this unique and highly productive effort is provided by industry, education, and government.

EME's organization is efficient and designed for results. Policy and direction are provided by the Board of Directors, composed of representatives from industry and education. Program policy is implemented by the President, Dr. John Jones, a former teacher and administrator at both public school and university levels. Direct management and support for the state program operation is the responsibility of the Regional Director, Ed Dalton, former teacher and specialist in curriculum and instruction. Each of nine EME regions is managed by a State Coordinator, all well known and respected educational leaders within their geographic areas. Each coordinator is supported by the carefully selected state training committee. Committees are responsible for the planning and conduct of the energy education programs and services.

Obviously, no education program can be effective without appropriate instructional materials. The development of unique energy-focused teaching

resources is an important component of the EME program. All EME materials are designed by teachers and curriculum specialists, with technical assistance provided by industry and government experts. Each new resource is classroom-tested, to ensure its instructional value. As a result, EME materials have been adopted by school districts and individual educators across the country, and are recognized as being among the best available resources for energy conservation education. Original EME materials included a seven part Activity Guide. The Guide offers a conceptual framework of goals, concepts and objectives for energy and conservation education as well as dozens of teaching ideas for all grade levels. A principal EME teaching resource is the multi-disciplinary energy conservation education Lesson Plans. Four binders contain more than 250 complete teacher-developed and classroom-tested lessons. The Lesson Plans are the result of a three-year developmental process which involved more than 150 teachers, curriculum specialists and energy experts in eight states. Supplementing the teaching resources are several energy-focused reference documents. These include an energy and environment Glossary, Energy Films Index, an Annotated Bibliography of key energy and conservation education resources, and an annual classroom calendar. The combination of unique materials and careful design implementation experiences is achieving the goal of energy literacy. Energy & Man's Environment is a unique education program; one which speaks objectively to one of our nation's critical needs: an informed and energy responsible public. We invite all educators to join us in this critical task.

Ed Dalton

Ladies and gentlemen, I'm happy to share this presentation with Dr. Jones. I will describe some of the instructional materials more fully and explain the type of in-service program we conduct to assure appropriate use. We are very proud of our materials and the results they achieve. Materials are designed mainly for teachers, and our efforts in in-service work are directed to that purpose.

The slide presentation showed our Film Index. This is a resource document for teachers. It is designed to help them attain the best and most up-to-date energy films. We've also prepared an energy and environment Glossary. This Glossary is a collection of new energy and environment terms that teachers, as well as their students, need to understand if they are to participate in the new energy dialogue. It is also used by language arts teachers for vocabulary development. We offer an Annotated Bibliography of key energy education materials. This document is based on the screening of nearly 88,000 items under an FEA research contract. The Sampler that is being distributed to you contains at least one page or more of each of the instructional items that EME has created.

Our program has six major topical components: sources of energy, uses, conversion, impacts of energy, limits, and future. Energy conservation is a theme throughout, although this summer we will be preparing another section of the Activity Guide which will deal totally with energy conservation. The Activity Guide was created as an idea bank and conceptual framework for teachers. It contains usable ideas for the teacher, regardless of grade level or discipline, and presents key concepts, goals and objectives.

We have also created complete Lesson Plans. One book contains lesson plans recommended for grades 10-12; others have been prepared for grades 7-9; 4-6; and 1-3. Each looseleaf binder is indexed so that teachers can easily use them in their content areas. Each lesson plan indicates the amount of time necessary to conduct the activity, pinpoints the exact materials needed, and contains a suggested assessment procedure. In addition, every lesson plan has a career education activity. Included in each major section are sample test items which may be used at the teacher's discretion to pinpoint areas of weakness or strength.

Our intent was to provide materials that can be easily used. We know that teachers are busy, that their curriculum is loaded and the expectations are great. We wanted to help in every way that we could to make energy concepts an appropriate part of whatever they were teaching.

To facilitate implementation, EME conducts a comprehensive regional teacher in-service program. During the last two years, we have conducted 250 conferences, workshops and seminars in our 8-state region. At the present time, we have nine training groups. Each state has a Coordinator and Committee which is responsible for the planning and implementation of energy education programs. There are currently 109 staff members.

If you are interested in knowning more about EME materials or have specific questions about our organization, we would be happy to respond to your requests. Please direct your inquiries to either Dr. Jones or myself. The address is listed both in the Sampler and in our brochure.

John Jones

We are extremely pleased with the progress that has been made. However, the task is immense. It will take all of us working together to develop energy literacy. I hope our comments have been useful to you.

FAR WEST LABORATORY FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

Bela H. Banathy, director, Instructional and Training System Program, Far West Laboratory for Educational Research and Development, San Francisco, California

## Energy-Focused Environmental Education

I wish to report on energy education projects in progress at the Far West Laboratory. The salient organizing concepts of these projects include:

- A thrust toward wholeness--a systems view of both curriculum content and curriculum design; consequently,
- A balanced treatment of energy and environmental concerns in the form of energy-focused environmental education,
- Giving primacy to the learning experience level in the hierarchical complex of education, and
- A functional (real life) context orientation to learning and application.

Energy focused EE reflects a recent trend in science and human affairs. Jean Matthews articulated this trend when she said, "Attempts to end perceptual fragmentation and the whole movement toward synthesis acquired tremendous thrust as the Appollo Spacecraft flashed back pictures from space and struck the human optic nerve. The oneness of the Earth and its systems came through with the impact of a sledge hammer."

The need to comprehend the systems of Earth and the way in which they function and interact has generated an enormous impetus toward the understanding of wholeness. This challenges our long-standing preoccupation with specialized knowledge pursued within well-established disciplines. The holistic view should be employed as a complement to traditional reductionist analysis, at the very least. Systemic thinking, embracing the notion of wholeness, may move us toward a state of competence from which we will be able to oscillate between taking apart (analysis) and fitting together (synthesis).

We are concerned with the availability of energy-focused environmental education that would enhance the development of environmental/energy awareness and literacy in the individual, and generate the capability to make rational decisions about the private and public uses of energy. Environmental education--as defined by the Environmental Education Act--is a clear manifestation of the holistic view, and calls for examination and articulation of the patterns of interaction of parts which integrate into the whole. Energy-focused environmental education, as a holistic, interdisciplinary effort, will enable the individual to confront the energy dilemma from a perspective wholeness, and to see the relationships between the various components of the systems of humanity and nature to which the energy problem is related.

There is, in addition, an even broader implication of an energy-focused environmental education. It can provide an impetus and an experiential base for observing the interrelationship of all knowledge and the way that knowledge expresses the real world. With appropriate reinforcement in other curriculum areas, we might enable learners to view holistically all aspects of their lives.

Wholeness is the key organizing concept which guided the development of the two projects I am to report to you today. Sponsored by the Office of Environmental Education of DOE, these projects were conceived in response to the Environmental Education Act; and the products developed during the course of these projects will facilitate the implementation of the Act. The first project addresses the design of a set of teacher training models. Two of these models are designed in the functional context of energy-focused EE; the others aim at fusion of EE with science and social studies. The two energy-focused models are developed for two distinctively different target groups. The first is intended for high school teachers, who would learn to plan and implement curricula in energy-focused EE. The second model is aimed at leaders of various community groups, who would act as facilitators for introducing energy focused EE into their particular programs. The components of the models, their structure, and the approach to their design are quite similar. Therefore, I will describe the first model, and then briefly review the second.

The Energy-Focused EE High School Teacher Training Model includes the following components (Figure 1):

- An Explanation/Orientation Component. This component provides a rationale for the model, explains its organizing principles, and characterizes its target group.

- The Behavioral Model displays knowledge, skills, and attitudes relevant to energy/environmental awareness, literacy, and problem-solving and decision-making.

- The Curriculum Model specifies the various curriculum domains (that address the desired behaviors) and their relationships. (Figure 2)

- The Content Manual sets forth specifications for the curriculum content of energy-focused environmental education at the high school level.

- The Curriculum Management Manual provides specifications for proposing, planning, implementing, and evaluating an energy-focused environmental education program at the high school level.

- The Implementation Guide introduces specifications for conducting the teacher training program.

An image of training implementation is provided by Figure 3.

The (Curriculum) Content Sourcebook displays a research base of a selected set of concepts and principles relevant to energy-focused environmental education.

The Evaluation Design sets forth a scheme for the assessment of the model.

The Delivery Systems Design displays specifications for an institutional infusion strategy.

The structure of the model emerges as one defines the functional relationship of its components (Figure 1). More specifically, the characterization of the target groups and the specification of the desired competences feed into the design of the curriculum model. The definition of the content emerges from an interactive consideration of the curriculum model and the potential content. All of the above are considered in the design of instructional arrangements. A model of training implementation emerges as we speculate about ways of presenting a teacher training program to be based on the specifications displayed in the various components of the model. The design of evaluation and delivery systems looks at the entire model.

What has emerged from our model-building work heretofore may be viewed as the model of an ideal system of energy-focused EE. This model can be considered generic to a variety of operational models, which can be derived from the ideal system as specific constraints are introduced. Constraints include: the motivation, level of present competence, locale and accessibility of the target groups; time available for training; instructional/learning resources now available to mediate the content; resources available to support the additional development of instructional/learning resources; and institutional constraints on infusion/delivery. In view of all the above considerations, we can select various program configurations and design operational models.

We expect to have such an operational model completed by the end of the summer. Our next step then would be the development of a teacher training program, based on and implementing the operational model.

The second model portrays energy-focused environmental education for community leadership development. The purpose of this program is two-fold: (1) to prepare community leaders to make both public and private decisions compatible with energy/environmental awareness and literacy, and (2) to enable them to communicate such awareness/literacy to the group with which they are working. The generic form of this model has been developed already, and we have had opportunity to test the model with potential users.

The curriculum domains configuration of this model is displayed in Figure 4.

The second project on which I wish to report involved the design and pilot testing of a model for linking environmental education in schools with programs of the environmentally-oriented informal education

sectors. Conducted under a grant from the Office of Environmental Education, the project has focused on energy education.

During the course of the project, we designed a model for linkage and mutually-supportive organizational arrangements between formal and informal educational programs and personnel, in order to enhance their capability and effectiveness in conducting environmental education programs.

In the design and pilot testing of the model, the informal sector was represented by Boy Scouts of America, whose environmental education program can reach more than 5,000,000 people nationally. The Scout program now includes an intensive energy education effort. The formal sector was represented by a school district in the San Francisco Bay Area. Personnel from participating agencies developed linkages and formalized cooperative arrangements which have been implemented on primary, intermediate, and secondary grade levels, and in all three branches of Scouting.

The implementation of the model has led to three major outcomes:

- Infusion of the energy-focused environmental education curriculum of the school into the program of informal education sectors; and thus, the enrichment of those programs as well as the reinforcement of the formal curriculum;

- Infusion of some energy-focused environmental education program-content and approach from the informal education sector into the curriculum of the school; and thus, the enrichment and extension of the formal curriculum; and,

- The joint design, development, and implementation of energy-focused environmental education programs which benefit both the formal and informal sectors.

The pilot testing of the program was completed last month; the results have guided the development and refinement of the linkage model and relevant procedural guidelines for the planning, implementation, and evaluation of linkage and cooperative arrangements.

In closing, let me return to the notion of "wholeness". Our current educational curricula are highly fragmented and compartmentalized into subjects and disciplines. This may be one reason why students have difficulty relating schooling to real life. Many of us feel that education should have a quality of conceptual and functional wholeness. I suggest that energy-focused environmental education offers a holistic framework for organizing curriculum. It could become the overall functional context, relevant to real life, under which other subject-matter areas might begin to fuse into a more integrated curriculum.

Audrey Champagne & Leo E. Klopfer, Individualized Science Program, Learning Research and Development Center, University of Pittsburgh

# Criteria for Effective Energy Education

## Introduction

In preparing this paper we had in mind the needs of those individuals who must make decisions concerning instructional materials and programs for energy education.[1] In particular, the paper addresses the needs of three kinds of decision makers: persons responsible for purchasing or selecting energy education instructional materials and programs (purchasers); persons responsible for allocating funds for the development of such materials and programs (funders); and persons actually responsible for designing such materials and programs (designers). Contained in this paper are the guidelines that will aid (a) purchasers in analyzing and evaluating instructional materials and programs, (b) funders in analyzing and evaluating proposed specifications for the development of instructional materials and programs, and (c) designers in planning for and determining specifications for the development of instructional materials and programs.[2]

The paper outlines a process that can be applied to the analysis of design of instructional programs and materials. We also discuss the role of values in decision-making, with special emphasis on the role of values in making decisions concerning energy education. In addition, the paper presents some of our criteria for effective programs and instructional materials for energy education.[3]

Both in analyzing and designing instructional materials, carefully conceived procedures are necessary to insure that attention has been paid to each aspect of the materials. The process of analyzing instructional materials requires the systematic gathering of information, while the process of instructional design demands systematic attention to the multitudinous details involved in the conceptualization and production of instructional materials. Extensive lists of questions, comprising a major portion of this paper, represent the means by which the analyzer can glean appropriate information from instructional materials, and by which the designer and the funder can check to see that specifications for proposed materials are complete.

The questions have been organized into nine tables, each of which pertains to one of nine major components of instructional programs. In our experience, not all decisions concerning instructional materials rely on information about all nine of these components. Figure 1 illustrates our experience in regard to the importance of each component for different types of educational decision-making. Decisions made by funders or purchasers of instructional programs and materials are generally based on information from only selected components. On the other hand, designers of instructional materials and programs must have information related to all of the components.

Designers, purchasers, and funders differ also as individuals with respect to the relative importance they give to each component in the decision-making process. For example, it is generally the case that several competent designers will make varying decisions concerning the design of

particular instructional materials even when each person's decision is based on the same information. All competent designers will, however, be knowledgeable about the parameters of potential decisions related to each component and will be able to provide rationales for the decisions they make. A more concrete illustration of this principle can be seen in the context of decisions made by materials purchasers. Some individuals faced with a purchasing decision give primary consideration to the cost or physical appearance of the instructional materials. Others faced with making the same decision will focus their attention on the ease with which the materials can be implemented in the classroom or on the demands that the program places on the teacher. Only the most sophisticated of potential purchasers will base their decisions on the more technical aspects of the material's design--for example; the use of principles of instructional theory in its design. Most purchasers find it very difficult, if not impossible, to carry out sophisticated analyses of materials of the sort that would determine, for example, how well the materials fit the educational goals of the school system.

Individuals faced with making funding decisions often give primary consideration to the designers' reputation, the completeness of the development plan, or the appropriateness of the proposed materials for the target population. Publishers, for example, base many of their funding decisions on the cost of the product to the purchaser and on the size and characteristics of the potential user population. Often funders must rely on the expert judgment of the designers in regard to the more technical decisions related to instructional design. Just as with potential purchasers, it is sometimes, but not often, the case that funders are as knowledgeable as the most competent designer and can make more substantive analyses and evaluations of specifications for instructional materials on all of the components toward which the questions presented in this paper are addressed.

The questions in the tables provide a mechanism for the systematic gathering of information, a necessary but not sufficient condition for informed decision making. We believe that, in addition to information, values are central to all decision-making processes, including those involved in the processes of designing, funding, and purchasing energy education materials and programs. In design, for example, decisions are made about the rationale for the program or materials, the content, the packaging, the student activities, the teacher's role, and many other matters. The decisions that are made reflect the values of those who make them. A certain program may, for instance, devote considerable attention to teaching children about the amount of coal and oil in the earth but little space to the question of how alternative sources of energy might be developed. This distribution of content suggests that the designers have placed more value on knowledge of facts than on knowledge of processes. Decisions about content made by an energy education program's designers reflect particular values.

The process of selecting instructional materials for purchase is also a matter of making decisions based on values. In purchasing, decisions are made concerning which materials will be selected, how they will be used, with whom, etc. Because choices exist, decisions must be made. The amount of time and money a school district is willing to expend on energy education reflects the value that the school district places on energy education. Additional considerations in the selection process also reflect values; for

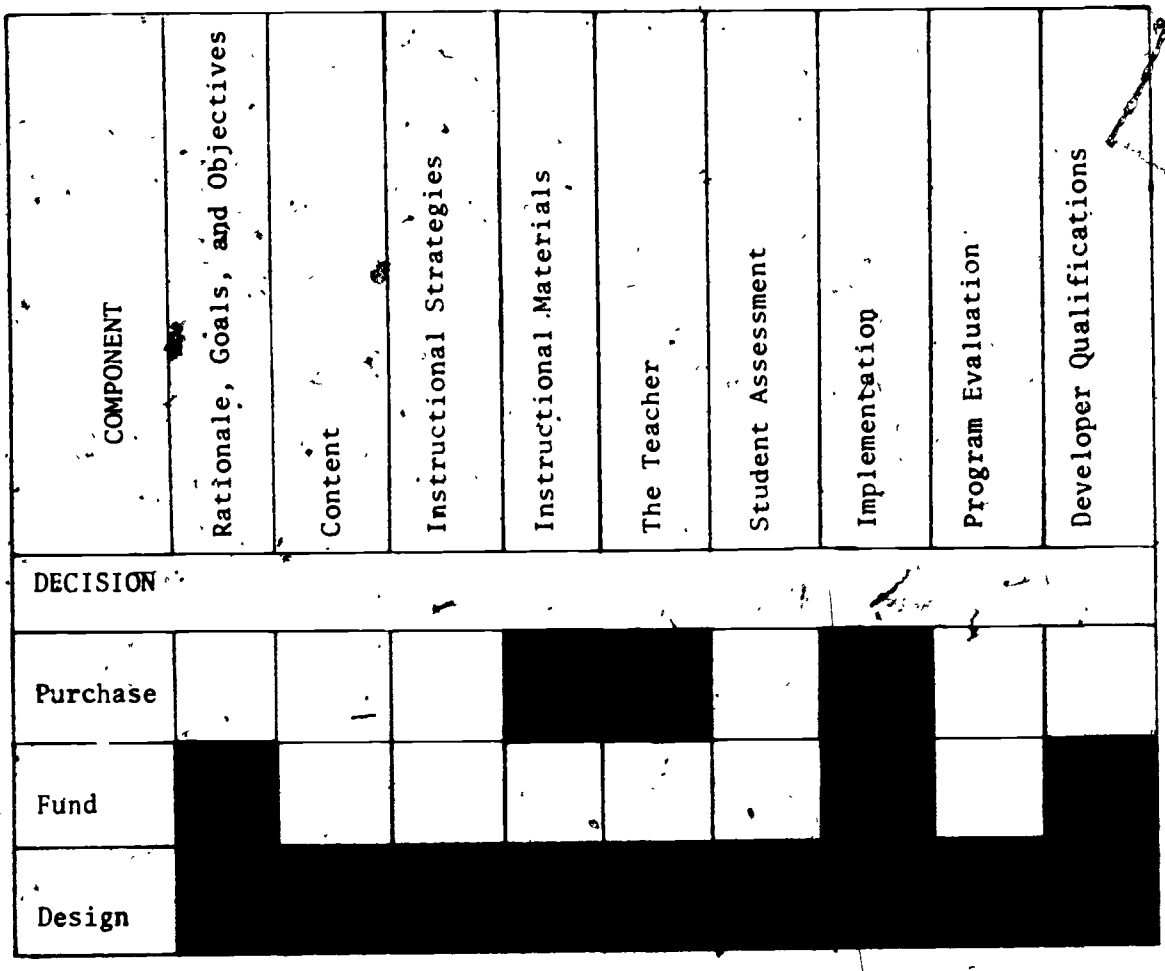



Figure 1.

Components of Instructional Programs
Which Generally Receive Primary Consideration in Decision-Making.

example: Should the materials be individualized? Should they emphasize conservation? Will they deal with political and economic issues? Questions such as these consider values, that is, what the school and the community who will use the instructional materials judge to be important, worthwhile, "good."

Because decisions made about energy education are value-laden, we believe it is important that the values inherent in instructional materials be explicit. If they are, the work of persons who must make decisions about such materials--whether or not to fund a development project, whether or not to purchase materials for a school, or a similar major decision--will be facilitated, by allowing these decisions to be made on a rational, informed basis. For the same reasons, we feel that specifying the values intrinsic to the materials will also aid the designers in their work.

The functions of information and values are interactive in the decision-making process and, therefore, can never be treated as discrete entities. The questions we pose for your use, our discussion of the importance of the information that the answers contain and the criteria for effective energy education we put forward for your consideration are all reflective of our values. One of our values is a high regard for public education. Also, we believe, that the proper kinds of instructional materials can play a significant role in enabling the nation to cope with the energy dilemma.

Some persons may challenge this assertion, but we suspect that their doubts stem from a failure to recognize the potential of recent developments in the field of instructional technology. Principles of instructional technology that have become known, codified, and validated through research in recent years can be successfully applied to the processes of designing and analyzing educational materials.[4] Many instructional materials of the past have failed because these principles were either not applied or inappropriately applied in the course of the materials' development. Often, too, well-designed materials have failed because they were improperly implemented or even poorly matched to the needs of the school system that purchased them. Considerable experience has been gained during the last decade and a half in designing, analyzing and implementing instructional materials. Such experience now makes it possible to suggest with some assurance necessary conditions for the design, selection, and implementation of effective and successful instructional materials for schools. We value also the application of systematic procedures to the processes of analysis, design and implementation of instructional materials.

These are our values; they determine our criteria for instructional materials. The questions in the tables reflect the application of some of our values to the process of establishing criteria. Consider for example question B.9 in Table 1, "Are there explicitly stated objectives corresponding to all the program's goals?" Because we value a systematic design process, we would include the presence of behaviorally stated objectives as one of our criteria for effective instructional materials. That is not to say that the only right answer to question B.9 is "yes." There are effective instructional materials that do not contain explicitly stated behavioral objectives. A "no" answer should, however, result in further analysis of the instructional materials in order to determine if the functions served by behavioral objectives have been adequately met.

The illustration in the preceding paragraph is intended to emphasize that the particular answers that result from the application of the questions presented in our tables to any particular instructional materials do not determine in themselves the potential effectiveness of those materials. The information resulting from the answers to the questions must be considered in the context of criteria which you set, based on the values you hold. In the following discussions of issues relating to components of instructional materials, we set forth certain of our criteria, but you must set your own criteria after considering the issues we raise.

## Rationale, Goals, and Objectives

Before discussing our criteria for the rationale, goals, and objectives of energy education programs and instructional materials, it is necessary for the sake of clarity to indicate what we mean by the terms "rationale," "goals," and "objectives." For our purposes, the rationale of a program is a statement that explains such matters as why the development of the program was undertaken, what societal needs the program was developed to respond to, and what were the underlying assumptions of the program's designers. By "goals" we mean, simply, the broad aims that the program or the materials are designed to achieve. The goals of a program of energy education presumably would include such things as increasing students' knowledge about energy and changing their behaviors related to energy consumption. Objectives are much more specific statements of the outcomes that various parts of a program are designed to produce.

Decisions that must be made in the course of developing or selecting energy education materials will be facilitated by the kinds of information that are available in carefully thought out and written statements of rationale, goals and objectives. Because of the value we attach to developing educational materials systematically and on a rational basis, the first considerations in this development, we believe, should be those surrounding a program's rationale, goals, and objectives. The "nitty-gritty" decisions about the development of a program--will it include manipulative activities, will media other than print be used, etc.--can be made rationally only after decisions have been made about why the program is needed and what it aims to achieve in both general and specific terms. Reversing the order of these kinds of decisions can easily lead to programs that are incoherent, inconsistent, and ineffective.

We also believe that the process of selecting a program or materials for purchase will be expedited if, early in the selection process, careful attention is given to the rationale, goals, and objectives of the programs and materials under consideration. If, for example, a program espouses goals that are quite inconsistent with the goals of the community where the program will be used, the program can probably be eliminated from consideration.

From our analysis of the energy dilemma and the role of education in it, evolve our criteria for the rationale and goals of energy education materials that we would judge to be potentially effective.

This is our analysis of the dilemma. In the years to come, the demand for energy will exceed the supply. Costs of delivering energy

Table 1

Rationale, Goals, and Objectives

A. Adequacy of Rationale

1. Is there a rationale for the program, or must the rationale be inferred from the program's instructional materials and procedures?
2. Is the program's rationale conceptually sound?
3. Are the assumptions that underlie the program's rationale clearly set forth in the rationale?
4. Which philosophical assumptions underlie the program's rationale? For example: Do the program's designers believe that educators in schools have the right or responsibility to teach directly for changes in students' out-of-school behaviors? Do they believe that individuals have a right to consume as much energy as they please and can afford to pay for?
5. Which psychological assumptions underlie the program's rationale? For example: Do the program's designers believe that it is possible in the context of formal education to teach children to change their out-of-school energy conserving behaviors?
6. Which assumptions about social policy underlie the program's rationale? For example: What do the program's designers believe about the extent to which formal education should act as an active agent of social change by teaching individuals ways to adjust their life styles in the face of energy shortages?
7. Which political assumptions underlie the program's rationale? For example: What do the program's designers believe about how much control the federal government can exert over the energy consumption of individuals and businesses?
8. Which scientific assumptions underlie the program's rationale? For example: Do the program's designers view the conversion of solar energy as an important source of energy for power generation? What is the designers' stance with regard to the safety of nuclear energy sources?
9. Which economic assumptions underlie the program's rationale? For example: Do the program's designers believe that the cost of energy to individual consumers should be kept reasonably low?
10. Does the rationale include any unwarranted assumptions or uncritically accept any untested assumptions?
11. Are the assumptions underlying the program's rationale consistent with those held by individuals in the communities where the program will be used? If they are not, what are the implications of the discontinuity?
12. Are the assumptions underlying the program's rationale made explicit to the learner through the program's instructional materials?

B. Conceptualization of the Program

1. Are there explicitly stated goals, or must the goals be inferred from the program's instructional materials and procedures?
2. Are the goals of the program consistent with its rationale?
3. Are goals included which attend to the teaching of information; the development of problem-solving skills, and techniques of personal values clarification, decision making, and goal setting?
4. Do the goals include engendering out-of-school behavior changes in students, or are all goals stated only in terms of behaviors related to the formal educational setting?
5. Are the goals appropriate for the target population of students who use the program?
6. To what extent are the goals acceptable to the greater society and to special interest groups concerned with energy?
7. Are the goals stated with sufficient specificity to test the congruence between the program's goals and the instructional strategies it employs?
8. Are there ways for assessing how well the goals of the energy education program have been achieved?
9. Are there explicitly stated objectives corresponding to all the program's goals?
10. Are the objectives consistent with the program's rationale and goals?
11. Which levels of student behaviors in the affective domain are represented in the program's objectives?
12. Which levels of student behaviors in the cognitive domain are represented in the program's objectives?
13. Are the objectives stated in behavioral terms or in some other way that makes them functional?
14. Do the objectives clearly communicate the designers' intent to the teachers who will implement the program?
15. Can the objectives be used by the teacher to assess the extent to which the program's intended effects have been engendered in the students?
16. How well integrated are the instructional components of the program?
17. Are there provisions for monitoring the progress of students and assessing their attainment of objectives in the program?
18. What evidence is there that the design of the program takes into account the findings of educational and psychological research?

Table 1 (continued)

C. Planning for a Proposed New Program

1. What is unique about the proposed energy education program?
2. Is there an overall plan for the design and development of the proposed program?
3. Is the plan for developing the proposed program feasible?
4. Is a strategy built into the development plan for modifying it if necessary?
5. Are the program's goal statements sufficiently specific to guide the development of instructional strategies and materials that match the goals?
6. Does the development plan include a mechanism for formative evaluation?
7. Is the plan for the design of the proposed program sufficiently thorough and internally consistent?
8. Does the plan for the design of the proposed program take into account the known characteristics of the students who will use it?
9. Does the plan consciously or unconsciously violate generally accepted tenets of developmental theory or of cognitive learning theory?
10. What means are suggested in the planned design of the proposed program for evaluating student achievement and assessing changes in out-of-school behaviors?
11. What roles and expectations for the teacher are planned in the design of the proposed program?
12. Does the planned design of the program give sufficient attention to the management of the proposed program in the classroom?
13. Are the limitations in finances, flexibility, and adaptability of schools recognized in the plan for the proposed program?

will continue to increase. Increased use of energy will further deplete our natural resources and influence the ecological balance of the environment. Individuals confronting the energy dilemma will be forced to make decisions and choices; their concerted decisions will influence national energy policy and their individual choices will determine their life-styles.

