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ABSTRACT

Reported are the proceedings of a conference of leaders in energy education held at Land Between the Lakes near Brandon Springs, Tennessee. Classroom teachers, curriculum coordinators, university faculty, and education specialists from business and government participated. A "Conference Consensus" paper, the text of the keynote speech, a summary of the panel discussion, and descriptions of the poster session presentations are included. Conference attendees in working groups produced seven papers on various aspects of energy education including materials, school programs, evaluation, local implementation, teacher education, private industry, and policy. In addition to these documents, the report lists each participant's name, address, and interests in energy education. (WB)

Third Annual Practitioners Conference on Energy Education

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Conference Consensus

This report represents the concerns and consensus of the Third Annual Practitioners Conference on Energy Education. It addresses several vital needs of energy education, and recommends strategies by which to broaden and strengthen energy education. The Conference Consensus was written by the Policy working group and adopted by the conference as a statement of purpose.

NETWORK/CLEARINGHOUSE

Network: The National Science Teachers Association (NSTA) and the Education Commission of the States (ECS) are proposing to combine components of two different energy education networks which they sponsor--the United States Office of Education (USOE)/ECS network and the NSTA/National Council for the Social Studies (NCSS) Regional Energy Education Network (REEN). NSTA and ECS are seeking funding to combine and expand these networks, and plan to hold five regional meetings and a national meeting. Suggested below are ways to use this opportunity to meet some of the network needs that have been expressed in the conference.

The regional meetings will serve several purposes: information exchange, further design of network structure and activities, and especially the stimulation of workshops.

State representatives to the network who have the opportunity and commitment to institute and direct a series of teacher workshops on energy education will be sought. A team of three or four will be selected from each state. State energy offices, state education agencies, NSTA, NCSS, Joint Council for Economic Education, principals associations, Association for Supervision, Curriculum and Development (ASCD), and leaders in energy education from the private sector will typically be represented on the state team.

These meetings will have several important goals: to begin to establish "networks within networks;" to foster communication (there will be a network newsletter, for instance); to increase the number of energy education workshops for teachers; and to tie the educational networks to the technical and informational networks already in place. Hence the need for a clearinghouse arises.

Clearinghouse: It is very important that a clearinghouse be closely associated with the network. The Educational Resources Information Center (ERIC) is a potential starting point. Ideally ERIC would compile a "master index" of all documents pertinent to energy education. Such an index would involve searching other pertinent data bases such as National Technical Information Service (NTIS), the Department of Energy (DOE) Technical Information Center (TIC), the Energy Information Resource Inventory at DOE-TIC, etc. Energy education classroom materials would be an important subset of the documents indexed (and participants at the Practitioners Conference are urged to submit their materials). A data base of resource people in all the states should be established. This latter listing could be informally begun from NSTA and other files and added to at the network meetings.

Recommendation: A task of the scale described above is beyond ERIC's present mission. Therefore, a recommendation will be transmitted from the Practitioners Conference on Energy Education to the National Institute of Education (NIE) and to the appropriate ERIC administrator to encourage the expansion of the ERIC mission to include compiling this master index. The Conference suggests that this recommendation be supported by resolutions from the Boards of Directors of NSTA and NCSS.

FUNDING SOURCES AND STRATEGIES

Energy educators need to