This situation requires citizens who are knowledgeable, who are aware of their personal values, who are skillful problem solvers and decision-makers, who have well-defined personal goals, and who are able to predict the consequences of their energy choices and decisions, both for themselves and for the society in which they live.

This analysis has these implications for energy education. Energy education must be multifaceted, that is, it must not only convey information, but also deal with social, economic, political, and moral issues. In addition, it must make provision for increasing individuals' abilities to define their values and goals, to solve problems, and to make decisions. Our analysis also suggests some criteria for the rationale and goals of energy education programs. The rationale and goals of such programs should reflect the multifaceted nature of energy education. The philosphical, psychological, social, scientific, and political assumptions underlying the rationale and goals should also be specified, as we have stated, to guide the work of the designers and to facilitate understanding of the program by others. Section A of Table 1 presents questions that the decision-maker can use to gather information about a program's rationale. Questions about the goals of energy education programs and materials are included in Section B of Table 1.

As the heading indicates, the questions that comprise Section B of Table 1 deal with the conceptualization of an energy education program; that is, the relationship of the program's rationale to its goals, of its goals to its objectives to its instructional materials. The information that one gathers by asking these questions is useful in making judgments about a program's consistency and coherence, two important prerequisites for effectiveness.

Section B of Table 1 also presents a number of questions regarding the statements of objectives. It is our opinion that an important process in operationalizing the goals of a program is the translation of the program's goals into specific objectives. Objectives can serve a variety of functions. The format of the objectives determines, in part, the extent to which the objectives can serve the functions. For example, objectives that are stated behaviorally--in terms of observable student behaviors--are useful as means of communicating, to the teachers who implement the program, the designers' ideas about the effects of the program. Educators rely on observations and descriptions of overt behaviors to infer the state and organization of an individual's knowledge. It follows, therefore, that behaviorally-stated objectives are also useful starting points for assessing the extent to which the program has attained its goals. The use of behavioral objectives is sometimes criticized because they so often describe trivial behaviors. This need not be the case, however. In fact, a program can be evaluated in part on the extent to which its objectives sample behaviors from all levels of the cognitive and affective domains as described by Bloom, 1956, and Krathwohl, Bloom, & Masia, 1964.[5]

Figure 2 shows some examples of behavioral objectives from several levels of the cognitive domain; Figure 3 presents behavioral objectives from all five levels of the affective domain. These objectives from the affective domain are particularly important to energy education, since, as can be seen in Figure 3, they are concerned with the student's behavior outside the classroom. They are also closely related to the processes of values clarification, goal setting and decision-making, processes we believe are essential parts of energy education.[6]

Finally, Section C of Table 1 lists some questions about the planning of proposed new programs or materials for energy education. The questions will be of special interest to persons considering undertaking the development of such programs and to those who must evaluate plans for materials development projects.

Content

The content of an energy education program must reflect and support the goals and objectives of the program. Since the goals and objectives of an effective energy education program encompass a variety of behaviors and an extensive knowledge base, the content of such a program will, of necessity, include both skills and knowledge areas. Thus, our criteria include considerations both of the information and knowledge conveyed to the student (the cognitive domain) and of the skills in values clarification, goal-setting, problem-solving, and decision-making (which have behavioral components in both the cognitive and the affective domains).

Content relating to information and knowledge must be considered from two standpoints, completeness and accuracy. Our current energy dilemma is highly complex, and even a superficial understanding of its complexities requires some knowledge in several of the academic disciplines. Some elementary knowledge of principles of physical, biological, social, economic, and political science is necessary for an appreciation of the complexity of the energy dilemma and for informed, sensible personal decisions about energy use. This suggests that the content of an effective program of energy education will be multidisciplinary. The effects of an energy education program that considers the energy dilemma from the perspective of a single academic discipline can be deleterious to the goal of attaining informed knowledge of the issues in energy use. Such perspective may suggest simplistic solutions to a complex problem, solutions which are not likely to be satisfactory.

Accuracy of informational content needs to be considered from two perspectives, the correctness and precision of the information, on the one hand, and the intellectual honesty with which it is presented, on the other. Checks on the correctness and precision of information can be made with relative ease by experts from the relevant academic disciplines. The perspective of intellectual honesty of informational content is more subtle. This criterion requires that students be made aware of the fact that some of the information presented is tentative and that in our complex world many decisions are made in the absence of complete information. It also requires that general principles with regard to energy conservation, rather than specific dictums, be taught. This distinction can be illustrated by an example from the health field. Some years ago the public was urged to

*Behavioral Objectives*

1. *The student identifies the following attributes of energy: energy can change things; energy added to a system changes the system; energy has different forms; energy can be converted from one form to another form.*

3. *The student gives examples from his own experience of heat energy and light energy changing a system.*

6. *The student describes the energy conversions in various systems: e.g., a lightbulb (electrical energy to heat energy and light energy), a buzzer (electrical energy to sound energy), a wood-oxygen system (chemical energy to heat energy and light energy), a boy doing work (chemical energy to kinetic energy).*

7. *The student identifies the source of energy for a familiar system (animal, plant, car, electric appliance) and describes some of the energy conversions that take place in each system.*

8. *The student discusses events in the life of James Prescott Joule in relation to his scientific contributions and to the culture of his time.*

15. *Given several illustrated situations, some of which depict work being done and some of which do not, the student identifies those pictures in which work is being done.*

20. *The student identifies a fuel as a chemical substance that interacts with oxygen to release stored energy.*

21. *Given a description (written and illustrated) of a situation where several energy-converting systems have different amounts of fuel, the student identifies the system which can release the greatest amount of energy and orders the systems according to their capacity for releasing energy.*

23. *The student writes a short essay on how his life would be different if all the coal and petroleum on earth were used up.*

27. *Given data on a sample of water of mass m (in kilograms), at temperature $t_1$, and told that heat energy is added until the temperature is at $t_2$, the student determines the quantity of heat energy (in kilocalories) added to the sample.*

29. *The student identifies the following attributes of energy from the sun: keeps all the water in the oceans from freezing, makes the wind blow, is stored in petroleum and coal, is converted into sugars and starches by green plants, moves water from place to place on the earth's surface, and is the earth's most important source of energy.*

30. *The student writes a short essay on what his life would be like without the sun's energy.*

Figure 2.

Illustration of Cognitive Domain Objectives Concerning Energy: "Behavioral Objectives for the Joule Unit" (excerpt), from Champagne and Klopfer, 1975, pages 26-28.

*Affective Objectives*

*RECEIVING*

*The student is alert to everyday situations where energy is being wasted.*

*The student recognizes that her or his actions have an effect on the national consumption of energy.*

*RESPONDING*

*The student voluntarily seeks out information about ways to limit her or his personal consumption of energy.*

*The student is willing to dress more warmly indoors in the winter in order to help limit family fuel consumption.*

*VALUING*

*The student has a sense of responsibility for keeping the waste of energy in the home at a minimum.*

*The student recognizes the desirability of using public transportation rather than a private automobile whenever possible.*

*The student assumes an acitve role in keeping the waste of energy in the home at a minimum by shutting off lights in unoccupied rooms.*

*The student seeks out information about the cost benefits of limiting appliance use in order to influence her or his family to limit their energy consumption in this way.*

*The student displays her or his conviction of the need to develop energy sources alternative to fossil fuels by encouraging elected representatives to support research on alternative energy sources.*

*The student displays her or his conviction of the need to reduce energy consumption by urging the family to keep the thermostat at the minimum level necessary for comfort in the winter.*

*ORGANIZATION*

*The student relates her or his desire to own a large automobile to the need for conserving energy.*

*The student reexamines her or his preferences for certain kinds of architectural structures, in terms of whether they help or hinder energy conservation.*

*The student attempts to identify characteristics by which her or his family could develop a plan for limiting their consumption of energy.*

*The student judges candidates for elective office partly in terms of their commitment to alternative energy sources and the need to limit energy use.*

*The student judges arguments by public figures about the feasibility of limiting energy consumption in terms of what s(he) knows about the need to do so.*

*CHARACTERIZATION*

*The student is predisposed to consider ways of limiting energy consumption in making a decision about a house s(he) will build or buy.*

*The student views her or his career choice in terms of her or his desire to seek ways to limit energy consumption or to seek energy sources alternative to fossil fuels.*



Figure 3.

Illustration of Affective Domain Objectives Concerning Energy

have annual chest x-rays for the purpose of the early detection of tuberculosis. When the realization of the potential dangers of regular x-rays forced a change in this health policy, many people took the attitude that this was yet another example of the contradictory advice of the "experts," in this case the physicians. If people had been taught the health principle behind annual x-rays--namely, that early detection of TB improves the prognosis--and then had been given alternative means for early diagnosis, the effects of changing recommendation would not have been as negative. Similarly, if students are taught general principles regarding energy education, rather than specific rules, they will be better able to cope with the vicissitudes of the energy situation that can be expected in the future.

The informational content of energy education programs will, if it meets the criteria suggested above, provide the basis on which decisions can be made and plans of action can be formulated. Providing information alone, however, does not insure that the student has the skills necessary to use this information to solve problems or to make decisions or plans. Thus, included as a part of the content of an effective energy education program should be opportunities for students to develop skills in decision-making and problem-solving. While the development of these skills is often included in statements of educational goals, there is evidence that they are given much less attention in schools than knowledge goals.[7] If energy education is to achieve its goals, the teaching of decision-making and problem-solving skills will need to be emphasized in the content.

If goals of an energy education program include having students apply decision-making and problem-solving behaviors to energy-related situations they encounter outside the school, the development of skills in values clarification and personal goal setting will also need to be included in the energy program's content. Students will conserve energy outside the school only when this action is consistent with their personal goals. Helping students clarify their values and understand the consequences of their goals is a very important aspect of energy education's content.

The foregoing discussion delineates some considerations we feel should be kept in mind in planning the content of energy education instructional materials or programs or in judging such content. Table 2 presents a more detailed and specific list of questions that should be considered in judging the content of effective energy education materials. Figure 4 shows the science content as it is presented to the student in one set of instructional materials on energy, the Joule Unit (Champagne and Klopfer, 1974a).[8]

As a final note, we point out that our criteria have some interesting implications for our present system of formal education. To meet the criterion of multidisciplinarity of content, for example, formal education must be prepared to break down its traditional subject matter barriers. The inclusion of content in the areas of decision-making, problem-solving, goal-setting, and values clarification also requires considerable departure from tradition. Thus, while we believe that formal education can provide individuals with the information, skills, and motivation needed to cope effectively with the current energy dilemma, we anticipate that effective energy education will require from schools a willingness to reorganize the usual compartmentalization of school subjects.

Table 2

Content

A. Coverage

1. From which of the academic disciplines is the program's subject matter drawn?
2. Is any essential subject matter missing from the program's content?
3. Is more subject matter from any academic discipline included in the program's content than is necessary to meet the program's goals?
4. Are the breadth and depth of subject-matter content adequate to meet the program's goals?
5. Is information concerning the consequences--personal, short-term, social, long-term--of current habits of energy consumption provided to the student?
6. Is information about alternatives to current habits of energy consumption provided?
7. Is there a good balance between subject-matter and process skills content?
8. Which skills are included as a part of the program's content?
9. Is the range of skills included in the program's content sufficient to meet the program's goals?
10. Does the program's content include the process skills necessary for making decisions and solving problems about energy use which the student may expect to face?
11. Does the program's content include the skills the student will need to attain the goals of clarifying one's values, setting personal goals, and solving problems in regard to one's personal energy consumption?
12. Is the student provided with suggestions and guidance for obtaining the information needed to attain his or her goals with respect to energy consumption?
13. Does the program's content help the learner to distinguish between emotional and logical arguments relative to the energy dilemma?
14. Does the program's content help the learner to distinguish between reliable sources of information concerning energy and sources that may be biased?

B. Appropriateness

1. Is the subject matter and process skills content of the program well-matched to the needs and abilities of the target learner population?
2. Is there evidence that the content of the program is appropriate for the range of levels of cognitive development likely to be encountered in the target learner population?
3. Are the skills presented in the program relating to values clarification, goal-setting and problem solving appropriate to the range of levels of affective development likely to be found in the target learner population?
4. Is subject-matter content sufficient to provide an adequate understanding of issues relevant to the energy dilemma which individuals in the target learner population may encounter?
5. Are the principles of energy conservation presented in the program widely applicable to the range of energy-use patterns likely to be encountered by the target learner population?
6. Is the program's content likely to be interesting and informative for the individuals in the target learner population?
7. Is there a good match between the program's subject matter and the process skills it attempts to teach? That is, is the subject matter a good vehicle for teaching the process skills?
8. What values are expressed in the selection of the content of the program?
9. Does the program present well-established principles of energy conservation, rather than emphasizing a set of prescriptive rules that may become obsolete or outmoded?
10. On what basis has the subject-matter content of the program been selected?
11. On what basis was the process-skill content of the program selected?
12. Is the portion of the content relating to values clarification, goal setting, and problem-solving skills given sufficient emphasis compared with the emphasis given to the subject-matter portion of the content?
13. Which values are emphasized in the program's content?
14. Does the program's content overemphasize a certain viewpoint or belief to the extent of virtually excluding equally valid alternative viewpoints or beliefs?
15. Is the reasoning in the arguments the program presents concerning the energy dilemma always logically sound?

Table 2 (continued)

C Accuracy of Subject-Matter Content

1. Are the information, concepts, principles, theories, and speculations included in the subject-matter content consistent with accepted ideas in the relevant academic disciplines?
2. What evidence is there that the program's subject-matter content has been reviewed for accuracy?
3. Are the technical terms drawn from the academic discipline and included in the program's subject-matter content defined with sufficient care so that their meaning is unambiguous and clear?
4. When a concept which is included in the subject-matter content has both a popular and a technical meaning (e.g., work), is the necessary distinction clearly made?
5. Does the program's content help the learner to distinguish between broadly applicable principles of energy conservation and narrow prescriptive rules?
6. Has the subject-matter content been presented in such a way as to correctly distinguish fact from theory and/or speculation?
7. Are any assumptions which are presented in the subject matter content identified as assumptions?
8. Does the learner have the opportunity to question any assumptions which are set forth, or are they to be accepted without examination?
9. Are those well-established concepts and principles which are included in the subject matter content identified as ideas which are not likely to be changed over time and on which the learner can rely?
10. Where the subject-matter content includes information that is not yet well established, are cautions given that the information is subject to change?
11. Are ideas which are supported only by limited evidence at the present time identified as tentatively held ideas?
12. Does the program's content help the learner to distinguish between tentative and well-established ideas?

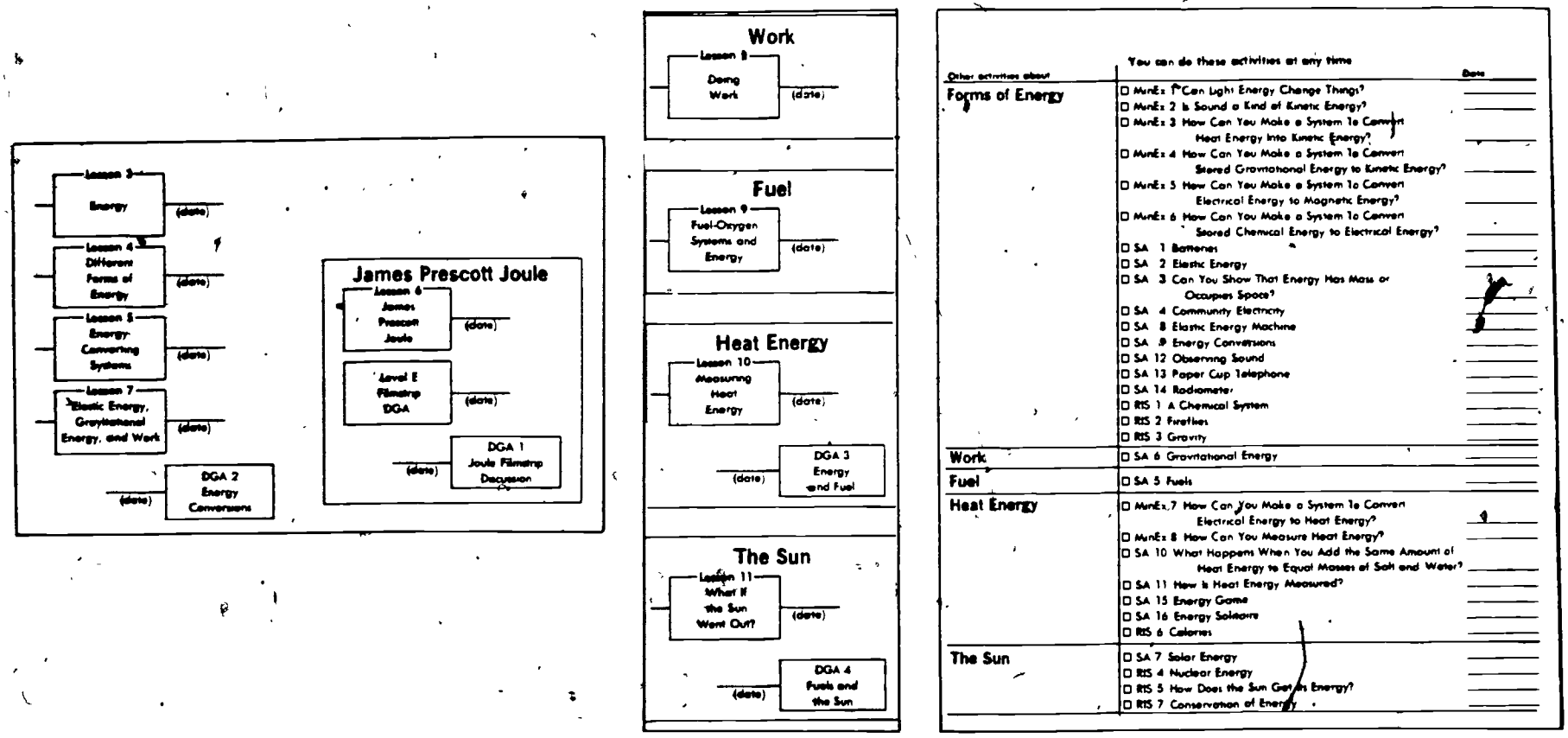



Figure 4.

Illustration of Science Content Included in a Science Unit on Energy: "Joule Planning Booklet" (excerpt), from Champagne and Klopfer, 1974a.

## Instructional Strategies and Materials

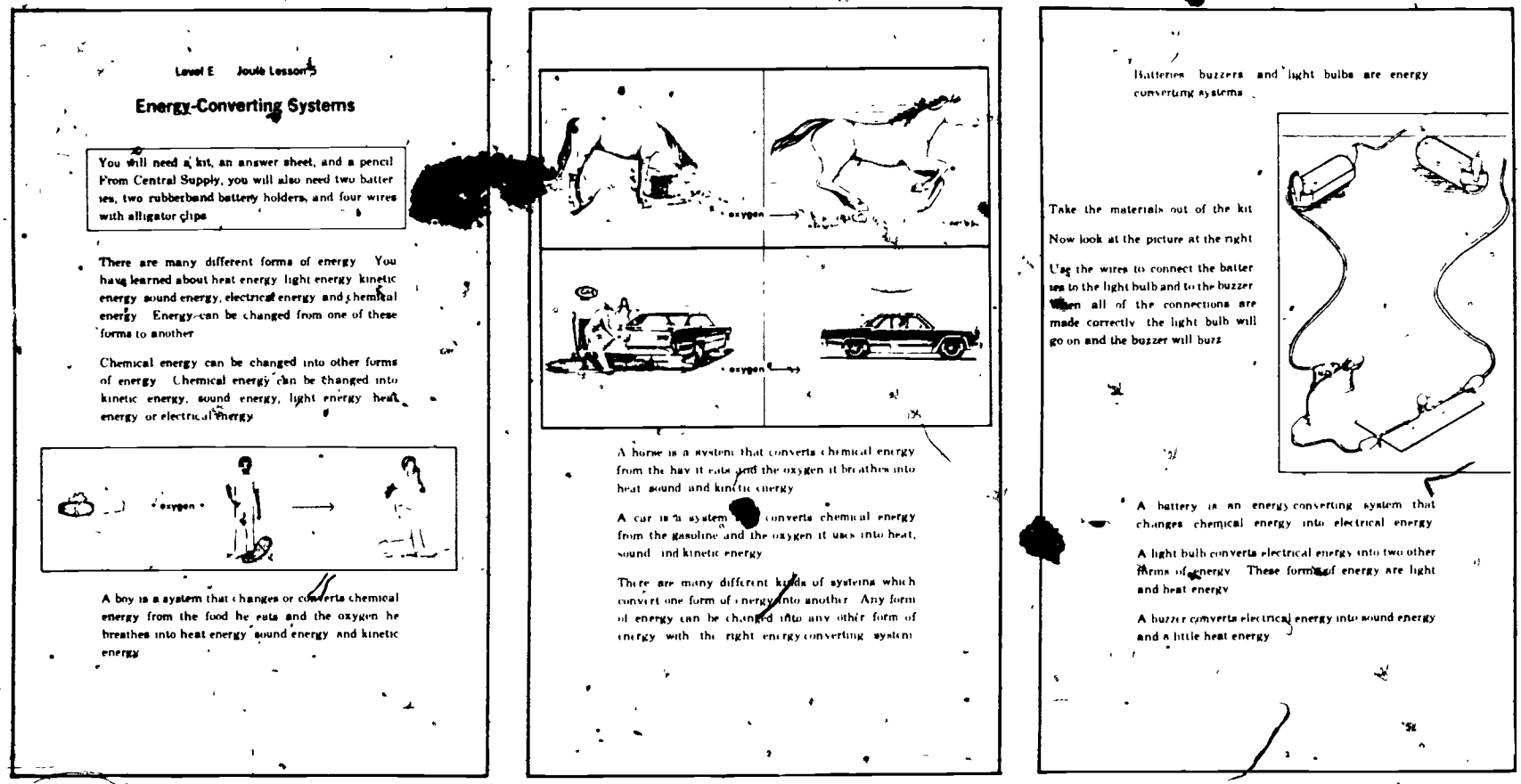
In our view, the goals of an energy education program necessarily cover a broad range of knowledge and behaviors of different levels of complexity. In order for these goals to be realized, they must be translated accurately into effective teaching procedures and instructional materials. The process of accurate translation, known as instructional design, is a complex one. Each of these aspects of instructional design--defining teaching procedures and developing instructional materials--will be considered in turn.

One important step in the definition of teaching procedures is the statement in behavioral terms of what is to be learned by the students. Once the desired outcomes for a program are stated and classified, a next step in the design process is to select an appropriate teaching procedure to bring about a desired outcome. Learning theory suggests that behaviors from different domains and behaviors of different levels of complexity are learned in different ways. For example, riding a bicycle (a higher level psychomotor behavior) and spelling cat (a lower level cognitive behavior) are both learned behaviors. Each is learned under very different conditions.

An instructional strategy is the process by which the conditions for learning a certain class of behaviors are created. For example, in cases where it is necessary to impart information to the student, a didactic instructional strategy may be used. Figure 5, a reproduction of Joule Lesson 5, in which information about types of energy conversion is presented to the student, illustrates the didactic instructional strategy. Other kinds of instructional strategies are used when it is desirable for the student to learn higher level cognitive behaviors. Joule MinEx 3, reproduced in Figure 6, illustrates the application of modeling to teach a problem-solving behavior. "A Seminar on Energy," part of which is reproduced in Figure 7, illustrates the use of simulation to teach students how to behave when participating in a seminar. Modeling and simulation are instructional strategies sometimes used to teach complex behaviors.

There is a considerable body of research and psychological theory from which evolve principles that are useful in designing instructional strategies for successful teaching of behaviors from different domains and of different levels of complexity. An example of such a principle involves the relationship between experiences with physical objects and the learning of abstract concepts. Some psychologists believe that understanding of physical concepts is gained only after having had the opportunity to experience them through the manipulation of physical objects. This principle is illustrated in the excerpt from Joule Lesson 5 in the accompanying Figure 5. In this lesson the student experiences the concept of energy conversion through manipulations and observations of a battery-bulb-buzzer-system. The student experiences first-hand the conversion from potential energy (the chemical energy stored in the battery) to kinetic energy (the light and heat from the bulb and the sound and the heat from the buzzer). The Joule MinEx 3 illustrated in Figure 6 is another illustration of the application of this principle.

Educators are most experienced in designing instructional strategies to successfully teach the lower level cognitive behaviors. The higher



Level E Joule Lesson 5

## Energy-Converting Systems

You will need a kit, an answer sheet, and a pencil From Central Supply, you will also need two batteries, two rubberband battery holders, and four wires with alligator clips

There are many different forms of energy You have learned about heat energy light energy kinetic energy sound energy, electrical energy and chemical energy Energy can be changed from one of these forms to another

Chemical energy can be changed into other forms of energy Chemical energy can be changed into kinetic energy, sound energy, light energy heat energy or electrical energy



A boy is a system that changes or converts chemical energy from the food he eats and the oxygen he breathes into heat energy sound energy and kinetic energy



A horse is a system that converts chemical energy from the hay it eats and the oxygen it breathes into heat sound and kinetic energy

A car is a system that converts chemical energy from the gasoline and the oxygen it uses into heat, sound and kinetic energy

There are many different kinds of systems which convert one form of energy into another Any form of energy can be changed into any other form of energy with the right energy converting system

Batteries buzzers and light bulbs are energy converting systems

Take the materials out of the kit

Now look at the picture at the right

Use the wires to connect the batteries to the light bulb and to the buzzer When all of the connections are made correctly the light bulb will go on and the buzzer will buzz

A battery is an energy converting system that changes chemical energy into electrical energy

A light bulb converts electrical energy into two other forms of energy These forms of energy are light and heat energy

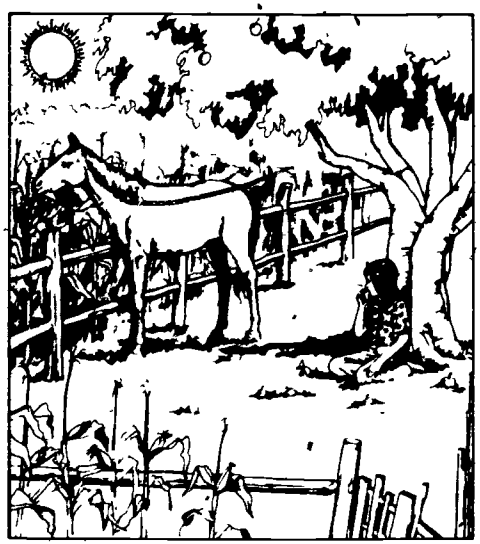
A buzzer converts electrical energy into sound energy and a little heat energy



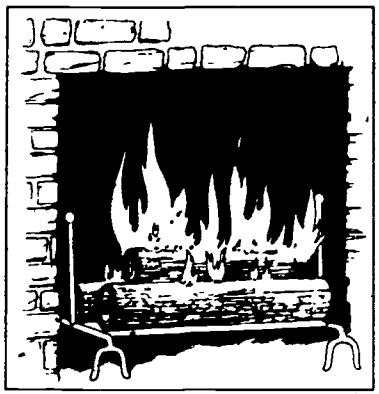
Figure 5.

Illustration of a Didactic Instructional Strategy: "Joule Lesson 5, Energy Converting Systems" (excerpt), from Champagne and Klopfer, 1974a.

Plants are important energy-converting systems. Plants use light energy from the sun to convert carbon dioxide from the air and water from the ground into oxygen and food (apples, corn, and grass, for example). The oxygen and food produced by plants are a system that has chemical energy stored in it.



Animals are energy-converting systems too. Animals convert chemical energy from the food they eat and the oxygen they breathe into heat energy that keeps their bodies warm and into kinetic energy for moving about and doing things. They also convert chemical energy into sound energy when they make noises.



1 When logs burn in a fireplace, what two chemical substances interact to release energy?

2 What form of energy is stored in a wood-oxygen system?

3 When the chemical substances in a wood-oxygen system interact, chemical energy is converted into other forms of energy. What are they?

Write your answers to all the numbered questions on your answer sheet.

Fig. 5 (continued)

individualized SCIENCE

Level E

Joule MinEx 3

# How Can You Make a System To Convert Heat Energy into Kinetic Energy?

Things you will need for this MinEx

pencil

science notebook

*from Central Supply*

scissors

small pie pan

50 ml plastic beaker

paper towel

*from Teacher's Supply*

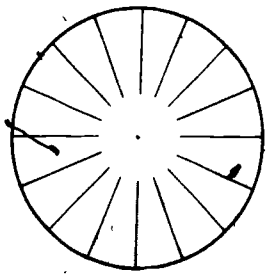
hotplate

NOTE: If you have a different plan for answering the question talk about your plan with your teacher



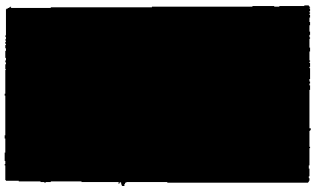
## *This is what Amy did.*

First Amy got a small pie pan. She cut around the bottom of the pan with a pair of scissors. In this way she cut out a circle of aluminum.



Amy made 16 equally spaced cuts in the aluminum circle. She was careful not to cut all the way to the middle.

Amy twisted each of the 16 blades a half turn in the same direction.



Then Amy pushed a map pin through the center of the aluminum wheel. She then pushed the pin into a long stick so the blades of the wheel pointed out.

Then she set the stick and aluminum circle aside while she prepared the rest of her system.

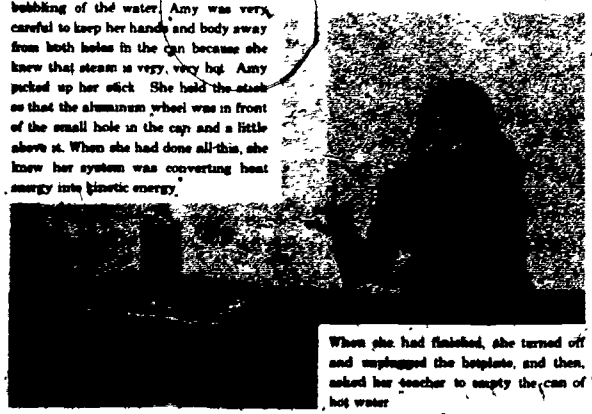
Figure 6.

Illustration of a Type of Problem-Solving Strategy: "Joule MinEx 3, How Can You Make a System to Convert Heat Energy into Kinetic Energy?" from Champagne and Klopfer, 1974a.

Amy got a can with an opening in the top and a small hole in its side. She poured about 50 ml of water into the can.

Then she put a stopper in the top of the can to seal it.

Amy set the can on the hotplate and turned on the hotplate. She set the hotplate dial at 4. When she heard the bubbling of the water, Amy was very careful to keep her hands and body away from both holes in the can because she knew that steam is very, very hot. Amy picked up her stick. She held the stick so that the aluminum wheel was in front of the small hole in the can and a little above it. When she had done all this, she knew her system was converting heat energy into kinetic energy.



When she had finished, she turned off and unplugged the hotplate, and then, asked her teacher to empty the can of hot water.

## *Can you think of another system to convert heat energy into kinetic energy?*

If you try Amy's system, make sure that you are as careful as Amy was when working with steam. Remember to ask your teacher to empty the can of hot water when you are ready to clean up. You can keep your aluminum wheel.

What kind of energy conversion takes place in the can-and-wheel system?

### Some Things To Write About

1. What form of energy does the aluminum wheel have when it is turning? How do you know?
2. What form of energy is added to the water in the can-and-wheel system? Where does this energy come from?
3. What kind of energy conversion takes place in the hotplate?

### Some Things To Think About

1. Does the steam coming out of the hole in the can have energy? How do you know?
2. Why are there two holes in the can? Why do you put a stopper in the large hole?

### Suggestions for Other Investigations

1. Set up your system again. Hold the aluminum wheel so that the steam hits the wheel in different ways. How should you hold the wheel so that it turns the fastest? When does it have the most kinetic energy?
2. Make wheels with blades that have different shapes and test them with your system. With what shape of blade does the wheel turn fastest?

Fig. 6 (continued)

Level E Joule Lesson 12

## A Seminar on Energy

You will need your science notebook and a pencil.

What is a seminar? What happens at a seminar? This lesson will help you understand what a seminar is.

A seminar is a meeting of a group of people to report, to discuss, and to exchange ideas on a central topic. In a science seminar, scientists meet to talk about a scientific idea or question that interests all of them. Each scientist brings information to the seminar to share with the other scientists. Each scientist hopes to learn about some new ideas by taking part in the seminar. By sharing the information each scientist has found through his or her work, they hope to gain a better understanding of the question.

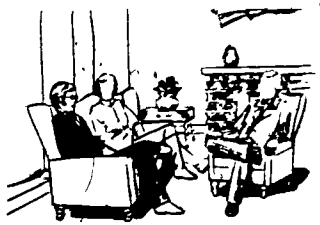
You could compare the way scientists work together in a seminar to a group of people planning a party. The party planners are interested in this question: What can we do so our friends will enjoy themselves at our party? The planners meet and combine their talents to work out an answer to the question. One person makes cupcakes and another makes punch. A third person decorates the party room and a fourth brings a record collection. By working as a group, the planners solve the problem of throwing a good party more easily than if one person planned the party alone.

### The Seminar

This seminar will be an informal gathering of three scientists meeting to discuss a specific topic. Since it is informal there will be no discussion leader to direct the order of comments from the scientists.

Place: St. Louis, Missouri
Setting: Parlor in the home of the wealthy Doctor William Beaumont
Time: 1850

William Beaumont would have been a dear old man of 65 years when James Joule was 32 years old and had published papers on the conservation of energy, and when Carl Voit was only 19 years old and had yet to do his studies of nutrition. But let's imagine that all three scientists are of similar ages and have achieved success in their fields of study.



The seminar begins with the scientists sitting comfortably and talking earnestly.

Voit (V): The topic for our seminar today is the relationship between the food an animal eats and the animal's need for energy.

Joule (J): The work of many scientists has contributed to our understanding of how chemical energy stored in food and oxygen is converted by the body into heat energy and kinetic energy.

### Introduction to the Seminar

The Level E seminar is a lot like an actual seminar scientists hold. Joule, Beaumont, and Voit are meeting to talk about this question: How is the food an animal eats related to the quantity of energy the animal uses?

Each man has done different work that is related to the seminar question. Joule studied energy. He found that energy is not lost or gained when it is converted from one form to another. Voit studied one particular energy-converting system, the human body. He tried to find a relationship between the chemical energy stored in the food an animal eats and in the oxygen it breathes and the amount of heat energy an animal's body releases. Beaumont looked inside a human being's stomach and observed the way food is digested.

While the three scientists in the Level E seminar share what they know about the seminar question, they gradually learn more about the relationship between the food an animal eats and the energy it uses. Joule's work concerning the conservation of energy is helpful to Voit. Since Joule showed that energy is neither lost nor gained as it is converted from one form to another, Voit can say that the amount of chemical energy stored in the food an animal eats and in the oxygen it breathes is the same as the amount of heat energy its body gives off. Some chemical energy is converted into kinetic energy in the animal's body. This kinetic energy is later converted to heat energy. Even though the chemical energy in the food and oxygen is converted in the animal's body into other forms of energy (heat and kinetic), the amount of energy remains the same.

Figure 7.

Illustration of a Type of Simulation Instructional Strategy: "Joule Lesson 12, A Seminar on Energy" (excerpt), from Champagne and Klopfer, 1974a.

**Beaumont (B)** But my work on digestion was most important. I showed how the body digests the food

J (Joule says with respect.) Yes Dr Beaumont but surely you must agree that Dr Vort's studies with the human calorimeter are important too

V And your idea of energy conservation Mr Joule Without that the calorimeter studies are meaningless

B Calorimeter? I am familiar with Lavoisier's studies using a calorimeter but I know nothing of yours

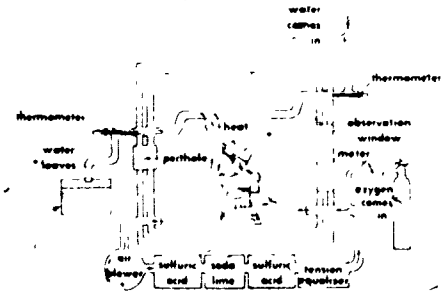
V May I describe a human calorimeter to you?

B Yes please do

V This calorimeter is much like Lavoisier's But with it we are able to make much more exact measurements than Lavoisier

J Ah yes accurate measurements Accuracy that's the secret

V Here gentlemen is a picture of a human calorimeter






As you can see it is large enough for a person to sit in (Vort points to the person in the picture.) The person gives off heat (He points to arrows and the word heat.)

There are two thermometers in the calorimeter One is on the right (he points) and one is on the left (he points) The thermometer on the right measures the temperature of the water going into the calorimeter The thermometer on the left measures the water's temperature as the water leaves

B And the temperature of the water that leaves is higher than the temperature of the water that enters? The heat from the person raises the temperature of water as it passes through the room?

V Yes The calorimeter is made so that none of the heat escapes through the walls So you see my calorimeter is an energy tight system

B What is so startling about all this? Everyone knows a person gives off heat

V With this calorimeter Dr Beaumont we can measure how much heat energy is given off when the person eats different foods

B Now that interests me After all I am the expert on how food is digested in the stomach So you are saying that as food is digested heat energy is made by the body

J I don't think Dr Vort means that at all Dr Beaumont Heat energy is not made by the body The human body converts chemical energy stored in food and oxygen into heat energy Energy is conserved it can't be made or destroyed Energy can only be converted from one form to another

B Please explain what you mean Mr Joule I really don't see how all this talk about energy fits in with my brilliant studies of digestion

J You may think of the human body as an energy converting system The food we eat is changed by the body

10

B That Mr Joule I alone have observed with my own eyes

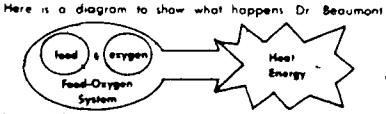
V Yes but as I have demonstrated when the body changes the food we eat energy is released

J You see foods are made up of different kinds of chemical substances Chemical systems have stored energy This simply means that when chemical substances interact the energy stored in them will be released

B What are these chemical interactions you speak of?

J The chemical substances in foods interact with the oxygen a person breathes in Oxygen is a chemical substance too of course

V Here is a diagram to show what happens Dr Beaumont




Imagine the person in the calorimeter has eaten some food The chemical substances from this food (Vort points to food) interact with the oxygen (Vort points to oxygen) This is the food oxygen system (he points to the large circle) In the body the food oxygen system releases its stored energy Heat energy is given off (He points to Heat Energy)

J The main point is this Dr Beaumont The amount of energy stored in the food oxygen system is the same as the amount of heat energy released The body cannot make energy The body changes chemical energy into heat energy

B (Beaumont says to Vort.) Then the only energy that gets into the calorimeter is stored in the food oxygen system The only energy that comes out is heat energy You measure the heat energy that comes out

V Yes Mr Joule has explained that the energy going into a system equals the energy coming out from the system

11

Fig. 7 (continued)

level cognitive behaviors represent a greater challenge. Designing instructional strategies that teach people to take action on the basis of what they have learned in energy education is a challenge of an altogether different order of magnitude.

It cannot be assumed that providing students with information about energy and the shortage of energy necessarily will have any effect on their actions with regard to energy consumption. Indeed, it has been the finding of educators in other fields where a goal of education is to change people's behaviors, e.g., nutrition, that providing people with information does not change their behaviors (see, for example, Hochbaum, 1977). Behaviors related to energy consumption, like those related to eating, are, in general, habitual, requiring no deliberate attention from the individual. To achieve the goal of changing students' behaviors with respect to energy consumption, the instructional strategies of an energy education program must take this habitual nature of many of these behaviors into account.

As a first step toward changing these behaviors, students should be made aware of their habits of using energy, i.e., these behaviors must be brought into the realm of conscious attention and decision-making. Further, instructional strategies should make provision for guiding students in the process of making responsible, informed decisions about their use of energy. And, just as it is true that a decision-maker who must choose a program of energy education must make this decision on the basis of what is valued, so a student making a decision about his or her use of energy must also make this decision on the basis of what he or she values. This implies that the instructional strategies of an energy education program will need to be concerned with helping children identify and clarify their own values. This further implies that the student should not merely be asked to state his or her values with respect to energy, but also that the student be aided in the process of identifying and clarifying such goals.[9] Especially important in a program with the goal of changing students' behaviors or actions is the opportunity for students to set goals for themselves, on the basis of their own values. Goals are "indispensable for action" (Kreitler & Kreitler, 1976, p. 103) and are necessary links between beliefs and values, on the one hand, and actions, on the other.

The clarifying of values and the setting of goals can be viewed as prerequisites to an individual's changing his or her habits of energy consumption. Such a goal might be broad and altruistic; for example, "I would like to conserve energy for the sake of future generations." More relevant to the student and, therefore, probably more effective in changing the student's behavior, would be a goal such as "I would like to reduce my family's utility bills." In any case, having formulated a goal, the student can then go about the process of making responsible decisions about energy consumption.

The foregoing discussion suggests a number of questions to be considered in designing the instructional strategies of a program of energy education. We have listed a sampling of such questions in Table 3.

Not only must an instructional strategy be appropriate to the desired behavior, it must also be appropriate to the learner characteristics of the target population of students, and it must make adequate provision

Table 3

Instructional Strategies

1. Are the instructional strategies well matched to the learnings?
2. Is provision made for students to examine their own habits of energy consumption?
3. Are opportunities provided for the student to examine his or her own beliefs and values with respect to energy consumption?
4. Are techniques for setting personal goals with respect to energy consumption suggested to the student?
5. Are means of evaluating the consequences of his or her own goals with respect to energy consumption provided to the student?
6. Is the student provided with the information needed to plan ways of achieving his or her own goals with respect to energy consumption?
7. Is the student provided with strategies for selecting or planning ways of attaining his or her goals?
8. Is the student provided with means of evaluating the attainment of his or her goals?
9. Which principles of learning theory are applied in the instructional strategies of the program?
10. Is the process of reaching desired outcomes consistent with the instructional strategies?
11. Which instructional strategies are used to enable the students to acquire a functional understanding of concepts, principles, and theories?
12. Does the program include appropriate instructional strategies that enable the students to develop skills in problem solving?
13. Is a sufficient variety of instructional strategies used in the program?

Table 4

Instructional Materials

A. Adaptability to Learner Characteristics

1. Is the content to be learned appropriate to the ability and cognitive developmental level of the target population of students?
2. Are the skills to be taught appropriate to abilities and cognitive developmental level of the target population of students?
3. Do the instructional materials make realistic, rather than unrealistic, demands on the students' cognitive or manipulative skills?
4. How are the students' interest and active involvement with the instructional materials maintained?
5. Are the instructional materials selected or designed in such a way as to be adaptive to a variety of learner sensory modes?
6. Are illustrations and/or photographs appropriate for the developmental level of the student and for the kinds of pictorial information conveyed?
7. Are the design, format, artwork, and style of presentation likely to be appealing to students of the age level and environment for which the materials are intended?

B. Instructional Design Characteristics

1. What is the relationship between the stated instructional outcomes and the instructional materials?
2. Is the design of instructional strategies consistent with what is known about learning?
3. What attempts are made to share the objectives of the program with the student via the instructional materials?
4. Are the instructional materials adequate to enable the student to attain the instructional objectives?
5. Do the instructional materials provide the student with opportunity to practice the skills and behaviors of the program's stated outcomes?
6. Is provision made in the instructional materials to provide the student with adequate feedback on his performance?
7. Are the media of the various instructional materials appropriate for the kinds of information they are intended to convey? For example, is auditory information presented aurally; have appropriate media been chosen to present various kinds of visual information?
8. Are instructions to the student within the instructional materials clear and easily understood?

C. Sequencing

1. Is the sequencing of the instruction clear and based on some readily definable theoretical model?
2. Is the sequencing of instruction appropriate for the kind of learning (e.g., process, cognitive) the instructional materials are designed to teach?
3. Does the introduction to instruction begin with an experience or concept that is likely to be a part of the student's experience?
4. Does the introduction to instruction refer back to previous instruction in the sequence?
5. Are there adequate directions for the student to follow in proceeding from one part of the instructional materials to another part?
6. What kind of provision is made for assessing the students' performance during and at the end of the instructional sequence?
7. Is there an adequate summary in each of the instructional materials and a hint to the student of what will come next in the instruction?

D. Consistency, Accuracy, and Values

1. Are the facts, information and interpretations of ideas included in the instructional materials correct or in accordance with the best current thinking on the topic?
2. Are the several components of the instructional materials free from inconsistencies (e.g., between directions for using manipulatives and the manipulatives themselves; between manipulatives and printed materials)?
3. Is the "tone" of the instructional materials consistent with the goals of the program (e.g., Are instructional materials designed to persuade the student to adopt a set of behaviors regarding energy use free from a tone which deprecates the student)?
4. Are the instructional materials free from obvious or subtle sexual, social or racial bias?
5. From what moral and/or political perspective are values presented in the instructional materials?
6. Is information related to values presented honestly and realistically rather than overstated in an attempt to persuade the student of the "correctness" of a particular position?
7. Are the values expressed directly or indirectly in the instructional materials identified as such to the learner?
8. Are materials free from evidence of supporting the policies of any special interest group?
9. What affective outcomes are the instructional materials likely to produce in the student?

Table 4 (continued)

E. Printed Instructional Materials

1. Is the print medium appropriate for the behaviors being taught?
2. Is the reading level appropriate for students in the target population with respect to vocabulary, organization of ideas, and structure of sentences?
3. What provisions are made for students whose reading level is below the grade level for which the materials are intended?
4. Are the illustrations, tables, and/or photographs instructive and appropriate to the text, and labeled properly and clearly? Do they convey accurate information?
5. Is the layout of the printed page attractive, easy to read, and instructionally functional (e.g., an illustration placed near text that refers to it)?
6. Are the printed typefaces clear, easy to read, and large enough for the students who will use the instructional materials?

F. Non-Print Media

1. Is the medium selected the most appropriate one for attaining the expected student behaviors and for presenting the topic being taught?
2. Is the medium selected the least expensive one that can adequately present the topic or concept?
3. Is the audiotape or recording of sufficiently good technical quality?
4. Is the language level of the narration in the audiotape or recording appropriate for the students in the target population?
5. Are the voices used in the audiotape or recording generally pleasant and distinct?
6. Do the sound effects used in the audiotape or recording support and enhance the narration?
7. If music is used in the audiotape or recording, is it properly "mixed" with the narration?
8. Is the pacing of the audiotape or recording satisfactory for students in the target population?
9. Does the audiotape or recording continue to produce sound of good quality after extensive use?
10. Are the visuals of the film, filmstrip, filmloop, or videotape technically well done?
11. Is the pacing of the film, filmstrip, filmloop, or videotape appropriate for students in the target population?
12. Do the visuals used in the film, filmstrip, filmloop, or videotape relate well to the accompanying audio portion?
13. Do the visuals in the film, filmstrip, filmloop, or videotape communicate the concept they are depicting (e.g., art depicting speed should convey the notion of motion)?

G. Manipulatives

1. Can most students in the target population (successfully) use the manipulative to carry out the program's specified operations with it?
2. Have the manipulative materials been selected and/or designed in accordance with what research has shown to be appropriate for the manipulative abilities of the target population?
3. Does the design of the manipulative enhance the possibility of its proper use?
4. Is the manipulative or apparatus designed so that it is self-instructional?
5. Are the sensitivity and accuracy of the apparatus adequate for the uses to which it will be put?
6. Does the manipulative have potential for general use in the classroom?
7. What is the life expectancy of the manipulative or apparatus in normal use?
8. Are manipulatives sufficiently sturdy to resist damage when dropped?
9. Are manipulatives made from non-toxic, flame-resistant materials?
10. Are manipulatives free from potentially dangerous sharp and pointed edges?
11. Is the manipulative or apparatus the least expensive one available that will function adequately?
12. If the manipulative is designed especially for the program, is there an essentially equivalent one commercially available that will function adequately?

for the individual differences and needs of individual children. So too, the instructional materials must be designed and produced to fit the learner characteristics of the target population and have built-in mechanisms for accommodating to different individuals' learner characteristics.

The questions in Table 4 are included to provide a framework for consideration of issues relating to student instructional materials. Characteristics of the target population which can be predicted with a moderate degree of accuracy include level of reading ability, level of cognitive development, level of motor skill development, and achievement level in mathematics. Materials should be developed to match what is generally known about the level of development or achievement of each of these characteristics in the target population. However, even within a well-defined population, children will exhibit these characteristics to greater or lesser degrees. A well-designed program will make provisions for these individual differences. As an example we can cite the use of read-along audio tapes designed to accompany printed instructional materials. The printed materials are written for children who are reading at grade level. The audio tapes represent an accommodation to the individual needs of those children who are reading below grade level.

There are other ways in which children's learning requirements differ that are not predictable simply by knowing the characteristics of the population of which the student is a member. Students differ in the sensory mode by which they learn information best, some gaining more information from listening and others from reading or from TV or movies.

Children also exhibit preferences for different social settings for learning. Some prefer to learn by themselves, others are more satisfied learning by interacting with others--the teacher or their peers. An important point for consideration in any educational program is the extent to which accommodations for these and other differences are made in the instructional materials.[10]

There are both theoretical and technical considerations that should be given to the design and production of print media, illustrations, visuals, sound recordings and films. The selection of these to fulfill specified instructional requirements should show the awareness and use in teaching for specified outcomes.[11] Sections E, F, and G of Table 4 contain questions which pertain to the level of technical quality of the instructional materials. These questions focus on the issue of whether the materials have been produced carefully or whether slipshod techniques were used. Some specific questions listed in these sections of Table 4 may appear to be extremely trifling. Nevertheless, in the aggregate, these questions are very important. Technical quality can either enhance or limit the effectiveness of instructional materials and the instructional strategies which are used in them.

## The Teacher

The teacher is the single most important element in an educational endeavor. Without competent, committed teachers, even the best-conceived and most carefully developed educational program cannot be successful. Provisions must be made in educational programs to provide teachers with

Table 5

The Teacher

A. The Teacher and Energy Education

1. How familiar is the teacher with the subject matter content?
2. How well can the teacher apply her or his knowledge of the particular concepts, principles, and theories included in the program to new or unfamiliar situations in everyday life?
3. What is the teacher's attitude toward energy education?
4. What does the teacher believe about the value of energy education in contemporary culture?
5. Does the teacher enjoy learning about energy education and keeping abreast of current developments in it?
6. Is the teacher capable of providing the instruction necessary to teach the complex skills that are defined as outcomes for the program?
7. Does the teacher possess the necessary manual skills to assemble and use the equipment and apparatus of the program and to perform the included laboratory procedures?
8. Is the teacher able to conceptualize, arrange, and successfully carry out the investigations and laboratory experimental exercises included in the program?
9. How good is the match between the teacher's personal philosophy of education and the philosophy, goals, and specifications for the classroom environment?
10. Is the teacher reasonably well convinced that her or his students can perform well in the program and that they will like it?
11. Is there any part or component of the program with which the teacher disagrees or feels she or he does not understand well enough?
12. Does the teacher feel confident that she or he can organize, arrange, and adapt the furnishings, equipment, and other physical features of her or his classroom into a viable learning environment for the program?
13. Are there adequate directions to the teacher for assembling, preparing, setting up, and using the manipulative materials and equipment?
14. Is the teacher secure about her or his school's administrative support for her or his use of the program?
15. Does the teacher perceive that the teacher preparation program has been adequate for her or his needs in using the energy education program?
16. Does the teacher think that the program's teacher instructional materials give her or him a sufficient orientation to operate the program in the classroom?
17. Does the teacher think that the program stifles her or his own initiative and creativity to an intolerable degree?

B. Teacher Preparation for the Energy Education Program

1. Are the rationale and organization of the teacher preparation program consistent with the goals of the energy education program?
2. Are the teacher instructional materials and other instructional means and techniques used in the teacher preparation program appropriate for attaining the objectives of the teacher preparation program?
3. Is sufficient instruction provided in the teacher preparation program for the teachers to acquire confidence in performing the management and procedural tasks required by the energy education program?
4. Has the essential background knowledge that teachers need to operate successfully with the program been identified and made known to the teachers?
5. Are there adequate means and mechanisms included in the teacher preparation program for remediating any deficiencies between the teachers' assessed competencies and the essential information needed to operate successfully with the program?
6. Is the atmosphere prevailing in the teacher preparation program congruent with the atmosphere of the classroom learning environment espoused by the energy education program?
7. Does the teacher preparation program offer the teachers sufficient opportunities to work with all the various student materials of the energy education program?
8. How well does the teacher preparation program provide for the evaluation of the teachers' learning about the energy education program during the course of the preparation program?
9. Is the teacher preparation program successful in conveying to the teachers the "spirit" of the energy education program?
10. Do the teachers demonstrate a favorable attitude toward the energy education program before and after the teacher preparation program?

Table 5 (continued)

C. Materials for Teachers

1. Do the contents of the teacher materials give a fair and consistent representation of the program's philosophy, goals, organization, and content?
2. Are the media (print, non-print, manipulatives) of the teacher materials appropriate for the objectives they are intended to achieve?
3. Is the "tone" of the teacher materials consistent with the philosophy and goals of the program?
4. Is there a clear and rational organization in the teacher materials?
5. Are there adequate directions for how to proceed from one part of the teacher materials to the next part?
6. Do the teacher materials include sufficient provisions for sharing the objectives of the instruction with the teacher using the materials?
7. Are the provisions made in the teacher materials to give feedback to the teacher using them on her or his progress in attaining the objectives of the instruction?
8. What provisions are made for maintaining the teacher's utilization of the teacher materials?
9. Is the information contained in the teacher materials correct?
10. Are the illustrations, tables, and diagrams instructive and correctly matched to the text in printed teacher materials?
11. Are the art work, photographs, and page designs of printed teacher materials attractive and appropriate?

adequate preparation for the task of implementing the program and for continued support during the implementation process.

The implementation of energy education programs will represent a challenge even to the most experienced and creative teacher. The multidisciplinary character of the energy dilemma and the need to provide experiences that will give students opportunities to define their personal goals, clarify values, and examine their behaviors combine to make energy education a major undertaking for the teacher. To experience success, the teacher must be committed to energy education, be knowledgeable in several academic disciplines, be able to integrate this knowledge and bring it to bear on the energy dilemma, and be competent to teach for complex skill attainment and positive attitude development. We can predict that, in large measure, the initial success of an energy program will be determined by the extent to which the teacher preparation program is successful in helping teachers develop these attitudes and competencies. Section B of Table 5 contains some specific questions relating to the conceptualization of a teacher preparation program for energy education.

Section A of Table 5 addresses several interrelated issues pertaining more directly to the teacher's personal role in an energy education program. The questions in Section A provide a framework for assessing the teacher's potential for experiencing success in an energy education program. The teacher's success will be determined in part by his or her own abilities and characteristics and in part by factors external to the teacher. Both the teacher and the situation in which he or she will be teaching should be carefully considered when selecting teachers for participation in a program. No amount of preparation or inservice support can overcome the deficiencies of a poorly trained teacher or the resistance of the reluctant teacher. Questions related to the personal characteristics of teachers can also be used as a basis for diagnosing the needs of teachers who are being prepared for teaching in energy education programs.

Other questions in Section A of Table 5 examine factors external to the teacher which will impinge on the teacher and influence her or his success. Some of these factors include the administrative support the teacher can expect, and the physical classroom facilities, equipment, and other services available to the teacher. Even a well-prepared and highly motivated teacher can become discouraged and experience failure in the face of a difficult teaching situation.

Another issue, one addressed by the questions in Section C of Table 5, concerns the adequacy of the program's teacher materials to provide the teacher with continuing information and support during the implementation process. Teaching a new program requires the learning of much more information and the development of new teaching skills. More learning is required than can be absorbed in the time usually allotted to teacher preparation programs. Therefore, much of the information presented during the teacher preparation program must be available to the teacher when she or he is back in the classroom. A well-designed manual containing carefully selected and written information can provide the teacher with ongoing support. For example, sufficient information on the subject matter content should be provided to help the teacher feel confident that the necessary information is readily available to cover most classroom situations. Figure 8 shows an excerpt from the Joule Unit Science Content

## *Joule Unit Science Content Overview*

In seeking to describe the nature of the universe, scientists have found it useful to conceive of two basic components, matter and energy That much is easy enough to say, but to fully and precisely define "matter" or "energy" turns out to be far from easy Both of these concepts are subtle and elusive In this discussion, the focus is on the concept of energy, the subject matter of the Joule unit As you will see near the end, however, a full discussion of energy cannot avoid the concept of matter, since there is an exact quantitative relationship between energy and mass, expressed in an equation that relates the two basic components of the universe

### Energy

In the Joule unit, your students are introduced to the concept of energy by noting the changes that occur in a system when energy is added to the system or when a system converts one form of energy to another form of energy

Certain forms of energy can be observed in a system when the energy is transferred from one object to another A rapidly moving hammer transfers its energy of motion (kinetic energy) to the nail it strikes The hammer stops moving when it hits the nail, and the nail moves into the wood Light energy striking a glass of iced lemonade is converted or changed to heat energy The ice in the lemonade melts and, eventually, the temperature of the lemonade increases Kinetic, sound, electrical, heat, and light energy can all be observed to effect changes as they are transferred from one physical object to another

Other physical systems have stored energy by virtue of their position, state of stress, or chemical composition. The fact that energy is stored in these systems becomes obvious when energy is converted to another form and is transferred to another physical object.

Gravitational energy is stored in an object when the object is lifted upward To move the object, a force must be exerted through a distance Work is done on the object to store gravitational energy in the object

Elastic energy is stored in an object when that object is stretched or compressed To stretch or compress the object, a force must be exerted through a distance Work is done on the object and elastic energy is stored in the object

Chemical energy is the energy stored in two chemical substances An example of two chemical substances with chemical energy is hydrogen and oxygen When electrical energy is passed through liquid water, hydrogen gas and oxygen gas are formed Energy is stored in these two gases as they are formed, later, they can interact (hydrogen will burn as a fuel with oxygen) to release heat, light, and sound energy A single substance does not contain chemical energy Hydrogen by itself does not have chemical energy, it does not interact with itself to release energy When two chemical substances interact, their stored chemical energy is released

### Energy and Work

To store energy in any object or system, energy must be added to the system. To add energy to a system, work must be done on the system

In the Joule unit, the concept of work is taught only in the context of gravitational energy and elastic energy In this context, work is done when a force is exerted on an object, and the object moves in the direction of the force

However, you should be aware that, whenever energy is added to a system, work is done on the system For example, in the addition of electrical energy to water to form hydrogen gas and oxygen gas, work is done Whenever energy is transferred from one object to another, work is done

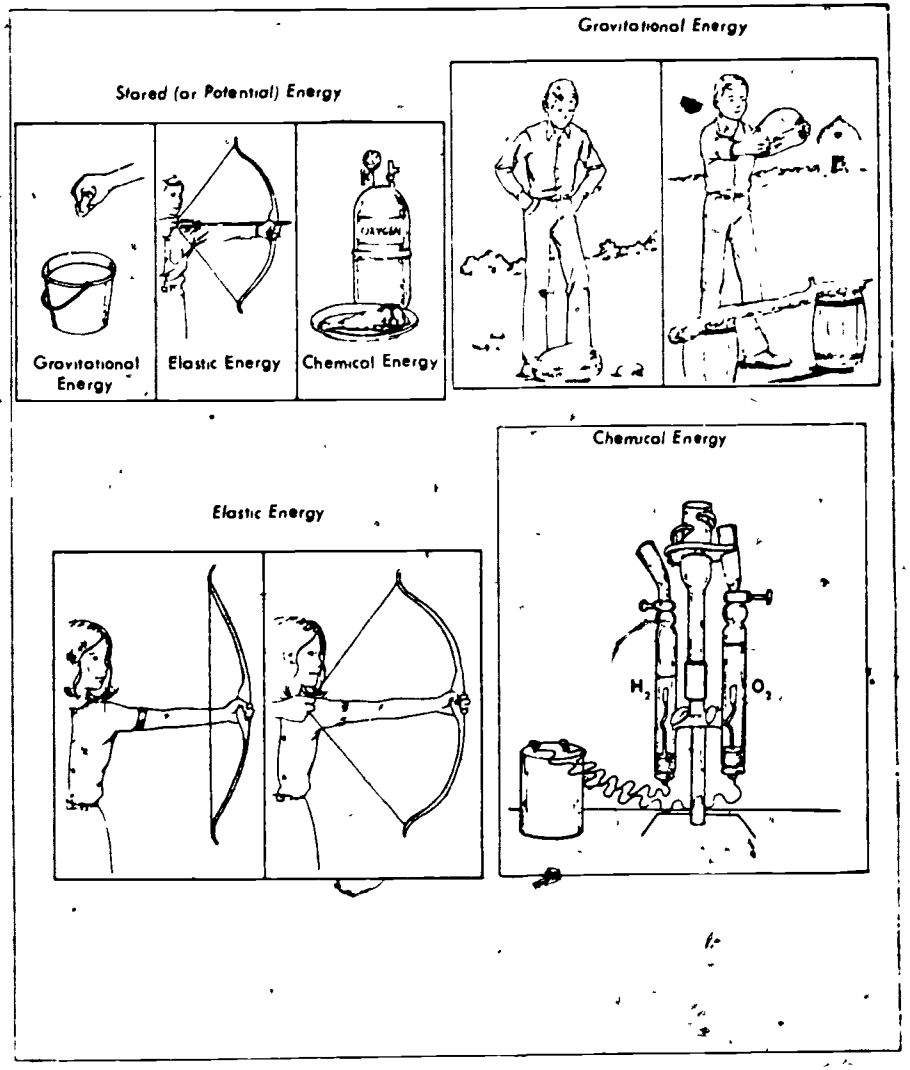



Figure 8

An Illustration of Materials for the Teacher. Joule Unit Science Content Overview (excerpt). Champagne and Klopfer, 1975

### Measurement of Energy

Different measuring units are used to express quantities of different forms of energy. In the Joule unit, the student is introduced only to the measurement of heat energy in kilocalories. Equal masses of different substances do not change their temperature equally when the same quantity of heat energy is added to them. For example, when equal quantities of heat are added to equal masses of water and alcohol, the temperature of the alcohol changes more than the temperature of the water. The kilocalorie, a measure of heat energy, is defined using water as a standard. To increase the temperature of 1 kilogram of water by 1 °C requires 1 kilocalorie of heat energy. To find the number of kilocalories (kcal) of heat added to any mass of water, one must multiply the mass of the water in kilograms (kg) by the change in temperature in °C and by the specific heat of water (the heat necessary to increase the temperature of 1 kg of water by 1 °C, i.e., 1 kcal).

heat energy = mass of water in kg × change in temperature in °C × specific heat of water

$$\text{kcal} = \text{kg} \times {}^{\circ}\text{C} \times \frac{1 \text{ kcal}}{1 \text{ kg } {}^{\circ}\text{C}}$$

While heat energy is measured in kilocalories, other forms of energy are measured using different measuring units. The mathematical relationships between the various energy measuring units are known, however, and there are calculations that equate different forms of energy that can be made. A measuring unit for kinetic energy is the joule, named to honor the scientist James Prescott Joule. One kilocalorie (heat energy) equals 4185 joules (kinetic energy). Using this relationship, a comparison can be made between the kinetic energy of a falling object and the chemical energy stored in sugar. Since 4185 joules = 1 kilocalorie, a 334,800-kilogram sphere falling with a velocity of 1 meter per second has the same energy as is stored in a tablespoon of sugar (40 kilocalories) and the oxygen needed to burn it.

1 kcal = 4185 joules

1 joule = $\text{kgm}^2/\text{sec}^2$

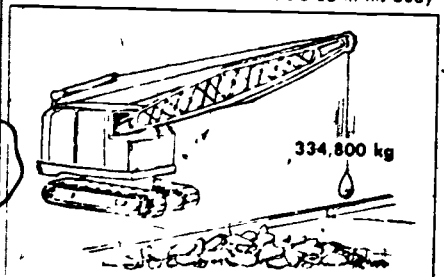
kinetic energy = $1/2$ (mass) $(\text{velocity})^2$

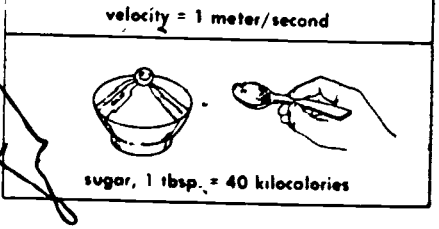
kinetic energy = 1/2 (334,800 kg) (1 $\text{m}/\text{sec})^2$

kinetic energy = 167,400 kg × (1 $\text{m}^2/\text{sec}^2$)

kinetic energy = 167,400 $\text{kgm}^2/\text{sec}^2$ or 167 400 joules or 40 kilocalories

Measurements of energy as it is converted from one form to another have convinced scientists that energy is always conserved. These measurements never show exactly equal quantities of energy before and after the conversion, but the difference is so small that the conservation of energy is the best explanation scientists can give. So far as known, no energy is lost in a conversion, and no energy is gained. There are countless examples of the conservation of energy in science, many of which have practical implications in everyday life. One must spend the energy stored in the chemical system made up of food and oxygen to get energy for bodily warmth and activity. The amount of energy that one gets from chemical substances in food depends on the mass and the kind of food that is eaten. If a person eats more food than he needs to get the energy to keep his body warm and to move the parts of the body, his body will convert the extra chemical substances in food into fat that is stored in his body.




### Sources of Energy

For human beings and other animals, food is the most important source of energy. For the earth, the sun is the most important energy source. Nuclear reactions on the sun release heat and light energy. This warmth and light gives our earth a constantly renewed supply of plant foods.

Coal and petroleum, two of our other sources of energy, were also produced by light energy from the sun. The formation of these substances required special conditions, though, there is little chance that they can be resupplied by the sun. As our supplies of coal and petroleum dwindle, scientists are exploring new energy sources, and we are constantly reminded not to waste the irreplaceable stores of these fuels that power our homes and industries.

Fig. 8 (continued)

Overview. The purpose of the Science Content Overview is to provide the teacher with background information about the science content taught in the Joule Unit.

The personal characteristics of the teacher and the type of school situation in which he or she is to use an energy education program are among the strongest influences on the success of a thoughtfully conceived program in the classroom. The teacher materials provided by an energy education program, however, will be vitally important in communicating to the teacher the attitudes, knowledge, and skills that are required in this new educational undertaking.

Student Assessment

Comparable in importance to the instructional strategies and materials of an energy education program are the provisions the program makes for assessing what students learn and how their out-of-school behaviors change. Well-designed instruction makes learning possible and provides opportunities for changes in students' behaviors to occur; well-designed assessment procedures increase the probability that students will acquire new knowledge and skills and that they will make use of the opportunities to develop new behaviors. Providing for the assessment of students' achievement or behavior in any aspect of an energy education program serves to focus the students' attention on that aspect--be it acquiring knowledge, learning problem-solving skills, clarifying values, developing attitudes, or making decisions. Aspects of the program in which students are not assessed tend to be ignored by the students and viewed as unimportant. If, for example, the energy education program seeks to improve the students' capabilities in making decisions about conserving energy but only provides for assessment of their knowledge of information about energy, the chances for realizing the outcome of improved decision-making capabilities are greatly decreased. Student assessment, then, is a key factor in determining the extent to which students will attain the desired outcomes specified by the program.

Procedures and instruments for student assessment fall into the area of educational measurement and evaluation, about which a good deal is known as a result of several decades of research and experience.[12] To provide for student assessment in an energy education program, it usually won't be necessary to invent something completely new. Rather, most of the needs for student assessment in energy education can be fulfilled by intelligently applying and adapting existing assessment procedures. Whether this has been done or will be done is an important question to raise about any particular extant or proposed energy education program. For a program that already has some provisions for student assessment, we would next inquire whether or not generally accepted assessment procedures and practices were employed.

Virtually all systematic assessment procedures begin with clear specifications of the objectives the student is to achieve. It is for this reason that, in the earlier section of this paper on goals and objectives, we insisted on the necessity of writing functional statements of objectives. The effort involved in making these statements as clear and precise as possible is worthwhile because they constitute the basis

Table 6

Student Assessment

A. Adequacy of Provisions for Assessing Desired Outcomes

1. Has a comprehensive list of desired student learning and behavioral outcomes been prepared?
2. What provisions have been made for assessing students' out-of-school behaviors as well as their in-school learnings?
3. Is there good correspondence between the program's specified outcomes and its student assessment procedures?
4. Is a reasonable proportion of all the desired learning and behavioral outcomes sampled by the assessment instruments and procedures used in the program?
5. Are the most valued learning and behavioral outcomes adequately assessed?
6. Do the assessment procedures make provision for testing relevant behaviors in all three domains (cognitive, affective, and psychomotor)?
7. Is there an overemphasis on the assessment of lower level behaviors in the cognitive domain?
8. Is there an overemphasis on the assessment of expressed attitudes?
9. Are students assessed on their ability to clarify their values and set goals with respect to energy consumption?
10. Are students assessed on their ability to apply their in-school learning about energy to out-of-school actions that decrease energy consumption?

B. Characteristics of the Assessment Procedures

1. Is the balance between assessment of students and self-assessment by the students a reasonable one?
2. What is the evidence that the program's designers are familiar with standard procedures and current practices in the area of educational measurement and evaluation?
3. Is excessive use made of traditional procedures for student assessment?
4. Are traditional assessment procedures applied intelligently?
5. Which innovative student assessment procedures are used?
6. Are the innovative assessment procedures used intelligently?
7. Do the student assessment procedures directly measure behaviors described by the objectives or are indirect measures used?
8. Where indirect measures are used to assess certain behaviors, are the measures valid?
9. Is the reliability of instruments used for student assessment satisfactory?
10. Have the items included in assessment instruments been carefully and correctly constructed?
11. Are the items included in assessment instruments free of racial, cultural, and sex-role biases?
12. How is the teacher involved in the student assessment procedures beyond the usual administration and scoring of paper and pencil tests?
13. How is information gained from student assessment procedures fed back into the instructional system?
14. Is a sufficient variety of procedures used to assess students?

C. The Student and Assessment

1. Do the assessment procedures serve as a positive learning experience for the student?
2. Will the student find that engaging in the assessment procedures is interesting, challenging, and satisfying?
3. Is the amount of student time devoted to assessment procedures excessive?
4. Is sufficient time allotted in the assessment procedures to make an adequate assessment of the student?
5. Do the students have the opportunity to learn to engage in and practice self-assessment?

for designing appropriate assessment procedures, and that task becomes much easier when there is a minimum of ambiguity about the learning and behavioral outcomes expected of students as a result of their experiences in the program. The statements of objectives should cover the full range of expected outcomes so that, taken all together, they can be used to define the total population of student learnings and behaviors which will be sampled by means of the assessment procedures. It is patently impossible to assess students on each and every desired outcome that an energy education program specifies, but it also is essential that no crucial or highly valued outcome goes unassessed. Hence, another key question about the adequacy of the assessment procedures concerns the extent to which the sampling of student learnings and behaviors which actually are assessed is balanced and represents the total population of desired outcomes. In Table 6 we have listed a number of additional questions that should be considered in judging the adequacy of student assessment procedures of an energy education program.

Two cautions must be kept in mind when confronting the matter of student assessment in energy education. First, student assessment is almost certain to be incomplete and inadequate if it deals only with learnings in the cognitive domain. The temptation to do this is strong, because assessment procedures and instruments are presently most fully developed in the cognitive domain, and because educators are most familiar with assessing cognitive learning and it seems safe. However, as we have argued throughout this paper, cognitive learning is merely one component of energy education. At least as important, and probably more so, are the development of problem-solving skills, clarification of values, improving capabilities in decision-making, and developing appropriate out-of-school behaviors with respect to energy conservation. Student learnings and behaviors in these aspects of energy education must also be assessed. Admittedly, procedures for such assessments are not so well developed as in the cognitive domain and a little more imagination and effort are required to carry them out. But, these are insufficient grounds for omitting student assessment in crucial aspects of energy education.

The second caution is to avoid reliance on student self-assessment as the sole assessment procedure where important aspects of energy education are concerned. All too often in instances when setting up a more systematic assessment procedure is difficult, cumbersome, or expensive, attempts at assessment are abandoned or students are asked to assess their own learning and behavior. Self-assessment alone is insufficient, however. We do believe that self-assessment of one's own learning is the best and ideal kind, in contrast with assessments externally imposed on individuals. In fact, we have been party to an instructional program which has the development of the ability to assess one's own learning very well in straightforward and clearly-defined situations.[13] But we also know that successful self-assessment involves specific skills that must be learned over a considerable period of time. Very few students have opportunities to learn these skills in schools today, so that very few are able to assess their own learning. This is true especially for situations where the learning or behavior is complex and the assessment criteria are ill-defined. These characteristics describe, it seems to us, many of the important desired outcomes of energy education, and we are not hopeful that self-assessment will be a highly successful assessment procedure with respect to them.

We are not recommending that self-assessment should not be used, but we do urge that it should not be relied upon as the only procedure. Here, as with other issues related to student assessment, good sense guided by reliable knowledge must prevail over expediency if an energy education program is to have the best chance for being effective.

Implementation

We have addressed in some detail the philosphical and theoretical issues that must be considered in designing an energy education program. The decisions that are made about these aspects of the program and the success with which these decisions are translated into classroom procedures and materials for the teacher and students represent one factor that will determine the extent to which the program is adopted for use in schools. Education is not, however, all theory and philosophy. The adoption and success of a program depend also on economic and practical considerations. The cost and the ease of implementation of a program, both at the school and classroom levels, are factors of major importance to school administrators and teachers.

A program with high initial or replacement costs or a program that makes excessive demands on school resources (classroom or storage space, time for teacher preparation, for example), is not likely to be adopted by the school. Questions that should be asked about both immediate direct costs and long-term indirect costs of a program are posed in Table 7, Section B.

A program that is difficult for the teacher to implement will not be used. The packaging of a program must be designed so that is is convenient for teachers and students to use. Table 7, Section A, addresses some very pragmatic issues that influence the ease of implementation of a program. Consideration of these issues in the process of designing a program can reduce the probability that the program will later have problems in adoption or implementation.

Program Evaluation

In the preceding sections of this paper, we have delineated a large variety of considerations about energy education that influence the effectiveness and success of an energy education program in schools. Questions about a program's rationale, goals, and objectives; its content and instructional strategies; and its provisions for the teacher, for student assessment, and for implementation represent considerations about the internal qualities of an existing or proposed program. In this section and the next, we turn to considerations external to an energy education program that are pertinent to making decisions about its actual or potential value.

Persons who are responsible today for making decisions about educational programs are fortunate. Unlike in the past when such decisions had to be made primarily on the basis of testimonial evidence and fortuitous observations, there is today an active area of evaluation research in education, one of whose primary purposes is to provide reliable information to educational decision-makers about how well educational programs "work."[14]

Table 7

Implementation

A. Packaging and Convenience (implementation at the classroom level)

1. Is the packaging of the program's instructional materials adequate for efficient classroom use?
2. Is the labelling of packages of materials and the various components of the program clear and unambiguous?
3. Are provisions made to facilitate returning items that have strayed to their proper places?
4. Are the program's instructional materials packaged and designed adequately for students to work with them on their own?
5. Are sufficient quantities of all items needed to operate the program supplied?
6. Is it easy to obtain those items needed to operate the program that are not supplied?
7. Can the program's instructional materials be readily and efficiently stored?
8. Is it easy to organize the program's instructional materials so that they will be accessible to the students and teacher when needed?
9. Is the teacher easily able to do the chores necessary to put the program into operation and to maintain it?
10. Can the materials of the program be easily handled and moved from place to place?
11. Are the manipulatives free of manufacturing defects that can cause difficulties in their use?
12. Is it a relatively simple procedure to obtain replacements of materials and expendable supplies?

B. Cost Considerations (implementation at the school level)

1. What is the purchase price of all the components of the program that are needed to install it initially?
2. What amounts of consumable supplies and printed materials are necessary for the program's operation?
3. What is the purchase price of all program components needed to maintain the program from year to year after it has been installed?
4. How does the annual per pupil cost for this program compare with the annual per pupil cost for others that are available?
5. To minimize the expense of duplication, can the program materials be readily transported for sharing between classrooms?
6. Will installation of the program require the construction of new facilities or modification of existing facilities?
7. What are the personnel costs for workshops and other sessions that are necessary to prepare teachers to use the program?
8. Will it be necessary to employ additional teachers or other personnel to put the program into operation?
9. Does the teacher preparation program for the program require unusual facilities or equipment?

Table 8

Program Evaluation

A. Evidence of Achievement of Program Goals

1. Does the student learn by engaging in the activities of the program?
2. How well does the student learn what the program designers intended him or her to learn?
3. How can the program be improved so that the student will learn better?
4. Does the student learn things from the program other than or more than what the designers intended he or she would learn?
5. Upon completion of his or her interaction with the program does the student demonstrate new behaviors?
6. Upon completion of his or her interaction with the program does the student demonstrate the behaviors that the materials purport to teach?
7. Does the student interact in the program in a way that is congruent with behaviors described by the program?
8. For any instructional unit, do students demonstrate mastery on paper and pencil tests after having studied the unit?
9. Do students reach the level of competency in out-of-school energy-related behaviors that are aimed for in the program?
10. To what extent do students attain the knowledge of facts, concepts, principles, and theories specified by the program?
11. To what extent do students comprehend the program's subject matter?
12. How well can students apply their knowledge of concepts, principles, and theories taught in the program to new or unfamiliar situations related to the energy dilemma?
13. How well can students apply their knowledge of concepts, principles, and theories taught in the program to situations in their daily lives?
14. How well do students integrate or synthesize specific content taught in the program with other knowledge they already possess?
15. Do students generate new ideas of their own based on their knowledge of particular concepts, principles, or theories taught in the program?
16. Do students apply rational decision-making procedures to energy-related problems?
17. How frequently do the students voluntarily participate in activities related to the energy dilemma?
18. Do the students develop the necessary manual skills to use the equipment specified by the program?

B. Evidence of Appropriateness of the Program for the Target Population

1. For any instructional unit, do pretest data show that most students in the target population are not already in possession of behaviors the unit will teach?
2. For any instructional unit, are the expected student behaviors generally too simple or too difficult for the students in the target population?
3. Does the student enjoy his or her interactions with the instructional materials?
4. Does the student dislike studying any of the instructional materials?
5. Do students show preferences for any particular type of learning procedure or instructional medium?
6. Does the student feel that what she or he is learning is worthwhile and/or relevant?
7. Does the student feel that what is presented is incongruent with his or her beliefs or values in any way?
8. Is there any lesson, activity, or procedure in the program that causes the student to act in a manner that can be interpreted as an indication that he or she is confused, anxious, troubled, or upset?
9. Does the student perceive that he or she is and/or can be successful within the context of the program?
10. Does the student feel that (s)he has the necessary capabilities to carry out the learning tasks (s)he is being asked to do?
11. How does the student react to unpredictable situations that may arise in the classroom?
12. Does the student welcome and/or look forward with pleasure to the time when (s)he has the program?
13. Does the student act in a manner that can be interpreted as indicating that (s)he is comfortable in the program? How frequently does he or she smile? How frequently does (s)he excitedly share new discoveries and ideas with others?

C. Adequacy of Program Evaluation Evidence

1. To what extent does the program evaluation provide evidence regarding the considerations delineated in sections A and B of this table?
2. To what extent does the program evaluation provide evidence regarding considerations about the program's content (see questions in Table 2), instructional strategies (Table 3 and 4), provisions for the teacher (Table 5), provisions for student assessment (Table 6), and implementation (Table 7)?
3. Does the program evaluation consider how well the assumptions of the program match the beliefs of various types of communities?
4. Does the program evaluation consider which of the program's goals, if any, are incongruent with the social, economic, or political views of significant groups of people?
5. How much and what kinds of evidence does the program evaluation provide about the achievement of each of the program's goals?
6. Is the evidence presented in the evaluation report based on a formative or a summative evaluation of the program?
7. Is the design of the evaluation study described completely?
8. What are the strengths and weaknesses of the sampling procedures?
9. To what extent can the findings of the evaluation be generalized?
10. Were the statistical analysis procedures carefully and correctly carried out?
11. Are data reported as percentages or proportions to mask the fact that actual numerical sizes of samples were quite small?
12. Are elaborate graphs or extensive tables of data used to display trivial or not highly pertinent information?
13. If a revised version of the program exists, were the data presented in the evaluation report collected on a previous or the revised version of the program?

This is not the place for us to give a short course on the techniques and procedures used in program evaluation research, but we can point out that the findings from evaluation research represent the kinds of evidence that can serve as the basis for decisions about the value of a program. While program evaluation research findings are not the only evidence that a decision-maker should consider, she or he is fortunate to have them available.

Several kinds of evidence should be provided in the findings from an evaluation of an energy education program. First of all, there should be evidence about the extent to which the program's goals are achieved when it is used in schools. It is important that this evidence attends to all of the program's goals, not only to those that concern cognitive learning or those that are easy to test for. Our remarks on this score in the earlier section on student assessment pertain here also. There also should be evidence about the appropriateness of a program for the target population of students for whom it is intended. Similarly, there should be evidence about the appropriateness of the program for the target population of communities where it is intended to be used. In the accompanying Table 8, we have listed a number of questions that suggest the various kinds of evidence that educational decision-makers could expect to obtain from the evaluation of an energy education program.

Quite a number of factors affect the adequacy of the evidence that is reported in program evaluation research. One important factor is whether the reported evidence comes from a formative evaluation or from a summative evaluation of the program. We have written elsewhere (Champagne & Klopfer, 1974b) about the stages of and procedures for formative evaluations, which are conducted while the instructional materials of a program are in the process of development. Instructional materials generally are revised, sometimes radically, on the basis of formative evaluation findings, and such revisions may be made several times before the final version of the program's materials is produced. Summative evaluations are carried out when the final version of the program has been released to the general public. The point to be emphasized is this: reported evidence based on a formative evaluation of a program cannot be unequivocally accepted as evidence about the quality of the program's final, publicly-released version. The reason is that the instructional materials in the publicly-released version may be quite different from those used at the time of the formative evaluation. When a research report is not clear about the basis of its evidence on either a formative or summative evaluation, the reported evidence is inadequate. Other factors that can contribute to the inadequacy of reported evidence are suggested by the questions we've listed in the second section of Table 8. Educational decision-makers should be aware of these factors; yet, if the caveats are heeded, evidence reported from program evaluation research can play an important role in making decisions about the value of an energy education program.

Although we believe that evidence from program evaluation research can be very valuable in making decisions about the value of an energy education program; we do not take the position that research evidence is all that decision-makers ought to consider, especially when they are deciding whether or not to select a certain program for use in a school. An important

aspect of decision-making in this situation is to determine the extent to which the program's assumptions are consistent with the beliefs of the people in the community where it is to be implemented, and to consider carefully the implications of implementing an energy education program in a community where its assumptions and the community's beliefs are incongruent. If, for example, a program is based on the assumption that governmental control of an individual's energy consumption is right and proper, it can be assumed that the program will meet with some form of opposition in a politically conservative community. More liberal communities might find unacceptable any program that does not explicitly state the assumptions on which it is based or fails to give the learner the opportunity to examine critically each of the assumptions. On the other hand, communities dedicated to energy conservation might not require that a program adopted for their schools critically evaluate assumptions which are consistent with the community's belief in energy conservation. The possible situations we've illustrated here call attention to the fact that making decisions about selecting an energy education program for implementation in schools is not a straightforward matter. Where decisions have to be made, values are involved.

## Designer and Development Team Qualifications

Our experiences and the experiences of others concerned with the design, development, analysis, and implementation of educational programs bear witness to the observation that the quality of any program that is produced strongly depends on the qualifications of the people who produce it. This observation is significant for making decisions about the value of an existing energy education program or the potential value of a proposed program. The chances of producing a superior program are greatly enhanced when well-qualified people are involved.

In the accompanying Table 9 we list some key questions concerning the qualifications of the designers and development team of a program in energy education. We are convinced that the requirements for effective energy education are so diverse and complex that a multi-talented team is needed to develop a good program, and this belief is reflected in our questions. We also are wary of external trappings of respectability or slick veneers, but prefer to look for evidence of substantial accomplishments, relevant experiences, and creativity. And, in addition to the personal qualifications of people, the support provided by the institution or organization which surrounds them is an essential component of designer qualifications.

Our consideration of designer qualifications might more appropriately have been placed near the beginning of this paper than at the end, for we firmly believe that the commitment of competent people and capable institutions is the single most important ingredient that is likely to make a difference in whether or not there will be effective energy education in schools. It is our hope that the ideas and suggestions we've given here will be useful to the singularly important men and women who are concerned with energy education and will help you take appropriate next steps.[15]

Table 9

Designer and Development Team Qualifications

A. Characteristics of the Major Designers

1. Is there evidence that the major designers have sufficient knowledge of the academic disciplines relevant to the program's content, instructional methodologies, and characteristics of the learner population, to develop a program of quality?
2. Do the major designers have a broad range of knowledge and experience to bring to the development effort?
3. What are the previous experiences of the major designers that provide a basis for their success in an energy education program development effort?
4. Is there evidence that the major designers are highly regarded by their peers?
5. Are major designers committed to a certain philosophy of education? A certain psychological theory? If so, which one?
6. Is there evidence (e.g., previous writings in the field, educational background) that the major designers have had a long-term commitment to energy education?

B. Characteristics of the Development Team

1. Does the development team include persons with adequate knowledge of the content from all the relevant academic disciplines?
2. Does the development team include persons who are well acquainted with goal-setting strategies and values clarification techniques?
3. Does the development team include persons with expertise in instructional design?
4. Does the development team include persons with extensive experiences in the schools?
5. Does the development team include persons who are well acquainted with the complexities of implementing a new educational program?
6. Does the development team include persons with extensive experience in designing student assessment procedures?
7. Does the development team include persons with expertise in the design of instructional media and materials?
8. Does the development team include persons with knowledge of procedures in publishing?
9. Does the development team include persons with experience in the formative evaluation of a program under development?
10. Does the development team include persons who are knowledgeable about the techniques and procedures of program evaluation research?

C. Resources Available to the Designers and Development Team

1. Are the designers and development team associated with an established academic or research institution?
2. Are the designers and development team associated with an organization having adequate prior experience in educational program development?
3. Are consultants representing a variety of academic and professional fields available to the developers?
4. Do the developers have easy access to children of the same age and learner characteristics as the program's target population?
5. Do the developers have easy access to schools representative of those for which the program is designed?
6. What library facilities are available to the developers?
7. What production facilities (art, photography, printing, woodworking) are available to the developers?
8. Are there sufficient financial resources available to the team to complete the development of the proposed program?
9. Will program development be a full time activity for the designers and development team?
10. Have the designers and development team sufficient time to complete the program as it is specified?

## FOOTNOTES

1 We limit our discussion of energy education to instructional materials and programs for students in schools. Providing for energy education, however, involves the school in more than its customary role of purveying knowledge. It also calls for effecting changes in the out-of-school behaviors of students, an outcome not included among the objectives of most instructional materials intended for use in the schools.

2 Some examples of each type of educational decision-maker we have in mind (purchaser, funder, and designer) and the kinds of public and private agencies with which they might be associated are presented here.

Persons concerned with purchase or adoption of energy education programs and instructional materials will most likely work with schools or state departments of education. Their professions include those of teacher, curriculum specialist, administrator, and adoption officer.

Persons concerned with the funding of energy education programs and materials will be found in a wide variety of agencies ranging from publishers, government agencies, and foundations to utility companies and consumer organizations. Their positions include those of executive editor, peer reviewer, and project director as well as that of consumer education specialist.

Persons concerned with the design of energy education programs and materials might be associated with schools, publishers, or educational research and development organizations. Persons affiliated with utility companies and consumer organizations might also have such design responsibilities. The positions of persons involved with energy education materials design include those of teacher, curriculum specialist, curriculum designer, and educational materials writer or editor.

3 The distinction we make between the terms instructional material and instructional program relies on our definition of an instructional material as any item, be it a manipulative or a printed material that is intended to be used for an instructional purpose. Our definition of instructional program, on the other hand, refers to a number of instructional materials integerated by means of an overall plan that directs how the materials are to be used in conjunction with one another toward the achievement of one or more instructional purposes. In the following sections of this paper we have generally used the terms instructional materials and instructional programs to refer to both ideas interchangeably. It will be clear from the context when a specific meaning is appropriate for one or another of the terms.

4 The literature on systematic instructional procedures is already quite large and is growing rapidly. For representative examples, see Travers, 1973; Resnich, Wang, and Kaplan, 1973; and Popham and Baker, 1970.

5 In addition to aiding communication and the assessment of the effects of instruction, stating educational objectives behaviorally facilitates

the selection of appropriate instructional strategies. (See page 189 of this paper.)

Benjamin Bloom was instrumental in providing educators and psychologists with an important tool, a taxonomic system for grouping together behaviors which have specified attributes in common. In this taxonomy behaviors are classified into three major groups called domains, according to whether they are primarily cognitive, affective, or psychomotor behaviors. Of course the division of behaviors into these three domains is an artificial distinction, since almost any behavior ordinarily is made up of cognitive, affective, and psychomotor elements. For example, behaviors relating to conserving energy in the home might rely partly on knowledge of ways to conserve energy, partly on the desire to conserve energy, and partly on the physical ability to perform tasks that aid in conserving energy, such as shutting off a light switch. Nevertheless, the classification of behaviors provides some extremely useful tools for educators.

Within each domain of the taxonomy, specific behaviors are arranged hierarchically in terms of their complexity. To illustrate this hierarchical arrangement, let us examine some examples of behavior from the cognitive domain. The first level of the cognitive domain is knowledge--behaviorally stated, the ability to recall specific information, e.g., knowledge of some ways that energy might be conserved in the home. The second level of the cognitive domain, comprehension, involves such behaviors as the ability to explain why insulating one's house will conserve energy. The third level, application, is exemplified by the behavior of applying the idea of energy conservation to an area where one has not yet learned ways of conserving energy. An example illustrating the fourth level, analysis, is the ability to recognize various techniques of energy conservation, e.g., using a single energy source for two or more different purposes simultaneously. The fifth level, evaluation, calls for such behaviors as the ability to compare various energy conservation plans proposed for one's family and to select one of them on the basis of the amount of energy it conserves and the likelihood that one's family will be able to adhere to it without undue hardship.

6 We shall discuss these processes more fully in a later section of this paper in relation to the instructional strategies employed in energy education.

7 This appears to be true even in school subjects such as science and social studies where problem-solving goals are more highly touted than knowledge goals. For discussions of this issue in relation to science and social studies, see Champagne and Klopfer, 1977; Massialas and Cox, 1966.

8 The Joule Unit (Champagne and Klopfer, 1974a) is an instructional unit on energy intended to be used by elementary and middle school students as part of a comprehensive science program. Materials from the Joule Unit are used here and in other places in this paper as illustrative examples of the application of some of our principles of instructional design.

9 Various techniques for values clarification have been devised, and some of the most interesting ones are discussed in Raths, Harmin, and Simon, 1966.

10 The ideas expressed here relate to the notion of adaptive education. One comprehensive account of this notion may be found in Glaser, 1977.

11 Reviews of research in these areas have been undertaken from various points of view by educational theorists. See, for example, the reviews by Levie and Dickie, 1973; Frase, 1973; and Wittrock and Lumsdaine, 1977.

12 The many years of work in educational measurement and evaluation have produced countless assessment instruments and a vast number of papers and books about student assessment procedures. For us, the two most useful compendia on student assessment are Bloom, Hastings, and Madaus, 1971, and Thorndike, 1971. However, educational measurement and evaluation is a very busy area, so the current periodical literature also must be consulted to keep abreast of new student assessment procedures.

13 A brief discussion of the goal of student self-assessment in the Individualized Science program is contained in Champagne and Klopfer, 1974c, and specific illustrations of self-assessment procedures may be found in Champagne and Klopfer, 1975. Evidence about how well students can assess their own learning is presented in the research study by Walker, 1975.

14 To anyone seeking more information in the area of evaluation research, we heartily recommend an excellent discussion on the philosophy and methodology of educational evaluation in Cooley and Lohnes, 1976.

15 We are grateful to Joan Donnelly and Dorothy Molter for their contributions in conceptualizing and preparing drafts for parts of this paper. Without their help, the paper would have been something much less, both in scope and detail. We also want to thank Alexandra Antoniewicz, Christine Frezza, and David Squires for editorial and clerical assistance in preparing the paper.

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NATIONAL SCIENCE TEACHERS ASSOCIATION

John M. Fowler, Director of Special Projects
National Science Teachers Association
Washington, D.C.

## Experiences with Energy Education

The NSTA has an unusual position in this conference, in that our materials have already been put forward as products by four different groups. I think that it is rather amusing that they were put forward as examples of education and industry collaboration and as products of the Office of Environmental Education and of the FEA and ERDA. We've been tarred with so many brushes that there is hardly any clear skin left. I would like, as they say, to make one thing perfectly clear, and that is that these are NSTA materials. They are not the products of any other group. We are, of course, delighted at the support that we receive from many different groups, and I think that has contributed to successes they have had. I want to take advantage of this opportunity, having had some of the publicity already done for me, and say only some brief things about the materials, and then say some more general things about energy education.

The first set of materials that were produced (supported by the Office of Environmental Education) was an energy environment sourcebook. It is just what it says, a sourcebook and a materials guide--which is an annotated bibliography in a series of reading lists--and an energy environment mini-unit guide, which is a collection of sample activities. The second set of things, which are here in enough quantity that you can take them away with you, are a series of fact sheets on alternate energy technologies. There are nineteen of these projected; fourteen of them are in print and here. They are not something that you put in the hands of students and expect great things to happen. I think we should also admit that we realize the dearth of teacher-background materials. There's very little to move the whole mass of energy education forward very far. These are probably of most use to teachers who are already determined to do something and want some back-up material. Let me make one other comment on the factsheet. There are fourteen of them here in final draft, and one of them is here in preliminary draft. The glossary that is in your folder is a preliminary draft of our Fact Sheet No. 18, which will be a glossary of terms from alternative energy technologies. I was amusing myself yesterday during some of the slow moments--that implies the worst slow moments--by proofreading, and I want to emphasize that this is a preliminary draft. I'd invite you all, during any further slow moments that may come along, to do the same thing, and if you find any mistakes, mail them in to us and that will guarantee that you'll receive the final copy when it comes out. There are typos in there, but I am more interested in getting from many of you who like to play this game, a criticism of the level of explanation in those glossary terms. Have we explained them to you in the way we want them understood?

We have not entered into the much more difficult task of producing classroom materials. We believe very strongly that the only way to make any impact is to give the teacher something that is complete, something that has in it all the material, not that they need, but that students

need. We have now produced six of these units. These are on display in the display room. These materials have been reprinted in fairly large quantities by ERDA. We are now making final revisions on them, and the final publication of the six will be completed by next fall. Our tentative agreement is through ERDA, and I invite you to contact either the NSTA or Don Duggan at ERDA if you want to get these for next fall. We are looking forward to having them available in large enough supply that they can go into classroom use. These materials also are available in large numbers from ERDA. What we are involved in is in the nature of a curriculum development program now. We are expecting to produce eight more of these packets this summer. We have a group of twelve or so teachers who are coming on board next Monday and will be working with us for about two months. We hope to continue that sort of cycle, of having things available for classroom testing next fall that are produced the following summer, with a final publication the following year. Most of this stuff is available free. We're eager to get it out into the classes and test it, so I extend to you a blanket invitation to contact us and get on our mailing list. I think that's the commercial I want to make.

Let me say a few things now about energy education from my several years of experience. Let me start with yesterday. If you are talking about your experience you might as well quote recent experiences. I couldn't help, as I listened to all the talks we heard yesterday, but think of the old story of the blind man and the elephant, the energy problem being the elephant. The technologist who spoke to us strode up to the elephant's massive head and grasped that and said, "What a fine brain there must be in there, and certainly this brain can solve our problems and can lead us forward." The industry man bumped into that powerful flank and felt those muscles and said, "This is a strong, powerful system, and it will certainly carry us forward into success." The consumer advocate unfortunately bumped into the foot and thought how the poor were going to be trampled under that great large paw as this powerful monster runs through the environment. One of the environmentalists bumped into the gut of the elephant and noticed how fat it was and said, "Look, look, we've got to go on a reduction program here, and lose a little weight and conserve." The other environmentalist was more skeptical, and approached the elephant--unintentionally I'm sure--from the rear. He grasped the tail and said, "Just as I thought--there's a string attached." Then there was the investigative reporter. (By the way, any resemblance to real speakers is up to you to decide.) This investigative reporter was following several steps in the rear and stepped in something and said, "This whole thing smells." I forgot one, I forgot the futurist who missed the elephant entirely and was last seen feeling up a camel in another stall.

In a capsule, there is the problem. Somehow the job of education is to open all those eyes and let them see that there really is an elephant there and that it's a very complex beast. It also is a very massive, slow-moving beast, although it is very powerful. They've got to understand it. They've got to understand what goes in the front and what comes at the back end, and they have to reach some kind of agreement so that they can all pull in the same direction, because that elephant is not going to move unless the whole group pulls in the same direction. I think that's what we are faced with. That's what we are trying to do in energy education. That's the strength and the weakness of this issue as a vehicle for education--it is complex. It is determinedly interdisciplinary. We cannot understand it

from one point of view of just one discipline. We have to put this all together, and you and I both know how difficult this is. The energy problem is not a conservation problem, and it's not a question of nuclear pro's and con's.

One of the things that I have thought about recently is the question of how it is we can say we have to teach about energy now in the educational system. Let's go back to other social issues and see how we can make that decision. The civil rights thing was one that immediately came to mind. The educational system made a decision to teach civil rights. How was that done? Well, there was a national consensus that it should be done. It was not unanimous; it was not a complete agreement, but there was a national consensus. Is there a national consensus that we should focus in on the question of energy education? Well, I think the one point of consensus is that we should teach energy education under the heading of conservation. I think you could get a national consensus that you should teach conservation. But if you try to break down the question of the "you should teach energy education" and be more specific, there is no consensus. If you look at the steps by which you introduce a social issue into education, I think you see that you go through awareness, mission orientation, and finally, into integration. Awareness we all handle one way or another. It's most effective when there's a crisis like last winter or like inaugural time. I worry a bit that we have talked much too much at this conference about mission orientation--the idea that we should teach these kids to do this or that. I'm skeptical of mission orientation even in conservation where it seems innocuous enough that one should be able to agree about it. I think we must go strongly into the integration phase. We must somehow make energy education part of the entire curriculum, not something that we add on to it.

I'll go back to the packet that we've been working on to give you just a brief example of what I mean. We have a packet that focuses on the Industrial Revolution, because we felt that in the social studies class somewhere it is always taught. So we have produced a packet which suggests ways of introducing the relevant energy concepts. When I say "energy," I really mean something that should be called "energy/environment economics," because it is much broader than just the physical concept of energy. So we tried to introduce energy under the framework of the Industrial Revolution. We have another packet on how a bill becomes a law which we hope teachers will use when they want to teach about the legislative process. For example there is the fifty-five mile an hour speed limit. Included in that packet is a simulated hearing at which the trucking industry and conservation groups report. We think that we have been able to get the teacher to accomplish two different things, to teach what he/she wanted to teach anyway--namely the legislative process--but in doing that, to also teach important concepts about energy. I feel that's the only way we can get these ideas into the curriculum. We have, in a sense, a hidden curriculum that we slide into the existing one.

Let me end by making one or two comments on Dr. Fenton's very helpful speech at lunch. He mentioned that curriculum development, and implied that the whole educational system, moves with glacial dignity, which I think is a very mild and successful way of putting that. One of the big advantages of the energy problem is that it is so massive and inertia-ridden that when change comes it will be very slow and long-term. In that

sense, I think that it's well matched to the educational system, whereas some other issues haven't matched very well. Even something like Viet Nam was not well matched, because it was too short. One needs to ask that the social issues going into the educational system not only be urgent, but that they be long-ranged, so that you have time for the system to absorb them.

On the questions of the level of ethical understanding that we can ask of our students, I want to remind you very strongly that we're not teaching solutions to the energy problems. We can't do that because we don't know what they are. What we are trying to do is to make them see the elephant. I think at best, at the upper levels, what we are trying to do is to present some of the options. We should have our advanced students construct a picture of this country relying totally on coal, or totally on nuclear, or totally on solar. We should also, and I personally feel this very strongly, include as one of those options the Schumacher approach to the appropriate technology options. Ask the students to design a country in which all the energy production is fitted to the size of the consuming elements. That would be a very interesting set of options. We will try to do that in our project. I think the thing that recommends that course of action is that we want our students to think in terms of options. They are eventually going to have to make some of these decisions. The only thing that we can say for certain is that the option, among the options we present, will not be the one they will eventually choose. We can present all the options except for the real one. I think that is part of the education process.

Well, let me finish by saying just a word or two about the goal of our NSTA project and why it is we are strongly into energy education, particularly into something that is not science education, but more broadly interdisciplinary education. We do feel it has some benefit to science. We think that this is a good vehicle for science education. But I would say our overall goal is the one that you've heard so often here, namely that these kids are going to be living in that world. We are now in the transition period between the time when energy was inexpensive and abundant and the time in which energy will be very expensive. We don't know whether it will be abundant or not, but we do know it will be expensive. We are in that transition period and we must prepare students for it. I think there's a second challenge to education that has not been emphasized strongly enough. This world that we're moving into will, in all likelihood, be even more complex than the one we are in now. Therefore, the job of education will become more crucial. We need people who can meet the scientific and engineering challenges that will be before them ten to fifteen years from now, but more importantly, we need the ones who can meet the social, economic, political and environmental challenges before us. Those are two of the goals.

There's a third one. I think that energy education can importantly improve the educational process. Now, before I expand on that, let me admit that I came into energy education with several advantages. One is that I have never taught below the college level, so I don't realize that it is impossible to do these things that I'm talking about. Another very important advantage was that I started several years ago, long before this conference, so I hadn't heard this conference, and how impossible it was to do this, and how difficult and how confusing it was. I think that the most important advantage that I have is working with teachers, and when you work with the teachers that's where the enthusiasm is. These are the

people who are saying we can do this. If you'll give us the content, we'll tell you how to teach it. These are the ones who are demanding that we expand and move into this area. I think one of the problems here is that there aren't enough teachers here. And I hope those of you who are perhaps pessimistic at this stage, go back and talk to the teachers. They want to do this.

The thing that carries me forward in this is a kind of cynical idealism. Education is a weak reed, but we have no other reed to lean on. My feeling about energy education is that if we could succeed, if we could open those eyes, and make our students see that whole elephant, understand that complexity, understand the economic, environmental and social and scientific problems that we lump all together and call the energy problem, and if we can move them a few small steps towards solutions of those problems, we would have solved all of our other problems too. Thank you.

SESSION X

THE MEANING OF SCARCITY

Richard J. Barnet is the co-founder and current co-director of the Institute for Policy Studies in Washington, D. C. He is the co-author of Global Reach: The Power of the Multinational Corporation. Barnet presented his views to the conferees in a major after-dinner address.

Basically, Barnet sees a crisis of understanding in the world as basic resources become scarcer and Third World countries and industrialized societies vie for positions in the global economy. The complexity of the resource problems on an international scale, according to Barnet, should be taught in the classroom to heighten students' awareness of possibilities, both positive and negative.

Barnet warned that the impending crisis of scarcity threatens democracy as a way of life. He asserted that the free enterprise values of greed, envy, and competition are "incompatible with the survival of freedom in the next generation." For democracy to survive in the future, he called for a reordering of the economic order "to share the resources in equitable and rational ways" and for a new emphasis in an interdependent world on the values of community, cooperation, and mutual aid.

# THE MEANING OF SCARCITY

Richard J. Barnet, co-director
Institute for Policy Studies, Washington, D.C.

For the last five years this nation has been trying to cope with an idea so revolutionary in its political and social implications that we cannot get hold of it: The idea of irremediable, systemic worldwide scarcity. We have taken to labelling the idea "the energy crisis," which sounds serious enough but is really a euphemism for a crisis of a more profound sort. There is mounting evidence that the industrial world is going to run out of fossil fuels before alternative sources of energy are developed unless the patterns of resource use are radically altered. But beyond that other vital elements to sustain advanced industrial civilization--minerals, water, even breatheable air--are in short supply.

After five years of presidential exhortations about lowering the thermostat it is reasonably clear that the campaign to alter lifestyles is the moral equivalent of a small and uninteresting war. It has not become a rallying point for national survival and is not likely to become so because the president's lofty message is drowned in a mass of contradictory communications. Anyone on Mars with a TV set and a set of subscriptions to American newspapers would conclude that for the throwaway society--annual trade-ins of cars, dresses, and missiles, emphasis on the technologies of convenience rather than conservation, indiscriminate sacrifice of scarce resources to mindless growth--waste is the symbol of affluence, indeed the badge of success. Underlying the ideology of conspicuous consumption is the naive faith in the technological fix, that technology will unlock new sources of energy to permit us to continue living the way we have been living on an ever grander scale. There is mounting evidence that technological rescue is not on the way. The costs in dollars and in energy of developing new energy sources are so huge and so unpredictable, the political obstacles to moving quickly in the conversion of the economy from one source to another so formidible, that even if solar energy and other alternatives are developed in time, we must expect profound social and economic dislocations.

The idea dramatized by the energy crisis that resources are finite is a radical notion which undermines some of the basic assumptions on which our whole social, economic, and political system rests. Until ten years ago everyone but a few cranks believed in the myth of abundance. They shared the common assumption that the earth was infinitely generous, that American power was sufficiently overwhelming that it didn't matter much if resources happened to be located in other people's countries instead of our own, and that the destiny of every civilization was to grow or die. Most Americans still cling to the classic American credo, and consequently worry about the energy crisis only when lines form at gas stations or when the monthly heating bill arrives. But the managers of every industrial nation who are charged with the task of maintaining stability in incredibly complex societies are beginning to see that scarcity, not abundance, is the basic condition for further development. What that means is not yet clear, but it will force us to rethink some of our most basic values and to make some explicit choices.

What role can primary and secondary education play in the process?

The first task, it would seem to me, is to help young people to develop the minimum understanding of the society in which they will make their way. It is a commonplace fact that just as generals prepare for the last war, teachers prepare kids to live in their parent's generation. Those who are now in school face future shock of epidemic proportions because they are being taught the consoling myths of continuity, that the next twenty years are going to be a straight line projection of the last twenty years. It is fashionable to talk of rapid change, but not to grapple with its meaning, to dazzle young people with science fiction accounts of technological progress, but not to develop understanding of why the next generation may be profoundly different from the last.

The new world of scarcity that is coming into sharper focus is characterized not only by an energy shortage but also by a shortage of water, air, food, critical minerals, and appropriate technology. It is impossible to convey an understanding of any one of these crises without relating it to all of the others. The high cost of petroleum determines the distribution of fertilizer--who will eat in poor countries and what it will cost to eat in the rich countries. The drive to industrialize affects the supply of air and water, as we have recently seen in a dramatic way in California. The rise in energy costs directly stimulates the international traffic in arms as the industrialized nations try to solve their balance of payments and jobs problems by exporting sophisticated military technology.

The United States imports 86% of its bauxite, 91% of its chromium, 98% of its manganese, 72% of its nickel and 68% of its tungsten. The dependence upon these and other raw materials which, given present technology, are absolutely critical for the functioning of the U.S. industrial machine, is expected to rise in the next few years. Whatever the total worldwide supply of these minerals turns out to be, the distribution is increasingly subject to the decisions of others, that is the resource producing nations. Access on traditional terms and at traditional bargain prices is over.

Scarcity may exist in absolute terms, that is, there may really be no more oil in the ground after a certain date, or it may exist as a consequence of maldistribution or because it takes too much energy or too much money to make the oil available for industrial and home use. There are compelling studies showing that the potential world food supply is more than adequate to take care of the projected population growth. But the distribution problems are staggering. In many parts of the world subsistence farming is giving way to corporate, mechanized agriculture devoted primarily to exports with the result that many who used to grow their own food can afford neither to stay on the land nor to buy adequate food in the market because they cannot find jobs. In vast areas of the world 40% unemployment rates are not uncommon.

To survive in the next generation will require seeing some of these connections between energy systems, food systems, technological development and environmental change much more quickly than we have done. Understanding the next generation will involve grasping the meaning of interdependence. The word is fashionable. Indeed it is already a cliche, but what does it mean? In presidential speeches the word has an almost idyllic ring. But

interdependence is a value-free notion. There are modes of interdependence which work to the advantage of all parties to the relationship and there are modes of interdependence that accentuate inequality and misery--the interdependence of masters and slaves, for example. To understand the causes and the nature of the rising levels of international tension that are in store for us when the price of oil rises, teachers of the next generation will have to study interdependence in specific and practical ways. Who benefits and who pays? What is the relationship between rising oil prices and the price of bread in the supermarket? How are prices set? What is the effect on an American city of a decision to locate a refinery in one country or another? What does it mean that the U.S. is increasingly dependent upon the export of agricultural products to pay for imported energy and minerals? These are not esoteric questions. Unless young people are able to comprehend such relationships and to see the policy implications in the way the food, energy, and technology systems intersect, they will lack the minimum understanding necessary to survive as citizens. They will be targets for indoctrination, but they will not be active participants in the process of social change into which they will be swept.

How is it possible to teach matters of such complexity? They are not taught now in universities. How can we expect to develop intellectual and moral sensitivity to such questions in junior-high school? This is the heart of the problem. The reaction to the escalating complexity of modern life in the past generation has been to simplify and to entertain. As attention spans shorten, the solution has been to aim discrete bits of disconnected information at students much in the manner of the TV newscaster and to hope that some messages will penetrate the glazed eyes that line the classroom. The result has been that the classroom audiences across the country that make up the next generation are peculiarly ill-prepared to cope with the historical moment into which they have been born. Civilizations survive only to the extent that they are able to adapt to changed circumstances, only when the people are able to develop the new knowledge, acquire the new social character, and to assimilate the new values needed in the new age.

The first step in developing survival skills is to understand the shape of the new international order that is developing and how it is determining life in the United States. The perception of scarcity is transforming relations among nations, among regions within nations, and among classes. As dependent as the United States is on imported resources, Japan and West Europe are more so. As the United States fights to increase its exports to pay for these vital imports, the other industrialized countries step up their competition for the same markets. The past generation has been marked by the ideological compatibility of the industrialized nations. The common struggle to maintain liberal capitalist democracy against communism was far stronger than the economic issues that divided one from the other. It is less true today. Protectionism, fights over resources, antagonistic positions on nuclear energy, struggles for economic independence and self-sufficiency now characterize the international system. The stability that was born of the Pax Americana at the end of the Second World War is gone. It is of no help to students to nurture the comfortable illusion that it continues. Every effort to change power relations in the world over the issues that divide the industrial nations directly affects Americans--the prices they pay, the jobs they get, the standard of living they enjoy.

Unless we are able to see the last generation for what it was--a time of unique economic stability and growth in which the United States had unique economic advantages, principally access to energy and raw materials at bargain prices, the next generation of Americans is likely to turn jingoist and isolationist as it becomes aware of its loss of economic status. These instinctive reactions are exactly the opposite of what we need for survival.

The fight between the so-called Third World countries and the industrialized world over the shape of the global economy is a second fact of life about which Americans for our own survival are going to have to become more sophisticated. The efforts of the poor countries to use their control of resources to increase their bargaining power vis-a-vis the industrial countries and the counter-efforts of the rich countries to preserve the status quo comprise a central drama of international politics. To understand it requires getting behind the abstractions with which we usually discuss these issues, identifying the real actors--notably multinational corporations, which control the world market and distribution systems in vital commodities--and being aware of their relationship to politicians in both poor and rich countries. Nowhere are the workings of interdependence less clear than in the so-called North-South relationship. How the international debt system, commodity pricing, trade arrangements work to the disadvantage of the poor and weak--the countries themselves and particularly the hungry and destitute within the countries--have been amply demonstrated although there is a low level of awareness of these matters in this country. But why the rich should work for new structures which will redistribute political and economic power to make possible a more equitable international order has not been explored. The economic confrontation with the resource producing nations is seen as another zero-sum game, just like the nuclear confrontation with the Soviets, "helping the poor countries" is regarded as charity. But it is really environmental protection. A world in which billions are on the edge of starvation, the level of desperation rises, and extreme social dislocation results is not a world in which liberal democracy can be maintained in the United States. Erecting the fences necessary to preserve even the illusion that we can keep the United States as an affluent enclave in a global slum will radically change the country and the people. I fear that it already has. And, of course, the United States is not an affluent suburb. Vast areas of this country, including the center of every major city are decayed; the development process has been distorted in such a way as to leave millions jobless and without hope. Instead of being one happy suburb, the United States itself is deeply divided between the losers in the national game, the inhabitants of our collapsing inner cities and the rural poor, and the winners who commute from the "bedroom communities" on the urban fringe. More and more the United States has taken on characteristics of an undeveloped country. One serious index of this is the rising population of university graduates with high aspirations and low prospects for employment. Their plight also is the consequence of the way the present world economy works. The fruits of America's privileged position in the world are distributed in highly inequitable and irrational ways.

The fight over resources and the need to cope with scarcity will dramatize these issues of distribution, but we should not assume that awareness of maldistribution gives rise automatically to the impulse to give up privilege and to share power. Quite the contrary. Liberalism in America, as elsewhere, rests on the notion of growth. The entire historical era that

began in the New Deal has been rooted in the Keynesian notion that steady economic growth makes redistribution of income possible. As the pie grows bigger, ever-larger crumbs can go to those who do not "pull their fair share" in creating wealth. Thus transfer payments in the form of social security, welfare, unemployment benefits, health benefits, etc., to the old, the sick, the unemployed. (The substantial subsidies to the rich are thought to be different because the rich produce and the poor don't.) In large measure because of the energy crisis, or more accurately because of the growing realization that the expenditure of natural resources to produce economic growth is a self-limiting process, we are passing from the age of Keynes to the age of Milton Friedman.

We are in the process of abolishing the free lunch. The Carter Democrats are not restoring the programs for the poor and disadvantaged that Nixon and Agnew took away because they were bad for the character of poor people. Austerity is the ascendant political slogan around the world. Even the Italian Communists are turning away from subsidization to reduce economic inequality and are supporting belt-tightening measures that hit workers hard. The Swedes are having second thoughts about the lavish welfare state. Inflation, decline of productivity, and exponential growth of government are chronic social diseases everywhere.

The feeling that we have come to the end of the frontier--that there is not enough air, water, food, capital, space, energy--is producing a crisis of democracy. The political system operates on the premise of one-man vote and of increasing participation. The economic system operates on the assumption that preserving and indeed increasing inequality is necessary to keep up sagging productivity. Scarce resources cannot be spent on those who do not produce.

The crisis of democracy is developing because more and more people in the world--including this country--are becoming irrelevant to the productive process. The growth in production is slowing up as population levels rise, and the productive process is making less and less use of human beings. The contribution to the productive process of a large proportion of the world's population, perhaps a majority, is not needed or wanted by those who control the process. They constitute what in Dickens' day used to be called the "surplus population." How then can those who control the productive process tolerate political democracy when the pressures on the economy are pushing in exactly the opposite direction? If we are to have a chance of keeping democracy, and that means expanding it and deepening its roots in American life, the next generation of citizens will have to develop much more sensitivity to the vulnerabilities of democracy. Just as the last thirty years may turn out to have been a uniquely stable moment in the economic history of the century, a respite in a series of depressions and wars that have characterized the last 100 years, so also (despite McCarthyism, J. Edgar Hoover, and Richard Nixon) it may have been a relatively easy time for American democracy.

Facing the realities of the coming generation in the classroom is the minimum we owe young people. To begin to grasp ideas that reflect fundamental political and social transformations one must begin the process at an early stage of education. The education system has totally failed to assimilate the revolutionary political fact of the last generation--that

the harnessing of atomic energy to warfare has rendered defense impossible and has given a handful of men the power to destroy the world not only for themselves and their contemporaries but quite possibly for all future generations. That idea, which has changed literally everything, is either denied or trivialized. We still talk about defending ourselves with the hydrogen bomb with the same vocabulary our ancestors talked of bows and arrows. We have not been able to make the intellectual leap. The danger is that we will treat the idea that the resources of the earth are limited in the same manner.

I am not suggesting that third grade teachers become Cassandras or that the high schools become centers for the study of doom. Indeed one of the symptoms of an age of dislocation is the doom industry. There are dozens of books around purporting to analyze the various bangs and whimpers with which the world will end. Some say the earth is getting too cold, others that it is becoming too hot. Too much rain. Too little. Population explosion. Etc., etc. Cassandraism is a way of denying responsibility that immobilizes political impulses and paralyzes critical imagination as effectively as patriotic euphoria. Weltshmerz is a social condition that traditionally accompanies the death of democracy. It is the natural consequence of foolism optimism: The responsibility of teachers is not to frighten, depress, or overwhelm but to stimulate a heightened awareness of possibilities, both positive and negative. That is a tall order in a world that is objectively frightening, depressing, and overwhelming.

How do you convey a sense of realism without totally depressing students. For one thing, I believe that a sense of realism is an antidote to depression. There is nothing that produces such a sinking feeling as the awareness that what one is being taught about the world in which he is to live is fantasy. In good times fantasies can be assimilated as harmless fairy tales or pep talks. In bad times they produce cynicism and boredom. The dark side of reality should be confronted in the classroom as a problem to be resolved, not as an inevitability to which we surrender. I am not suggesting that everyone accept that assessment of the risks facing this generation that I make--mounting economic crisis, crisis of democracy, high risk of nuclear war--only that the analysis of these systemic problems which are all exascerbated by the problem of scarcity be laid side by side the consoling conventional wisdom. We don't know how it all is going to turn out. The next generation has been given a time of transition in which to grow up and hence it is going to have to live with ambiguity. Seeing connections, between the various forces in motion, studying alternative solutions, analyzing what could be as well as what is, are all essential survival skills.

But survival ultimately will depend upon a transformation of values. Our particular form of economic organization--we call it free enterprise and pretend that it is a new model of old-fashioned capitalism when it is really a marriage of big government and big business operating on quite different principles--fosters the values of greed, envy, and personal competition. We teach ourselves that these values are universal expressions of man's basic nature. But historians and anthropologists tell us that just isn't so. The idea that money making and personal accumulation are the goals of life was not present in the middle ages or in ancient Greece. This civilization has put what the great economic historian Karl Polanyi calls "the market mentality" at the center. The race to accumulate, the

race to consume, the race to waste provides the dynamism for the American way of life. These values are incompatible with the survival in freedom of the next generation.

The prime survival values in an interdependent world are community, cooperation, and mutual aid--not competition. Competiveness is to some extent instinctive and will always be present in human organization in some form. But a society can start from either of two premises--that it is a negative force to be tamed and redirected through social institutions or that it is the fuel of economic growth. Rampant individualism was a society-building value in an age of developing capitalism. It has become a religion throughout the advanced capitalist world. In Germany not long ago a measure to impose an 80-mile an hour speed limit on the murderous autobahns was defeated with the slogan, "Free Speed for Free People."

Community is one of the Orwellian words. As 1984 approaches, we use the word as a synomyn for suburb, which is a collection of individuals, most of them lonely (loneliness is the national disease) and competing interest groups. Community is the expression of man's basic nature, and therefore it is the supreme survival value. When Aristotle defined man as a political animal he was saying that human beings are incomplete outside a supporting political and social relationship. We should be exploring with our children at home and at school why individuals need community, what they can expect from community, how do you plan together, how can people collectively change their lives, what changes in the political and economic system would be necessary to make community possible. We should try to restore a sense of history that would enable students to see that the values they hold are not universal but are products of a particular time and a particular social organization and to foster critical imagination that could enable young people to see how things could be better.

The destruction of community in America as a consequence of the bulldozing of cities, the construction of highways, the closing of plants, and the celebration of individualism--there are many other causes too, of course--is responsible for much of the social pathology we see around us. A recent study sponsored by the National Institutes of Health documented the extent of child abuse in this country--hundreds of thousands of cases involving the use of a gun or a knife against infants. It is a symptom of the breakdown of community. Child maiming does not occur in extended families under the eye of grandmother or the neighbors. Much of the crime in our cities is also traceable to the collapse of community. No one watches, no one cares as unwanted kids turn into thugs.

It is easy to be for community in principle. It is hard to make the moral and political decisions that will allow it to develop. It is harder still to agree as to who is in and who is out. In response to scarcity the instinct is to resort to the lifeboat ethic. Throw out the weak and unproductive and spend the resources on the "deserving," the industrious, the affluent. Triage, benign neglect, survival of the fittest are the slogans of the new morality that is being pressed upon us from many sides. When Hitler talked in these terms a generation ago, Americans were appalled. Now some of our scholars and statesmen are suggesting that too many people are getting in the way of society.

We can no longer take it for granted that the most basic values that are supposed to lie at the core of our civilization--respect for human life, respect for human dignity, justice, frugality, honesty, moderation, and equality--are in fact the operative values. If we believe, as I do, that they are the essential moral ground of civilization, then we must rediscover them and defend them. We cannot afford to reject them as it is becoming fashionable to do or merely celebrate them in a ritualistic way. Either of these norms are practical survival values essential to the development of a society which can co-exist with nature--neither conquering nor being conquered--and to the development of complete human beings, or they are pieties. To incorporate these values into our economics and politics, we will have to understand much more clearly than we do now why they are essential to conservation of natural resources, preservation of the environment, peace, and stability, in short why they are practical.

Systemic worldwide scarcity makes a redefinition of human rights essential. There is no way of inviting a billion people around the world out of the lifeboat without running the great risk that they will sink it on their way to the final splashdown. The alternative is to work out a new economic order to share the resources in equitable and rational ways. That means a system in which every inhabitant of the earth has certain minimum vested rights--a minimum calorie intake to sustain life and health, minimum shelter, minimum employment possibilities, all necessary preconditions to the realization of the procedural rights which Americans cherish and which are increasingly violated around the world--freedom of speech, assembly, press, religion, and thought. Political democracy can no longer exist in an undemocratic economic order because the levels of enlightened consciousness around the world will not permit it. That consciousness must be either accommodated or repressed.

Is democracy a survival value? I believe that it is. But that may well be a minority view. Businessmen, the Trilateral Commission, prominent social critics are all suggesting that we have too much democracy. The problems are too complex, they say, to permit popular deliberation and the eccentricities of a one-man, one-vote system. The times call for emergency action, austerity, firm leadership. These are familiar arguments that have been with us since the first experiments in democracy. Much less familiar these days are the practical arguments for democracy, that concentration of power magnifies errors of judgment, that without participation in decision-making power over the social aspects of life human beings cannot develop. Especially under the pressure of resource scarcity, schools should be studying democracy, not indoctrinating the next generation in the civic pieties of the last, but taking on democracy as a problem. Why is it under attack? Is it a survival value? What are the new institutions--in neighborhoods, factories, families, international organizations--needed to make democracy work? Unless there is greater understanding of democracy and a much more self-conscious commitment to democratic principles in the next generation we run great risk of losing democracy. We seem to be at a transition moment in which we will have much more democracy in the next generation, or much less.

Schools cannot inculcate these survival values nor should they try. But they can help the next generation confront the extraordinary times in which they have been called to live. You can help young people to

repair two broken connections which leave us all isolated and vulnerable--the connection with our collective past which haunts us if we ignore it and the connection to the rest of nature with which we must find new ways to co-exist.

SESSION XI

IMPACT OF THE CARTER ENERGY PROGRAM
ON AMERICAN SCHOOLS

James D. Bishop, Jr. is assistant to James Schlesinger, head of the White House's Energy Policy and Planning Staff. In addition, Bishop serves as director of communications and public affairs, Federal Energy Administration.

In his address, Bishop focused on the general apathy and unawareness of the American public to the energy crisis.

Bishop asserted that the Carter administration has boldly faced the energy issue and proposes an 8 to 10 year transition period perserving freedom of choice for Americans. Unless our society can band together in a spirit of community to tackle the problem, Bishop concluded "the cold, dead hand of government will be tapping us on the shoulder with some regularity."

Education, according to Bishop, offers the best window to the future. It can help us develop the "kinds of tools we'll need to manage the future when it comes", he said, "because, if we don't, the future that is facing us is going to be far different and far more chaotic than anything that you and I would dare to imagine in public.

# IMPACT OF CARTER ENERGY PROGRAM ON AMERICAN SCHOOLS

James Bishop, Energy Policy and Planning Staff,
The White House, Washington, D.C.

When we started out in April to write an energy plan, we knew it would upset certain people in the country; what we didn't expect was that it would make everybody mad. So today I'd like to back away for a minute from the noise and the smoke and the artillery shells that are flying over our heads up in the Congress, and from the fact that half the people in the country who say that the Carter plan is the moral equivalent of a skirmish, to those who say it's an energy police state, and back away for a minute from the specifics of the proposal and talk a little bit about where the President of the United States is coming from on this issue, where Jim Schlesinger is coming from, and the fact that we are indeed right now in the middle of a revolution in the context of this problem. It will probably be a number of years before people begin to put together the pieces of what is indeed a revolution in values and in approaches.

Years ago, the poet Whittier said "...of all the sad works of tongue or pen, the saddest are those that might have been." And an old drinking friend of his, Bret Harte, said, "More and more are those we daily see, but hadn't ought to be." It was last April that Carter issued a challenge to all of us, whatever our walks of life, whatever we did, and he put the energy challenge into kind of a two hundred year context. He said we're entering a period which will be with us for the rest of our lives, which will demand the best of us, the best of our courage, and the best of our vision. We're entering one of those times. The importance of his recognition, and this government's recognition, of the energy dilemma can't be overstated. His words, and the words of Schlesinger, flow from very, very deep wells of conviction. The President has said many times that if he were really interested in his political survival, he probably wouldn't take this issue on--because the real stringencies and the bad times as represented by the OPEC capacity crunch which is five or six years away, he could avoid that, he could slide that and let some future president take it on. But Jimmy Carter understands the second law of thermodynamics, and he understands the significance of the fact that the love affair with fossil fuels that we've had for 100 years is coming to a screeching finale. What's in question is whether it's going to bring about a different kind of country, a more authoritarian society than we have now. Most of you know, in this room, that this isn't a new issue at all. About 25 years ago the Paley Commission told us about our energy limits. Energy limits were defined, and the numbers and the perspective of the Paley Commission would be appropriate to publish once again today. But the problem was that the President in those days, Dwight Eisenhower, and four of his successors, put the Paley Commission in a drawer somewhere, and it became something that people referred to in speeches, but never really focused on in terms of any seriousness.

The other evening Jim Schlesinger, in a private conversation, said, "You know, Adlai Stevenson was really right. People don't recognize the handwriting on the wall until their back is up against the wall." As a nation, as a government and as an educational system, our back is not up against the wall yet--but we are backing faster and faster, and we're

moving closer and closer to that wall: the handwriting is getting larger. And the things that we daily see, the things we daily learn, and the things that we daily read about the energy dilemma that really hadn't ought to be, as Bret Harte said, because they indeed threaten to overwhelm us, our children, and our grandchildren, unless we begin to make a very serious effort to understand the invisible crisis that surrounds us. And I think it's more than rhetoric to say that without public understanding, and without a commitment to action, without the recognition that it's really you and me, and not the man across the street, who have got to make these changes, unless that begins to happen, and unless there is the recognition that the cheap energy party is over, we indeed will be engulfed.

It's obvious to you to hear me say that a very, very serious gap exists between the facts and our awareness of those facts. Closing that gap to my way of thinking probably will be a more difficult job than punching new holes in the Gulf of Alaska, or going down into the Rocky Mountains for gas, or even coming up with new technology, because there is a broad skepticism and a broad suspicion out on the land when anybody comes forward with some leadership. What we've seen are a series of quick insights, kind of like summer lightning--some of the polls show a shift of concern, then when the warm summer winds begin to blow, the polls recede, and we go back to business as usual.

This month, about 10% fewer people in America even think the energy problem is serious than did last February. So this awareness seems to be a function of the weather--when people are cold, and inconvenienced, they're concerned, but when the warm winds are blowing and gas is available, they say, "Well, we'll worry about it next year." And the things that we don't know about energy, the extent of the job of re-education--de-education--of the American people about energy, as I say, is an absolutely staggering job. A number of people I know--but fortunately people I don't work with--frankly don't think we'll ever be able to do it, because there have been two or three generations of false signals on energy, and it's very hard to change the signals, and it can't be done very quickly. It must take years. But the problem is that we don't have the years, now. We lost them, between the Paley Commission Report and the end of the last administration.

I'd just like to tick off a couple of things which give some sense of the plight we're in. I'm not just trying to make a point--that what we don't know about energy is positively frightening.

Most people don't know, according to the Gallup Poll, that this country is now 50% short of oil every day. They don't know that east of the Mississippi River, there is only a small amount of oil being refined, and that Arab oil is moving up the rivers of America, up into New England, at a rate that's at least 100% faster than it was during the Arab embargo. People don't realize that drilling activity, despite what you hear from the oil companies about "no incentive," is now at a 17-year high, and yet production has been dropping more rapidly every year. And in fact, about 75% of the oil that we do produce in America comes from oil fields that were discovered 35 years ago--or are older--and the pressures in those fields are dropping quite steadily. A couple of other things. During one week, ending June 3, we as automobile drivers burned 2 billion gallons of gasoline, which is enough energy equivalent to raise all the vegetables of the entire

country for 10 years, and it's enough energy to produce half the corn crop that will be produced in the great states of the Midwest this year, which has a value of $14 billion. The energy we used in just 7 days is enough to raise 600 million hogs, which is enough for 3 for every single person in this country. And in the first 7 days of July coming up we will use gasoline energy equivalent to all the energy that was used by the American armed forces in 1944, during World War II, which was the worst year of the war. Just in June, July and August alone, gasoline that will be expended will equal the energy necessary to produce all of America's crops for a year.

There's no need to elaborate--there are about 50 or 60 little facts like that which really aren't intended to scare anybody, but which are intended to produce a concern, and a realization of the need for each of us to examine our identities--our energy identities--which most of us have not done up until now.

So what happened since the Paley Commission Report? Total consumption has doubled. And yet, lo and behold, I got a letter the other day that reported a poll that said that 50% of the teachers in the United States don't believe there's an energy problem. But the good news in that letter was that 90% of their students did. And the notion of students--the prospect of students leading their teachers has always been a fascinating one to me. And perhaps we're on the verge of something rather unique in the educational system. But I think to focus in on this group, on many different levels, the educational system in America is both part of the problem and part of the solution. Because, like American industry, schools waste an absolutely unbelievable amount of energy. The energy that's wasted means jobs lost for other people, lost opportunities, it means capital flying to the deserts of Saudi Arabia. At the same time, industry in this country is beginning to respond, and one of the most ironic things is that the educational system, which I think we all look at as enlightened and progressive, is actually falling far behind some of the giant corporations which are supposed to be so unresponsive to change. A number of companies have now gone to keeping two sets of books; one book is a "Btu book," and they keep track of every single energy unit that goes into their system and every unit that comes out. In the case of one large company, AT&T in New York, they will have saved $2 billion by 1982 over what they would have otherwise spent for energy. But apart from developing more raw energy, the schools, the educational system, offer, in my judgment, about the best window, perhaps the only window, to the future, and basic education, of the kind Mr. Boyer talked about the other day, is the only thing that can offer the kinds of tools we'll need to manage the future. Because if we don't, the future that is facing us is going to be far different and far more chaotic than anything that you and I would dare to imagine in public.

The Carter Administration, as some of you who have read the legislation will see (see, in part section 301), is prepared to come up with $900 million over 3 years for a grant program for schools and hospitals that go to on-the-shelf technology that already exists; automatic energy controls, solar, furnace modification, double blazing windows--there are about ten pages of our energy legislation devoted exclusively to schools. But I think to be absolutely candid with you, that money is not the only answer to this problem. The people themselves, with your help and our help, have got to

become concerned about their own survival. If they don't, all the money in the world is not going to turn this problem around. People will soon, I think, come to the recognition that this joyride we've been on, this love affair with fossil fuels, fossil fuels which took nature 400 million years to create but which will be burned in 100 years, that that love affair is coming to an end. So we all have a tremendous job ahead of us. Energy is no longer just a subject in school, like science, or English, or Latin; it pervades everything that we do. Energy has done something that a lot of people don't recognize--it has given us slaves. Each of us has 300 slaves today, making our lifestyle possible. Now the problem is that these slaves that we have, in the form of 14 pounds of coal every day that each of us uses, and about 4 gallons of oil, and about 4 kilowatt hours, and about .9 kilowatt hours of nuclear--which is an amount, incidentally, 75% more than our grandparents used--that these kinds of identities are rooted on the fact that the slaves that we've had are beginning to leave us, their strength is weaker, they're charging more for us to use them. And some of the slaves are actually running away from us. And we'll never get them back.

Above all, I think we all should agree that we can't fool ourselves here, as we get concerned about energy. It's very easy to get excited and ebullient and get emotional and start talking in esoteric terms about value systems, and everything like that, but you know that these new ethics we've got to develop aren't going to happen very quickly or overnight. It's a much longer term battle, and a much more fundamental set of changes in our attitudes, in your attitudes, in the government's attitudes, in everybody's attitudes. But the important thing is that our lifestyles can be preserved for quite a long period of time without slowing economic growth. Some of the economists are calling Carter a radical because he suggested that the United States do what Germany and Sweden and Japan have been doing for 25 years, that is to sever the link between energy growth and economic growth. The President has said that we're blessed, because we're wasting 50% of what we're using, that therefore our economic growth can proceed at about 5% a year, and our energy growth can actually drop below 2%. This has upset some very influential people on Wall Street and in the Midwest, and bankers and economists who said that can't be done. But what they forget is that the standards of living in other countries are equally high, and in some cases higher than they are here, and they're using a remarkable amount of energy that's half, in some cases 60%, less than what we're using.

Moreover, we have a context problem. The status quo perceptions of Apollo syndromes and black boxes and the fact that all you have to do is punch a hole somewhere and the problem will be over--these are considerable obstacles that we face.

What Jimmy Carter is saying is that we can survive in this country, and it doesn't necessarily mean you have to punch holes in the ground in order to get energy, because of the new source of energy which is called "conservation energy," is about the cheapest source of energy we have--it costs between $3 and $6 a barrel, whereas the Arab oil in 2 years will be $20 a barrel, replacement oil that we will be going after in Colorado will be $25 or $30 a barrel, the deep oil in Alaska could be as much as $35 to $40 a barrel. Now at that point oil becomes too expensive to burn to heat water or to power cars. At that point we'd use oil for food and medicine and penicillin, which is precisely what oil started out, in 1859, to be

used for, until Henry Ford developed the automobile, and until the British Navy converted from coal to oil in 1914.

The notion that an era is ending and that a new one is beginning is a very hard one to adjust to. And one has to approach this problem gradually with people who don't believe that, to get across the point that the changes that are coming need not be threatening to us, they need not scare us, they need not make us pessimistic, because this transition can be made and we can still retain our democratic form of government and our basic lifestyles. But the adjustments ahead, the sacrifices that we have to make to our cherished beliefs, are really significant, and man, speaking broadly, gives up cherished beliefs probably more reluctantly than anything else. And there's a whole series of cherished beliefs that are going to fall by the wayside in the next five years.

But consider the future for a moment. The future could be much brighter than the past. If all of us, the educational system, and the Congress, and the oil companies, and the environmentalists, can for a moment or two put aside their selfish interest, their personal interests, and begin to pull together in the spirit of cooperation. As Jimmy Carter said, in one of the most misunderstood phrases of our time, the moral equivalent of war does not mean going to war. It does mean wartime conditions. It means a spirit of pulling together that we really haven't had in this country since people went and collected aluminum and made balls and took it in and collected bottles and did things in a community way--when they had front porches and when people talked to others, instead of receding into air conditioned fortresses, reluctant to share with their neighbors. So we see a society ahead of us which some of us will see, and some of us may not, which is clean, and it's abundant, and there will be cheap energy again. We'll be using the infinite, inexhaustible sources that we've been using indirectly all these years. The sun, the geothermal, and the wind. And it will be a society, interestingly enough, that will be free from the threat of scarcity, it will be a society that is immune to blackmail, and it will be immune from prices that are set in desert kingdoms that dictate how much senior citizens on fixed incomes in Arizona have to pay for their electricity. The most important message that's coming from the Carter Administration is that we can look to all of this without fear; we need not be threatened by this change. It will take a tremendous amount of imagination, and a tremendous amount of resources and time to build this new society that we're talking about. But the most important idea that I can leave with you today is to say that Washington is going to play a very small role in all of this, because when you move into the age of scarcities, however temporary they may be, and you begin to look at the pie, and you begin to distribute the pie a little differently, that is the time when the government cannot mandate anything. And that is why the Carter energy plan, with 113 proposals, largely is a new attempt at preserving freedom of choice in the society. There's very little mandated in there, the theory being that we have 8-10 years of freedom of choice, to begin to moderate and adjust around us, because if we don't do that then of course the cold, dead hand of government will be tapping us on the shoulder with some regularity.

Last evening I was reading words that John Gardner wrote a couple of years ago, which I think describes the kind of commitment and spirit that all of us are going to have to generate in ourselves and among our friends if we don't already have it or if we once had it but became discouraged and

lost it. We need to generate it again. John Gardner wrote that a nation is really never finished. You can't build it and then leave it standing like the Pharaohs did the pyramids. It has to be built and rebuilt. It has to be recreated in each generation, by believing and caring women and caring men. And it's our turn now. If we don't believe, or don't care, nothing can save the Nation. And if we believe and care, then nothing can stop us. About a month ago I was out in a school in Virginia, not far from here, called Terraset, a man stood up and said to the assembled children, as he looked around at the beautiful new school which has solar energy on the roof and has heating systems which reduce the costs in the building 80% over what a normal building would--through very conventional technology which exists but that nobody's buying because they don't think the energy problem is real--this tall young man stood up and said about this beautiful school that if this project can help convince the American people of some of the advantages of improving efficiency, and going back to more frugal ways of yesteryear, it has been effective. Let me remind you, said this tall young man, that efficient use of energy--energy conservation--is not simply done for the sake of using less energy. We're convinced that efficient use of energy is essential to the human race, if it is to meet its aspirations for a better life. And with the United States consuming 35% of the world's energy every day, it is necessary that you make efforts. He finished by saying that if we can use our fossil fuels that remain to bridge into the future, we will then have developed the new tools that we will need to assist us in decreasing human suffering. On the other hand, he said, if we don't make these commitments to do these things in time, the results could be disastrous. The man who spoke these words was Prince Saud Faisal of Saudi Arabia, who is sitting on all the oil in the world, but who, ironically enough, had come to the recognition of the limits that the world faces far more than anybody in this country visibly at this point has. And it's interesting, because when the school in Virginia went and tried to get solar energy put on their school, they were turned down all across America, and they had to go to Saudi Arabia to get the money to install the solar system.

## SESSION XII

### REPORT TO THE CONFERENCE

The conferees held small group discussions on the energy education issues presented to the conference. Charles A. Whitehurst, professor of environmental engineering, Louisiana State University, served as coordinator of the discussion groups, and thus reported to the total conference his consensus of the groups' deliberations.

# SUMMARY REPORT: DISCUSSION GROUPS ON EDUCATION CONFRONTS THE ENERGY DILEMMA

Charles Whitenurst, Professor of Environmental Engineering,
Louisiana State University

The conference participants divided into five discussion groups to discuss the issue, "Addressing the Energy Dilemma." The group leaders initiated the group deliberations under a structured format which capsulized the conference's addresses by Edwin Fenton and Richard Barnet. These two speakers represented differing points of view on the role of schools in the energy dilemma. For discussion purposes, their viewpoints were summarized as:

> Schools need to become involved in the process of socializing society to a new lifestyle and should clearly advocate established government policies. (Fenton)
>
> Or
>
> If democracy is to survive, and if students are to be anything but targets for indoctrination, students must be taught new survival values in school that may conflict sharply with traditional societal values, (the sense of worldwide community, cooperation, and mutual aid versus competition, nationalism, and survival of the fittest). (Barnet)

Thus, a major issue was proposed for discussion by restating points made by Fenton and Barnet. On the one hand, Fenton says that school pupils cannot grasp the complexities of the energy issue. However, schools should do their part in helping to "socialize" the public to accept energy policies developed by the government. Thus he states schools should "clearly advocate government (energy) policies." Barnet, on the other hand, worries about such advocacy. In fact, he says that unless the complexities of the energy dilemma are taught to young people, "They will be targets for indoctrination, but not active participants in the process of social change." Thus Barnet argues that schools should begin teaching survival skills that he clearly acknowledges will run counter to many accepted values and beliefs.

The group participants were also asked to prioritize educational approaches to the energy dilemma from the Fenton and Barnet perspective. And finally, participants were asked to consider ten optional educational strategies including:

1. Emphasize training of technicians and engineers
2. Ignore government energy program and instead teach students to arrive at their own decision about the best approach for dealing with the energy crisis
3. Install K-12 program that advocates federal approach to the energy crisis
4. Set a community example for energy-related self-sacrificing

5. Teach students to influence their family's use of energy

6. Train students to use energy more efficiently

7. Raise consciousness level of students to plight of third-world countries

8. Teach students about impact of our country's economic system on the use of the world's energy supply in relationship to our population versus the world's population

9. Teach students to question energy policies advocated by energy special-interests

10. Provide school teachers with released time to learn more about energy situation

Discussion Sessions

Using this structured format, each group emphasized its own priorities by following a course of action derived from a quick consensus of the group. A majority of the participants advocated the following strategies for energy education:

1. To teach students to influence family

2. To teach energy efficiency and I would assume that this is another way to say--teach conservation principles

3. To raise the consciousness level in the public sector

4. To teach students to question energy policies advocated by special interests

5. To encourage the school system to set community examples

6. To teach the "interdependency" of world nations

7. To improve our (teacher-student) consciousness of the "third world."

On the negative side, a meaningful proportion of the participants didn't think that schools should install K-12 programs that advocate a federal approach (or solution) to the energy problem.

Points of Consensus

Two major points of consensus came out of the groups. They were:

1. We should use the school system to educate students about energy, and

2. We should go outside the system and impact the public consciousness through the latent curriculum.

With respect to these two ideas, specific suggestions, needs, and questions were discussed. They are summarized below:

1. Using the System to Educate

Teacher training, materials developments, and the utilization of school facilities as living conservation laboratories were chief considerations in all groups.

Recognizing that there will never be enough data to clarify all positions relative to this crisis (or any others), it was suggested that we proceed without data. This carries with it the suggestion that we teach children to make decisions in the absence of complete data.

Basic concepts, e.g., finite resource vs. exponential growth, should be taught.

The system should find, package, and disseminate energy conservation education projects which work.

It was generally stated that there must be an integration of curriculum with respect to content and construction; we must place emphasis on process (discovery, inquiry); efforts should cover all age levels; and, career guidance/vocational training must be integrated into the process.

It was conceded that the school system has the responsibility for teaching policy. With regard to this point, a question was asked: "Should we (the school system) follow past trends and only echo the prevailing concerns of society, or, should education lead society toward change?" Further, it was asked whether or not we could do either. One answer given says that education can be:

- Proactive to problems
- Reactive to policy

There was considerable concern about the role of teachers in the system, especially in the development of curriculum and materials. Thus, there was a concern about released time to do these activities.

The groups felt that teacher assessment, curriculum assessment, curriculum development, and in-service workshops should be done in a wide variety of subject areas in the school. Teachers in the subject areas should decide what within energy education falls in their bailiwick and take responsibility for teaching it. At a minimum, an effort should be made to include elementary, industrial arts, home economics, science, and social studies teachers. Most agreed that better use of available materials could be realized if given proper incentives.

There were advocates of change within the current "mode of schooling." They called for the "interrelation of all facets of schooling, with, perhaps, less separate classes. A suggestion was made for one-half the school schedules to be in individual subject classes and one-half in "total relationship classes."

Finally, it was suggested that schools learn to use the "teachable" moments during the next energy crisis, i.e., when the school is closed.

2. Using the Latent Curriculum

Most groups agreed that much has already been done in this area. For example (1) in transportation, people are obeying 55 mph laws, and there is an increase in the number of small cars on the road, (2) thermostats have been lowered in many homes and office buildings, and (3) there is evidence that conservation is in the thoughts of a large number of people.

All agreed that there is a need to increase these efforts, and that there is a need for more school-home energy saving activities.

Students need to internalize their concerns. Better means of communicating between schools/community/industry/government should be found, and total community response is needed.

School facilities, along with other public facilities should become "energy conservation centers" or laboratories.

In summary, the comments of one participant seems appropriate:

What should be educators' responses to the energy crisis?

- Research the problem
- Join with others in study
- Produce information for students which will include for each student an opportunity to know and evaluate the total problem (a) home, (b) school and community, and (c) large picture
- Find new ways to open up society to reveal the problems and alternatives
- Challenge and/or inspire students to look or act in a positive way to new ways of living and reaching life's goals
- Give students a chance to make decisions and/or choices
- Move toward solutions using the best information available and with the best movements known

## SESSION XIII

## REACTIONS TO THE CONFERENCE

Elizabeth Dodson Gray, co-director of the Bolton Institute and Harold L. Hodgkinson, former director of the National Institute of Education and presently executive director of the American Management Association's Professional Institute, provided critical appraisals and summarizations of the conference proceedings.

Gray opened her remarks with some accolades for the comprehensive nature of the conference and the diversity of viewpoints and criticism for the conference's structure and setting. She then suggested that future energy education should be holistic in nature, realistic in content, and oriented to "empowering students to make choices about their lives and futures."

In conclusion, Gray suggested a "paradigm change" involving taking individual feelings seriously, particularly children's feelings. As individuals face the uncertainty of the future with its inherent problems and potential, a new consciousness of individual purpose must evolve, individually.

Hodgkinson advised the conference to consider the concept of reciprocity or the teaching of relationships in energy education. He concluded that future curricula should not focus on just energy education, but rather, the teaching of generic competencies. These include the ability to break a problem down into its various parts; the ability to analyze a problem in terms of creating analogies; the ability to create options from the available information; and, "no proclamation of success until the test data are in."

In other words, he said that the most important element in energy education is how the student processes the information received, not the information, itself.

## REACTION TO THE CONFERENCE

Elizabeth Dodson Gray, co-director
Bolton Institute, Wellesley, Massachusetts

Looking in Your Mirror

I was asked to summarize the conference; secondly, to critique the conference; and third, to give some substantive direction for the future. I will attempt to do this.

i.

First of all, to summarize the conference I am not going to bore you with a content summary of the speeches all of you heard. I did, however, get a sense of SOME BASIC AGREEMENTS in the speeches and in the expressed sentiments of conference participants:

- There is agreement that there is an energy crisis.
- It is a crisis related to other crises--food, population, the environment, running out of resources.
- I feel there is agreement that we are facing limits in a finite world, and that it will be a difficult adjustment for the American people to get used to these limits.
- There is agreement we are probably facing value change and life-style change because of these limits. I say "probably" because there is some difference of opinion on that.
- I've sensed consensus that in relation to this world constellation of problems, education should be involved, but how deeply education should be involved, and the ways education should be involved are questions still very much at issue.
- I also heard a consensus emerging that energy education should not be added on in a kind of supplemental way, but rather it should be integrated into the curriculum. I will talk about that a little more later on.
- And finally, I've sensed a feeling almost of despair about what Dr. Fenton called the latent curriculum of this society. That latent curriculum has such an overwhelming impact upon the society in which our formal education functions.

Now I also sensed SOME DISAGREEMENTS IN THE FORMAL PRESENTATIONS. For example, there were the technological optimists like Earl Joseph of UNIVAC, and there were the technological pessimists like Joanna Underwood of INFORM.

There were also those who see us in the future going down basically the same road as in the past but with gradual changes, because of the momentum of our present system. I would put Mr. Hanrahan of ERDA here--

I think his was a beautiful presentation of that. On the other hand, there were those who feel that because of our problems the present course is a disaster; that we are either at a crossroads or at a dead end; and that we need a radically new direction. Certainly Joanna Underwood of INFORM was a beautiful example of that perspective.

Now it is not surprising that we find these two kinds of disagreements, because these are the two basic sorts of splits among futurists as they dialogue with one another. There are the technological optimists like Herman Kahn and, in his own way, Buckminster Fuller, and there are the technological pessimists. It is not that people like Jay Forrester, Robert Heilbrunner and William Ophuls are against technology; they are technological pessimists because they aren't "believers" that technology can solve any and all problems.

The other basic sort of split among futurists is between those who feel we can and will continue on down the same road making only minor modifications in how we do things, and on the other hand those who feel we must reverse direction or at the least recognize we are at a crossroads and now choose a very different road for the future. Certainly Amory Lovins falls into this latter category. Amory's article, "The Road Not Taken" in the October 1976 issue of Foreign Affairs is an absolutely classic presentation of this position. He talks about the next 25 to 40 years as a fossil-fuel "bridge" either to a nuclear future or to a future of solar energy and soft (small-scale and decentralized) technologies. He describes these alternatives magnificently, and it has been reprinted and widely distributed both by Foreign Affairs and Friends of the Earth.

There is currently emerging still another split, this one about what coming life-style changes will mean to people. There are those who really feel that life-style change is needed--and that it will be very difficult. And then there are those (and I thought Merilyn Reeves of the League of Women Voters did a marvelous presentation of this latter view) who agree that life-style change will be needed and feel that this would be a very good thing because they do not feel that the quality of life today is so hot anyway. They don't feel we are at the apex of what we might be, and therefore they feel that life-style change is not the end of the world but perhaps the beginning of even better things. Certainly Jim Bishop was saying exactly this at the end of his address when he was talking about the positive vision of what a different type of society would be like.

ii.

Now I would like to move on to my second assignment, which was to critique the conference.

First of all, I found it conceptually quite well organized. I found that the major speeches were richer and far more thought-provoking than, frankly, I had expected. Maybe I've thought about this enough that I find more interesting tracks I've not already gone down. So I especially enjoyed the new material in Professor Cicchetti's speech. I found his

account of the long-term existence of cartels prior to OPEC fascinating, and I can't wait to trot that back to people I know functioning in this field who perhaps have not viewed past history that way.

I thought the organization of the material--I'm thinking about the future Richard Barnet presented--was also very interesting, and I enjoyed that. Dr. Fenton I thought was interesting. I thought there was good intellectual meat to chew on in these three major addresses, and I like that.

I was pleased with the variety of perspectives presented. It extended almost in the same panel all the way from ERDA's position and that of the Energy Educators Forum, to INFORM and Nader's Critical Mass group. I thought this was great. And I think CEDaR should be praised for maintaining that variety and range of perspectives even with the money from ERDA which was helping make the conference possible. I really appreciate that.

Let's move on, however, to problems I saw in the conference.

I found that having six or seven panelists on one panel is a large overload which I have a hard time with. There was too much verbalization. We really need to examine our conference vehicles as learning experiences. I'm just amazed, when I came back to the academic life after having functioned in a parish ministry with my husband, to discover that much of academic life is really back in the Middle Ages. We still sit people in chairs and lecture words at them exactly the way they did in the Middle Ages.

This is appalling, particularly in a media environment like ours. It's no wonder that our kids perhaps are turned off in our school systems. They live in a media environment and they are not ready to relate to this lecture-way of learning. I'm not sure anybody is, really, and so I think that conference designers need to rethink their vehicle.

Secondly, there was no time scheduled for participation by the conferees at any of the sessions except the one discussion session. Even that discussion session was structured by readings, questions to react to, and sheets to fill out. I know I didn't like that too much, and I had the feeling many other participants didn't like it much either.

I find interesting the hierarchical structure of conferences that somehow or other conference planners are still willing to perpetuate. It seems to assume a trickle-down theory of learning, as though all knowledge and insight were at the top. Do we treat our children in schools the way we treat conference participants, expecting them to be empty vessels, totally passive recipients of information that elites drop in bit by bit? Do we structure discussion so that there is no real freedom of action and interaction? I think we need to ponder these things as educators.

This raises for me the moral dilemma that CEDaR wrote to Dr. Fenton about, and which he passed over. I feel it is a crucial question educators need to confront: Do we attempt to develop in students the ability to make choices and to be basically active about their lives? Or do we socialize them to go along with solutions determined by others?

Some time ago I read a fascinating article by someone who posited the intriguing theory that industrial societies basically need docile cogwheels, and they want their educational systems to produce those kinds of people for them. Now I don't know whether that's true or not--I'm not an educator. But I think it is an interesting question for us all to think about.

My point is that in the age of scarcity which is ahead of us, it is going to require incredible activity, decision-making, imagination, a sense of control over your own life, and familiarity in coordinating all this into effective action. If in our educational settings we do not allow and encourage our children to do this, then they may have content-knowledge in their heads, but they will not be able to deal with the world of their futures. I think Barnet, in terms of sketching out some of the dimensions of scarcity, talked about that. I would say that the design of this and most other conferences I attend is a clue to our instinctive preference about instructing children and for providing educational settings. It seems to me we always expect those in the seats to be the passive victims of knowledge, and I see that as a problem.

But I have an even more serious problem with the conference. Everyone here agrees that energy education must be holistic. But is not this conference itself designed to do energy education, and therefore should it not also be holistic? Now let me tell you ways in which I didn't find it holistic.

I found scattered reference to, but no real development of, the interrelated nature of the cluster of problems we face. I would have appreciated at least one session exploring the larger constellation of problems of which the energy problem is but one part. I think we all need to understand that better. It is also my understanding that if we are going to talk about energy education, we have to talk also about thermodynamics and about entropy. I heard no mention of either. These things, even though they exist "in other fields," need to be talked about in energy education as beautifully as Barry Commoner did in his book Poverty of Power (1976).

Secondly, there has not been a holistic sense of the people here. There is a problem I have with almost all conferences I go to. We are treated like disembodied minds. We are forced to sit long hours on aching rear ends, with no provisions for the exercise of the body except to eat and drink addictive beverages. I'm becoming increasingly allergic to all this as I really face up to trying to make my life-style holistic within a culture which does not function that way. I've gotten to the point in my own consciousness where I, not my culture, am going to control my life. I'm going to live holistically, and I resent going to conferences in which suddenly my attempt to integrate my mind and body is ripped apart again by the scheduling. Now, once again: it is not just this conference, it's almost all conferences I go to. It's the problem of our model, and our model stinks. I wish we would start to revise it. Why do we go on doing this? I don't understand why we don't revise the models.

I would like to give the conference an accolade on language. Usually about this time in a conference I am blowing my stack as a woman because of the generic male language that is used all the time. I found very little of this here; mostly in Barnet's speech and one example in Jim Bishop's, which he was aware of because he said "used generically."

I would also give the conference compliments for the numbers of women on the panels. I have had the experience, as a woman, of coming time after time after time to meetings and finding only white males standing up here lecturing to us. I have "had it" with that also.

Okay, let's see. I'm coming now to the whole environment of the conference--its latent curriculum, if you will! We have functioned in a high-energy, luxurious hotel, which I know also a lot of you have noticed. We're eating overstuffed meals which emphasize the high energy-content of meat. This kind of living is a large part of our internationl food problem, and if you are talking energy, you've got to talk food energy--and that means you don't eat stuff like this. As someone who has eliminated meat from her diet two or three years ago, I resent coming to a conference where I'm forced back into a life-style which I no longer live in.

I note that lights, the air conditioning, the fountains, and I'm reminded of a comment that a senior scientific figure made earlier this month when I was at an environmental futures conference in Iceland. The last day of the conference we went to a state luncheon at the Prime Minister's official reception home, and here was this fantastic twenty-foot long smorgasbord--just marvelous--mostly stocked with the native fish of Iceland. This senior scientist commented to my husband wryly as he started down the line to the food, "Well, when I'm traveling on the Titanic I certainly like to go first class." The conferences I go to where these problems are discussed almost always make me feel like that.

We can't just talk about these problems; we've got to practice what we preach. We've got to hold our conferences where what we're doing doesn't drown out what we're saying.

I also feel that we ourselves have got to change our identities and the way we live, and not just talk about it. I'd really be interested in knowing--and I'd like a show of hands--How many of you have changed significantly the way you eat in the last year or two since you became aware of this problem? (1/2 to 2/3 of the hands in the room go up.) Well good, that's a start. Now how many of you all have changed the way you buy, how much you conserve, and how? (Again 1/2 to 2/3.) Now how many of you have changed the way you use energy--your thermostat setting, how much you drive, your willingness to do more if we have the mass transit system to do it? (1/2 to 2/3.) Great.

The reason I think this is important is because as I talk to many people they say, "Well, I'd do it if everybody did it." First of all, that's ethical crap; you don't go on murdering people until everybody stops murdering. You decide, "I'm not going to murder anybody," and you let everyone else worry about whether or not they're going to murder people.

I feel the same way about life-style change. It does not depend upon 100% participation.

Then too, we really have the illusion that nobody else is changing their lifestyle. But did you look around and did you see how many hands went up? You see, you don't have to be discouraged by thinking that millions of people aren't doing it, because as I go around and lecture, I see that millions of people are doing it. So let's be a little encouraged. We never ask for public shows like this, so I'm sure most of you thought that most other people hadn't changed their lifestyle, especially if you felt you have. I think we need to share this kind of thing.

That's the end of my critique of the conference. Now I would like to offer substantive directions for energy education.

iii.

First, of all, ENERGY EDUCATION MUST BE HOLISTIC. We've all said this. Energy education must relate to other issues, and we must not just talk about energy and not talk about other things. We must not, in that sense, suboptimize the energy problem and decide that now there is a crisis, we will rush out and find more energy--and then don't think about all the other things we should also be doing, or all the other things we would inadvertently be doing while trying to solve our energy problems.

I have a marvelous definition of SUBOPTIMIZE that I would like to share with you, which I learned at a conference. Suboptimizing is doing perfectly what we shouldn't be doing at all. And if you understand holistic ethics, it means that we should not be suboptimizing ever. We must not "add on" energy education but instead we must integrate it in.

Now that means to me that energy is a marvelous integrating theme for showing how everything is interrelated. Now I'm talking about case studies. I'm talking about showing how energy can provide an integrative and organizing theme for the study of the biosphere, or of human systems, or all at once. You can talk about almost all physical sciences and biological sciences in terms of energy. As an example, I'm very impressed by a new course my son was taught last year at Deerfield Academy, where they are using the study of the weather as a year-long theme to integrate their first year in all the sciences. I think it is a fascinating idea, and I think this is the sort of thing we can do.

You can also talk about human systems as well as natural systems using energy as an organizing point for showing how in social studies the political and economic and social systems are interrelated. One of our colleagues at the Education Development Center in Newton, Mass., had worked with us on a program about "Growth Implications and the Earth's Future." It's a holistic thing we're trying to do. She has gone on with these holistic concepts and worked on a social studies curriculum which takes strip-mining of coal as its focus. Its title suggests its holistic and integrative character: "Energy, People and the Environment."

Its an incredibly interrelated thing, so you might want to look at it. That's another example of the kinds of things we might do.

If we are going to be holistic, we are also going to need to consider the school environment itself. You know: Consider your school as a closed system and get your students to analyze the energy and also to work on that latent curriculum. We need to be holistic in all these ways.

Turning now to a second major point, we need not only to be holistic but also to be REALISTIC. Barnet and Cicchetti, I think, agreed that we need to be honest with the kids about how the world is structured in terms of the reality of multi-national corporations and world-trade arrangements as well as the historical relationship between business and government. We can't act as though some of those realities of the real world don't exist. We can't teach energy education, for example, and not show the political, financial, economic and scientific power structure behind the nuclear industry. We're not facing choices in the real world which are weighted evenly between coal and nuclear, or between nuclear and solar. Nuclear has a whole industry and 25 years of investment by the Atomic Energy Commission behind it. Solar has little but some people's dreams of the future and a benign reputation. We need to be honest with the kids that we're not just looking at these things as intellectual exercises; we are talking about issues and decisions in the real world where some energy sources have a tremendous economic and political and academic power-base and other energy sources do not. Who speaks for the rivers and hydroelectric power, one way or the other, for example? The kids can understand how come some things happen and how other things don't happen. Kids can understand this and they need to know they can understand this. Demystification is a part of education.

A third major point is that we must not only be holistic and realistic, but I would say as an environmentalist that WE MUST NOT BE SO ANTHROPOCENTRIC. We must teach our students not just to look at the human world and human systems and human needs. We must look at the whole System-Earth of which the human is just one species who likes to feel that we are the most intelligent species. I have a whole thing on that which I won't go into, but I think it is an erroneous view of ourselves and we need to correct it.

A next major point is that WE SHOULD BE ORIENTED TO EMPOWERING STUDENTS TO MAKE CHOICES ABOUT THEIR LIVES AND FUTURES, as I talked about before. In this sense we need to be what I have called "future responders." We need to have a sense of what I have called "the 200 year present," and by that I mean we need to help our kids go back 100 years in history, very much as Dr. Ciccetti did, to see the role of past events and choices in our getting to where we are now. After all, the past provides some of the constraints under which we operate in the present. But then we also have to extend our time sense 100 years into the future, so we can understand that what we do in the present will in turn determine our future, which is very much our kids' future.

As an example of this, I've been very excited since I have been here learning about a program called City Building Education Programs in Los Angeles--Doreen Nelson's program. That's very exciting, and I

don't know how many of you know about it. It's a program in which elementary-school children design their cities, and they do it over long periods of time, which is why she works with elementary-school students. They get involved in this holistic concern for the human-built environment and for the environmental-environment apart from humans. They have to decide on their own government. They have to structure their lives; they actually build it with large slabs of styrofoam. I was struck by one of her comments--this illustrates what I'm talking about. She said she was asked by the then-mayor of Los Angeles, Sam Yorty, to take part in the Goals for Los Angeles Program, and she discovered that the citizens were asked what they wanted the future of Los Angeles to look like and be like. And she said, "We soon discovered that most people interviewed didn't have the tools, vocabulary, problem-solving ability, even perhaps the interest in the present environment, to imagine or invent the future."

Now I submit to you that it is absolutely crucial that our school systems help our children learn how to imagine and invent the future, to assume authority over their own lives, to organize information and to make decisions, to plan and to shape their own futures.

Finally, I think we need to TAKE CHILDREN'S FEELINGS MORE SERIOUSLY. DISCOVERING THE NEWS OF LIMITS IS A REAL DOWNER TO MOST PEOPLE, AND PARTICULARLY TO CHILDREN. We have some good friends we visit, to whom we talk all the time about these problems. We launched into a conversation over dinner once, and their then-7-year-old boy, who is very precocious, laid down his fork after about three bites and said, "Please do not talk about all these horrible things that are going to happen in the future any more; it makes me sick to my stomach. I want to finish my supper and leave the table, and then you can all talk about this."

I appreciate that feeling, because these horrible things we are discussing--pollution getting us, running out of resources, and so on--are much more real in the lives of our children because, whereas many of us have already lived a significant portion of our lives, we are talking about almost all of their lives. Theirs is a post-pollution consciousness, and I will cite to you my son, who is now fifteen. When he was five, we took him for one of the first trips he remembered into New York City. My husband and I were very urban-oriented people, so we look at the city and we see theatres and museums and all kinds of excitement; he looked at it from the car window as we approached and all he could see was smog--at age five, ten years ago. It made him say, "Yuck, look at the pollution," and scrunch down in the car and not even want to breathe.

Now that is a post-pollution consciousness. I'm aware too that there is pollution in our air. But I didn't immediately have that reaction. These are the students we are giving this information to. It is a downer. We need to understand this and we need to formulate it very carefully so that something like the City Building Program goes on; so that young people become empowered to imagine their futures, to take control of them. That, I think, is the best antidote we have for the great downer ahead.

There has been a great concern in the conference about HOW MUCH CONSCIOUSNESS CHANGE IS GOING ON, and a real debate over HOW MUCH PEOPLE'S CONSCIOUSNESS ACTUALLY CHANGES. I would like to bring to your attention an interesting thesis my husband has written up in a paper which has yet to be published called "The Grief Dimensions of Limits to Growth" (1975). He's taken the categories of Dr. Elisabeth Kubler-Ross and posited the thesis that, since individuals go through these stages when they must deal with loss, our society too is going to go through these stages when we deal with the loss of growth, the loss of the idea of progress and an unlimited future with endless natural resources.

I think this analysis is very sound, and I'd like to remind you of the stages as outlined by Kubler-Ross. The first stage is denial and shock. This is the reaction of the person who is told by their doctor they are going to die of a terminal illness. Or it is the first reaction of someone when someone else, a loved one, is dying. So it is a reaction of people who go through death themselves and it's also the reaction of those who experience the death of other people. The first reaction is shock and denial: "It can't be!" I submit to you that this reaction of "It can't be!" has been the first reaction of our society to the book The Limits to Growth. Absolute shock and denial. The Wall Street Journal still exhibits the great denial still going on in many parts of our business community to the thought of limits to growth.

The second stage is anger--anger in hospitals toward other people, towards doctors, toward nurses, toward all sorts of people. This is outrage that this can be happening to me.

The third stage is bargaining and postponement: "Now, God, if you'll let me live until June, then I'll love you forever, God. You know I'm about to die."

The fourth stage is depression, a deep and profound depression. People turn to the wall and literally just go into a great wave of depression.

The fifth stage is acceptance and an adjustment of your life and days to the imminence of death.

When our culture and we, individually, are confronted with the loss of growth, the loss of the American dream of unlimited futures, we must not expect that loss to take place with a mere shrug of the shoulders. We will go through some or all of these stages. I think this is a very perceptive analysis, and I think perhaps it will help us as we relate to children and parents, not to try to hurry them. People have to grieve, if you will, about the loss of their dream. We have been inspired by such dreams, and they don't get laid down painlessly or quickly.

John Raines of Temple University has a very penetrating analysis of what this means to Blue Collar families. He points out in "Blue Collar Families and Limits to Growth: Mourning the American Dream" (1977) that we must mourn with people the death of their American Dream. I think

we must begin to recast it in positive forms also, as Jim Bishop did for us. So I don't think it's a totally bleak thing. But we must first of all mourn with the mourners--because they have honored the American Dream, they have believed it and built their lives around it. It has become the meaning of their lives, as John Raines says so powerfully: If you cannot give your children a good life in suburbia, if you give them a kind of life you wish could be better, then you can at least give them the American Dream so they will work hard to stay in school and not get out on the streets and not get into trouble. The American Dream has assured us that if our children do this, then they will have a better life than we, as parents, did.

Now we've got to deal with the hope and assurance that there is in that Dream; we've got to honor it. We've got to help people mourn it, and you've got to be tender with people's feelings as you do it. We must allow people their denial, we must allow people their stages, we must allow people their mourning. We must not expect kids, children, to be saints overnight--to sacrifice and share the world when we adults have not been able to manage it in our generation either.

To approach this from a little different angle, I think it is helpful to realize we are confronting here what I would call a significant PARADIGM CHANGE. This happens to each person individually. I'm struck by how much like experiencing a conversion process it is in some ways. I'm a Christian and I have my graduate degree in theology. If you have a life history like mine, you are very used to having a really dynamic relationship with God which guides you. But such a relationship cannot be passed on to anybody else, including your children, just because you want them to have it. You learn, it seems to me--either you go nuts or you learn--to trust the grace of God, which is to say that you trust people to go through what is essentially a paradigm shift at their own speed. They experience their lives differently--in a way you cannot control and which you cannot structure for them. It's not something you can beat anybody over the head with.

I think the same is true of the paradigm change we have been talking about in this conference--of taking this constellation of problems seriously and changing your life-style accordingly. You have to allow people the freedom and timing of their own feelings. My children, for example, do not want to think about some of the limits that are in front of them, and I must allow them that freedom. Simply because I see what I see does not mean I can cause them to see it. I have changed my lifestyle, I have given up meat, and other things. My fifteen year old son has not given up meat, he has not chosen to do that, and I must allow him that freedom.

This seems to me very crucial as we set out as educators. We must both tell people what we know, and we must change our lives ourselves if we are convinced that is what we must do. But then we must allow people their own freedom to experience the crisis in their own way, and to come to their own choices about it. Consciousness change, like religious conversion, takes place within the mystery and uniqueness of each person's individual life experience.

## REACTION TO THE CONFERENCE

Harold L. Hodgkinson, executive director
Professional Institute, American Management
Association, Washington, D.C., and former
director, National Institute of Education

Energy Education: What Do We Do Now?

Mrs. Gray, you were fast on your feet and a tough act to follow. I will therefore not try to summarize the conference, except to agree with you on two important points. First, conferences should exemplify the pedagogy they advocate. If we recommend that people get involved in games and simulations and so forth, they should be available here, they should be a part of the conference. If we believe that people should interact with speakers, we should set up formats that make those kinds of things possible. I noticed one very dramatic moment the first day of the conference, when the gentleman from ERDA and the lady from the nonprofit institution were at absolute loggerheads. I could see the ERDA man writing like mad, and if we'd only had ten minues to let those two get at each other, I had a feeling we could have learned something. The second thing about the conference that's important is from Dante's Divine Comedy. There is one stage in Purgatorio--as I recall, it's about eleven levels down--in which the divine punishment is to have a number of educators forced to sit forever at the back of a large dark room looking at illegible overheads. I think with those two cracks I would like to leave the conference behind and instead summarize the last three conferences I've been to.

The first conference was on the crisis in the American family. This conference took place in March. It was based primarily on extrapolation, and we were told at least fifteen times that if present trends continue, there will be no American nuclear family left by the year 2000--at least, as we know it today. Figures were quoted such as the following: in the District of Columbia in this last year there were more abortions than live births; in addition, more births occurred out of wedlock than in wedlook; in Chicago in 1900 sixty percent of Americans lived in extended families (mother, father, children, and at least one other relative) by 1965 only five percent of Chicagoans lived in extended families. Therefore, if we extrapolate this out, you can see what's going to happen.

The second conference I went to, in April, was on violence in the United States. Major theme: there is a crisis in the United States of unprecedented importance, dealing with the number of murders and violent crimes that are committed in the U.S. Figures were quoted, such as the number of murders a child sees on television--the general average tends to be about 13,000 murders by the time he/she reaches ten years of age. Again, there's an exponential rate of increase in violent crimes, and if nothing happens, it's quite clear that we will all be dead by the year 2000. The year 2000 is always referred to.

The May conference I went to was on pollution. The message there was that there's a generally increasing level of pollution in a number of different areas of our natural resources. A number of interesting

comments came up about the nature of that pollution. Denver was mentioned as being one of the most striking examples of air pollution, and a number of other such topics were developed. Exponential increases in pollution were demonstrated, the projections out to the year 2000 were made, and it was clear that if things continue as they now are, there wouldn't be any water, polluted or otherwise. There seems to be certain conference style and a certain mode of analysis of the problem which is based on extrapolation: "If things continue at their present rate, x will be the consequence." That is a very useful analytical tool, but it is not the only analytical tool. I wish sometime we could begin a conference with a different mode than that of "if we don't do anything but project it out, we will arrive at the following consequences."

First of all, if you had such a conference in the fifteenth century, you would immediately be aware of the fact that the number of biblical interpretations were increasing so drastically that if you simply put biblical interpretations on an exponential curve, the world would be covered with paper by the year 1800. It does seem to me that we can learn a great deal from extrapolation, but do we need to think seriously about some other ways of organizing conferences on the family, violence, pollution, and other topics of that sort. I would agree entirely with Mrs. Gray that we need some new kind of integrative mode of analysis that will help us to put together the various kinds of crisis themes that we deal with and are serious about. (How does the family crisis relate to the energy crisis, etc.?) I hope to speak to that need.

The other thing that happened this morning, and it happened at every one of the other conferences, was that a "we-they" was created. By raising our hands and feeling virtuous because we've changed our habits, we then feel expiation of guilt, which is a classic religious theme and is very good for you. It's those other people, they, the ones who didn't come to the conference, who are the problem. That was true at the family conference, it was true at the violence conference, and it was true at the pollution conference. So expiation of guilt is useful therapy, but doesn't solve the problem.

I would remind you of one historical fact which was brought up at two of these conferences, and which I think is fascinating. Carthage was the first city in relatively recent history to have obtained a population of one million. This is well before the birth of Christ. Their main problems were air pollution, waste disposal, and soil salinity--the soil became so full of salt that they couldn't grow anything. I'm sure there were people who said then, in Carthage, that if we continue to go at the present rate, x is going to happen. Note that wells in Southern California are now beginning to pump salt water instead of fresh.

Let me now try to develop a theme that might be helpful in terms of trying to put together the various components that we have heard thus far. I think there is a key concept which I'd like to emphasize, and that concept is reciprocity. Things have interactive effects on other things, and they are not always predictable. The best example of this lack of predictability is what happened when Scott Carpenter, the astronaut, came down from his historic flight into space and was asked his feelings when he pushed the retro rocket button that would cause the rocket to come

shooting back through the fiery curtain. Carpenter replied, "It occurred to me that I was riding in a vehicle made up of over 500,000 individual parts, each part having been contracted out to the lowest bidder." Things then do have reciprocal relations with each other, and it is nowhere more clear than when we are in a vehicle of which we are no longer in control. One of the reasons why some Americans don't like airplanes, I think, is that they don't drive them. It is a different feeling to sit in an airplane than it is to sit in your own car, in which, for better or for worse you are in complete control. So the reciprocity of things, services and creatures is a terribly important theme, and I think we can begin to work seriously with that kind of notion in education.

I agree with Mrs. Gray that there has been a perceptual revolution that has taken place in the last decade. The most striking aspect of this to me, (I'm primarily a social scientist), was the first publication from NASA of pictures of the earth taken from a distance far enough away so that the entire circular surface of the earth could be seen. Having talked with and interviewed hundreds of people, it was clear that those pictures shocked many. The first group they shocked was the Flat Earth Society, which has been flourishing in the United States since 1850. They reacted by saying that the entire NASA effort was simply a government front, and that those pictures were all contrived. However, it was clear that for most people, we do begin to see the earth as a spaceship. That's a ten year old metaphor--Ken Boulding probably began it--but it's still very useful. What Boulding said ten years ago, not only about energy, but about pollution and human life, it's that we can't throw anything away and we can't kick anybody out. And if there are two important dimensions around which we might build a curriculum based on reciprocity, it is that we can't throw anything away and we can't kick anybody out. I did learn a homily that's very important for me from this conference--waste is only a resource for which we haven't yet found a use. That's a nice working thing.

Let me then present five kinds of reciprocities that we might find useful in building a curriculum. The first reciprocity to be taken seriously is the reciprocity between what schools teach and what the media teach. Mr. Fenton mentioned this, but we didn't get down to brass tacks. What would happen if we started building within a school communinty curriculum based on the media? I think that it would be very easy to do. One reason for the curriculum is to help kids analyze the real message behind commercial advertising. This morning when I got up I turned on the television. Like Mrs. Gray, I know whereof I speak, because I watch it, probably too much. The first thing that hit me at seven o'clock this morning was an Alpo commercial. That's a little tough at seven o'clock in the morning, but the message of the commercial was very clear: "doesn't your dog deserve Alpo?" Now thinking back to John Calvin, and the inculcation of guilt in the average human being, and how easy it is to feel guilty and to work hard for success when you feel guilty, I had this feeling that the only way I could be a good parent to my dog was if I fed my dog nothing but animal protein.

We could probably pick ten or fifteen commercials that convey very nicely a given value orientation which is contrary to that of the schools. The schools in the past have been what Willard Waller used to call, in a

wonderful phrase, "museums of virtue." Walking into a school used to be like walking into a museum--you could see all the virtues being practiced which the adult community no longer cared to practice, or didn't have the time or the inclination to. Thus we have the famous teacher's contract written in 1936 in North Carolina in which the female teacher promises, not that she will not get married during her tenure as a teacher, but that she will not fall in love. That was written into the contract. Teachers didn't smoke, teachers didn't drink, teachers didn't engage in many of the other social practices that we all engage in. Why? Waller says because schools are museums of virtue controlled by the adults to give an image of society to young people which is contrary to what the adults do, but which might help in the next generation.

One way to get into this reciprocity in schools would be to develop a study procedure for the analysis of school values and media values. When the media and schools work together, what happens? When they are at loggerheads, who wins? Such a program could fit simply into a number of existing courses rather than requiring a new one. Themes could include energy, environmental protection, the family, violence, etc., all timed to compatability of school values and media values. Parents would be an important part of the instructional process as would the students themselves. Rather than six new courses, this strategy provides for infiltrating a variety of courses in which the context and process would be relevant.

Reciprocity number two involves the interaction between producers and consumers. Mr. Cicchetti, if that's the right one, got into this a little bit, but I felt the analysis was not quite sharp enough. I understand now what the producers need in terms of incentives, but I always felt that I knew what they needed--they needed higher profit motives. The consumer, however, is something else. What are the various incentive systems that might work to make consumers and producers more reciprocal? At this conference we still see each other as enemies, producers on one side and consumers on the other. Are there any ways those forces could work together for the common good? If you say no, I commend to your attention a short look at Japan, where a number of very interesting experiments are underway in which consumers and producers are working together in a number of very cooperative settings.

Reciprocity number three concerns the relationship of the energy chain to the food chain and then into education. Our perceptions of these chains are all important. I would like to spend two minutes just to develop this a bit if I may. If you ask a goldfish to write down everything that the goldfish knew that was in his bowl, the last thing he or she would write down would be water. Water is so close to the average goldfish, so much a part of everyday life--and there are probably attitude surveys to prove this--that it would be very hard for a goldfish to separate him or herself from the environment enough to isolate water, because that's all there is--there's nothing else. I think that's a useful metaphor for this kind of reciprocity. The other metaphor that I'd like to mention is a statement from Milton Rokeach, who wrote a book a few years ago called The Open and Closed Mind. As a summary of his analysis, which is a very interesting

study, said the following: "Systems of human perceptions exist to serve two functions. The first is to explain the world insofar as possible, and the second is to protect the individual from the world insofar as necessary." We have all met people whose need for protection from the world is a lot higher than other people's. One of the questions we can ask is what sort of strategies can we develop to lower the threat level for these people, so that perhaps they can put on some of the glasses that might enable them to see the world in more useful ways?

Out of that, then, we come from the energy chain to the food chain. Let me mention briefly here the one most fascinating thing that hasn't been talked about at this conference and that's Asimov's law. I don't think this was brought up anywhere. Asimov has done a very intensive study of the relation of food to environmental factors, and has come up with what seems to be a very good working law. That is, 100 pounds of vegetable matter will feed ten pounds of herbivore or an animal that eats grass. On that ten pounds of herbivore you can raise one pound of carnivore. The relationship in the African veldt, then, between the grass lands, the zebras who feed on the grass, and the tigers who feed on the zebras, is a very concise mathematical formula quite easily worked out. And if you want to vary it, just have three dry seasons when the grass dies and you will see what happens to the herbivores and carnivores. In the U.S., a 100-pound man who eats only meat will need 1,000 pounds of beef on hand, to be fed by 10,000 pounds of vegetation.

The reason I present this is that it seems to me very important when we think about the food chain to realize how related it is to the energy chain, and that when we talk about the importance of the relationship between vegetable matter and animals that eat it, then other animals that eat the animals, we've got a very mathematical thing going and Asimov is the first man I know to put a formula to it which is quite invarient. It doesn't matter much where you are in the world--it holds up. We are carnivores and I must confess that I have given away some of my minor vices, but like Asimov himself, I still like rare roast beef. I tried and I tried but I can't get rid of it yet. But think every time you eat roast beef that represents a pound of you, ten pounds of beef, and 100 pounds of vegetable matter. Somehow if we have that perception zinging around in our heads it might help me and others to get through that part of the chain.

We have gone from energy to food. Let me take it now to nutrition. We know quite accurately what the consequences are for child development of a mother who has inadequate nutrition during pregnancy. If a mother has an inadequate diet, she has a one in four chance of producing a baby who, at age four, will have a brain weight of 125 grams below normal. That's a pretty concise fact. It's been tried in a number of settings and again, with relatively little variance. Normal brain weight may vary a little according to the amount of protein in any given culture, but not much. Therefore if we start thinking about learning difficulties which we have to deal with from age four on, one of the best educational policies this country could adopt is to make sure that every pregnant mother in the United States has had an adequate diet and has had one prenatal examination.

That then is one example of the problem of where you intervene in a complex chain of events. I've taken it just through energy to food to nutrition to brain weight to learning. You can carry it on further if you wished--to learning, to delinquency, to some of the other social processes and casualties that are produced by maleducation. Where then do we intervene in these complex chains? We really don't know where within the chain we ought to intervene, if at all, because we can't always predict the consequences. And it may be that one of the methodologies that we have to teach kids is how to deal with incalculable risks along with calculable ones, and put them together. I was terribly impressed on this score with a conversation I had with the Department of Agriculture people shortly before I left NIE. They'd asked me to come over and give a short talk on the relationship of nutrition to childhood learning and later learning problems. We talked about this for a while, and then one of the major domos in the Agriculture Department said that's very interesting, but it's based largely on hunger and, he said, hunger is not a problem at the Department of Agriculture. We produce the food, and we get it to the wholesaler and that's really where our interest stops at Agriculture; somebody else has got to take the problem over there. So the government is organized around the old perceptual scheme, not the interaction of various processes we have been discussing. To get across agencies is possible, but to get across departments in this town is virtually suicidal. We have to have some governmental mechanism that will think about that whole chain. If we had one, and if it became politically real, I would think we could quite quickly improve and be responsible for education because the politics really mirror the paradigm at work in this society.

Reciprocity four is across nations. I was struck with Mr. Barnett's notion in the U.S. as an undeveloped nation. Also the description we heard yesterday afternoon about what happened in Ohio when one failure led to another which led to another, and all these redundant systems that were supposed to have triggers to make sure no error took place--none of it happened. I was struck with the thought of what it must have been like in Columbus to realize that these systems were failing one after another because of the lack of reciprocal arrangements they had with each other. There has to be some kind of reciprocity that will help us get across national barriers. One agency now is, I think, the main agency for doing that; it's the Multinational Corporation, as Mr. Cicchetti mentioned. We need to pay a lot more attention to MLN's in schools. I don't think very many teachers know much about them. The reason I was so pleased with Mr. Cicchetti's remarks was that he explained to me for the first time the incentive system which allowed oil people to leave the oil in the ground, because they would make more money on it later on. That was neat, I had never really thought about that before. Across nations, we need to think about MLN's and what they are used for: Who are they accountable to? Who controls them? And then of course the question is, who should?

The fifth reciprocity we need is some kind of mechanism to get us across jurisdictions within the country. We have very little talk about states at this conference, and when we did they were sort of blue meanies--I didn't hear anybody who was terribly fond of either states' rights or state government in terms of their enlightened view of the problems we were discussing. I do think this reciprocity is going to emerge,

and I think so for two reasons. The first is that we are going to have to re-invent the railroads. If there is a transportation crisis in the United States, I think it is mid-range high speed transportation across major metropolitan areas. If you have taken the shuttle between LaGuardia and Washington as often as I have, you would know that is not a long-term solution to the problem. Japan has some excellent solutions in the form of high speed trains and monorail systems that work extremely effectively, but that's a very difficult way to go across jurisdictions. I had an overhead which I wanted to bring down, but couldn't, which shows the completion of two interstate highway systems as they come to a state line. It was taken from an airplane about two miles up, and you see these two marvelous strips of concrete coming up to the state line and stopping. One is about two miles north of the other. That actually exists in the interstate highway system, or did until a fast turn was made to get you down from one to the other. So we need a way of solving these jurisdictional issues between localities, states and the federal government, and I think the schools can play a limited role. They can't do it entirely, and some of this is going to be beyond the immediate scope of schools themselves. We can, however, begin to develop the importance of jurisdictional cooperation in the perceptions of our students. We will need all of our cooperation as we try to re-purchase the rights-of-way that have already been sold, usually to highway interests.

Those are five reciprocities you might want to think about in terms of how they could contribute to a curriculum. Let me propose that we need to think about some kind of curriculum that will not deal with the energy question alone. I would disagree with Mr. Boyer on this. We need a curriculum that will help schools to teach students to do the kind of social and technical linkage analysis that we've all been doing for the last two days. There are four generic competencies that I think underlie the liberal arts curriculum and have been shown to be related to success among industrial managers, sales personnel, and hospital administrators. These four elements of the generic competencies are as follows: One, the ability to parse a problem into its components, to break a problem down into its various parts. This is teachable, we've all done it, and we all do it. The second part of the generic competencies is the ability to analyze a problem in terms of creating analogies. "This is like something else I know," so that you are able to build in the relations of the problem to another problem you've worked with. You can create analogies. This is one reason why the Miller Analogies is still used for admission to graduate schools, because it works. Number three is option production. Can you create viable options by putting together these various kinds of action and other forms of analysis you have at your disposal. I'd suggest there are three things you have to put together before you can analyze a social problem. They are the normative assumptions that we've talked about this morning, values if you will; theories about how things happen (and you have to include theories into most of your analysis); and the facts, or relevant data. These three components have to be put together in options and analysis. The fourth, which is the one most of us fail on is "no proclamation of success until the test data are in." Given those four generic competencies which are taught in a number of liberal arts colleges and which seem to be correlated with success among industrial managers, sales personnel, and hospital administrators, we can start building a curriculum and help teachers do this in a better way.

The high school curriculum in the last decade has taken a fairly major leap from one thousand to two thousand course titles. Only 45 percent of today's high school seniors are taking a course called English. Ken Komoski has indicated that there are over five hundred thousand commercially available materials right now from which teachers can choose. How on earth can teachers choose from 500,000 commercially available materials? We must encourage teachers to develop more of their own materials. Teachers now spend less than five days a year working on materials that they devised. They spend the rest of the school year on commercially prepared materials. So the domination of those materials is very complete. I think we need more teacher autonomy working with community elements to develop the generic competencies I talked about a minute ago.

The final point has to do with what I call a new series of metaphors. Let me read one of these out briefly. Many of them come from the Hopi and the Navajo, because the Hopi and the Navajo have a great concern for the environment, and understood a long time ago the relationships between energy, productivity, human beings, and technology. And indeed if you want to see a fascinating thing look at the river cleansing ceremony in which once a year they go to the river and pray for their own atonement. They have committed crimes against the river, they are blessed by the river and they try to do better the next year. That's about eight hundred years old and that's not necessarily a bad way to look at the problem..

The issue of social pollution is a very vital metaphor. Every time we misutilize human resources we've created social pollution. Every time we lack integration between the local, state and federal jurisdictions, we have social pollution. It isn't visible in the air but ask your bank teller, your taxi driver, or others who deal with the public every day, and they will be able to spot it pretty well for you. There are at least three areas in which social pollution makes itself felt: in the world of education, in the world of work, and the world of leisure. The degree to which each person in this society has access to the community services that those three make possible, measures the quality of their lives. Number of patients per doctor is not a good measure of health care and never will be. But the speedy availability of health care to the citizen when the citizen needs it is measurable and a finite measure of at least the quantity of health care, and to some extent, the quality.

These three things, work, education and leisure work together in terms of either creating or minimizing social pollution. We are now in a crisis, it seems to me, in terms of the interactions of these three. We need to work with the reciprocities I have mentioned. If education is unrelated to the media in terms of the message presented to the public, that is a form of social pollution. As Robert Merton pointed out long ago, societies generally get the crime rate that they deserve. If you put people in situations in which conflicting norms are unresolved and nobody cares much, that's the kind of crime rate that you are going to get, because that's the kind of crime rate you deserve.

In closing I am not a pessimist, nor do I believe necessarily in the prophets of gloom, but I would like to point out to you a tombstone in

Laramie, Wyoming which I always liked. It carries the inscription: "See, I told you I was sick." I do have a feeling occasionally that there are people who come to conferences who would just love to have the world go to hell, because it would prove their point. I think we can deal with these complex problems, and reciprocity and autonomy are the two concepts I think we need to work with now. When do we become reciprocal? We know that Mrs. Gray is more autonomous now, she is going to decide her own life. But she's done that after a lot of reciprocating with other people. When do nations become reciprocal? When do they become autonomous? When does the United States say, "I don't care what you all are doing, we are going to do this thing our way." Those are questions we don't know much about. Social scientists will be of little help in analyzing those questions. There is no social science that I know of that is expert in the analysis of comparative normative judgments. There is a profession that is usually neglected at the family conference, the violence conference, and the pollution conference, and that's the philosophers. And I wish we had one philosopher here, a gentleman or lady who makes a study of values and how people make decisions about values. These questions then about reciprocity and autonomy, how they fit into the chains, can only be resolved, I think, when we know more about normative theory. How do people make choices? And how should they? If we get to that point, then I think we are on the way.

## CONFERENCE DISPLAYS

During the conference the Energy Research and Development Administration's (ERDA) Energy/Environment Simulator and a variety of selected energy education materials were on display.

The ERDA "Energy/Environment Simulator" provides observers with the opportunity to project by computer the nation's resource utilization in future decades. The effects of alternate decisions on the available energy resources and the environment becomes evident immediately. It is an excellent education tool.

ERDA provides displays of the "Energy/Environment Simulator" at various sites throughout the country. For further information, contact: Burrell L. Wood, special assistant for communication services, Office of Public Affairs, Energy Research and Development Administration, Mail Stop A1501, 20 Massachusetts Avenue, N.W., Washington, D.C. 20545, 301/353-4357.

Although the energy education materials displayed at the conference certainly were not comprehensive, they gave participants a good indication of energy educational product availability. These materials are described as follows:

1. The Hydrocarbon Civilization is a series of eight activities for students in grades 10-12 and their teachers. It includes an interest survey; a resource guide; four futurist techniques; an energy optionnaire; and a role-playing situation. Developer: Minnesota Environmental Sciences Foundation, Inc., 5400 Glenwood Avenue, Minneapolis, Minneasota 55422.

2. Energy and Society is a six-week course for grades 9-11. It includes a student textbook and a teacher's manual published by Hubbard Scientific. Developer: Biological Sciences Curriculum Study, P.O. Box 930, Boulder, Colorado 80360.

3. "The Joule Unit" is a unit on energy for grades 5-7. It is part of Individualized Science Program, a total elementary school science curriculum being published by Imperial International Learning Corporation. Developer: Learning Research and Development Center, University of Pittsburgh, 3939 O'Hara Street, Pittsburgh, Pennsylvania 15260.

4. Growth Implications and the Earth's Future is a book that explores the attitudes of secondary school students regarding ecological systems, growth, and survival. It also reviews available curriculum materials related to these issues, including materials for teaching key concepts such as food, population, and energy. Developer: Education Development Center, Inc., 55 Chapel Street, Newton, Massachusetts 02160.

5. Energy Conservation Activities: Grades 1-6 is a book for students and teachers. It includes activities that can be integrated into all subject matter areas of an elementary school's ongoing curriculum. Developer: Northern Colorado Educational Board of Cooperative Services, 830 South Lincoln, Longmont, Colorado 80501.

6. Teacher's Environmental Resource Unit: Energy and Power is a booklet for teachers and students in grades 7-12. It provides basic information on energy consumption and alternative energy sources. The Energy Crisis: A Simulation is a six-week learning activity designed for students in grades 7-12. Students play the roles of members of Congress and simulate actions needed to create a national energy policy. Developer: Brevard County Schools, Center for Environmental Learning, 1274 South Florida Avenue, Rockledge, Florida 32955.

7. A series of 9 films and 8 filmstrips with audio cassettes present information about alternative energy sources. An overview film describes the series. It's designed for use by junior high and high school students as well as by adults. Developer: Educational Media Center, University of Colorado, Stadium Building, Boulder, Colorado 80302.

8. "Energy is Where You Find It" is a package of two filmstrips and a teacher's guide for high school students. An oil project in Alaska and offshore oil drilling are described. Developer: Atlantic Richfield Company, P.O. Box 2679--T.A., Los Angeles, California 90051.

9. "Specifications for a Teacher Training Model" is a set of four manuals for teaching energy-focused environmental education at the high school level. Included are orientation, content, instructional management, and implementation manuals. "Specifications for a Community Leadership Development Model" includes a content manual for an energy-focused community leadership program. Developer: Far West Laboratory for Educational Research and Development, 1855 Folsom Street, San Francisco, California 94103.

10. Energy and Man's Environment Activity Guide is a set of eight resources booklets for teachers, grades k-12. Included is information on current and future sources and uses of energy, conversion of energy, limits of energy, and impact of energy as well as an introductory guide and a glossary. Energy and Conservation Activities for the Classroom is a series of four notebooks which include lesson plans for grades 1-3, 4-6, 7-9, and 10-12, respectively. The Energy Films Index and the Energy Education Bibliography are two books that list key resources for energy conservation education. Developer: Energy and Man's Environment, 9224 South West Hamilton, Suite 301, Portland, Oregon 97201.

11. Energy Conservation in the Home is a document subtitled, "An Energy Education/Conservation Curriculum for Home Economics Teachers." It explains major energy concepts and provides a comprehensive guide to understanding and conserving energy in the home. Ideas and Activities for Teaching Energy Conservation: Grades 7-12 is a curriculum guide for teachers. It includes overviews of energy resources and consumption patterns. It also presents 49 activities to help students understand energy concepts and practice energy conservation. "Finding Solutions to Environmental Problems: A Process Guide" is a booklet designed to help high school and college students as well as citizen groups identify the most pressing environmental problems in their communities and find solutions to them. Developer: Environment Center, University of Tennessee, South Stadium Hall, Knoxville, Tennessee 37916.

12. Our Energy-Based Economy is a multimedia kit that explains principles of economics and the relationship of energy supply to the free-market system. Designed for use in upper elementary and middle school grades, the kits include four filmstrips with soundtracks, activity and assessment sheets, and a teacher's guide. The Energy-Environment Game is a multimedia simulation for junior high and high school students. Through role playing, research, group discussions and public hearings, participants simulate a real-life controversy centered on the demand for increased energy supplies. The kit includes a filmstrip with audio cassettes and a variety of print materials. Electrical Safety In and Around the Home is a multimedia kit on electrical safety for children ages 9-12 years and their parents. The kit includes two filmstrips with audio cassettes, a teacher's guide, a game, and activity sheets. "Electricity Serves Our Community" is a two-dimensional cardboard model of an electric power system. It is designed to provide students in intermediate grades with an understanding of how energy is distributed to consumers. Distributor: Edison Electric Institute, 90 Park Avenue, New York, New York 10016.

13. Energy-Environment Materials Guide is an annotated list of readings for teachers and students. Student readings are organized by grade level. Energy-Environment Source Book is a resource document for teachers, k-12. It includes two volumes, bound together: "Energy, Society and the Environment," and "Energy, Its Extraction, Conversion, and Use." Energy-Environment Mini-Unit Guide is a collection of seven short units on energy for science and social studies teachers, grades k-12. Each unit includes lesson plans geared to particular grade levels. Interdisciplinary Student/Teacher Materials on Energy, the Environment, and the Economy is a series of booklets that provides resources for classroom use. The series includes: "The Energy We Use" (Grade 1); "Community Workers and the Energy They Use" (Grade 2); "Energy, Engines, and the Industrial Revolution" (Grades 8-9); "Transportation and the City" (Grades 8-9); "How a Bill Becomes a Law to Conserve Energy" (Grades 9, 11, 12); and "Agriculture, Energy, and Society" (Grades 10-12). Factsheet is a series of 19 summaries of major energy topics, including references, for use by teachers and secondary school students. Developer: National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009.



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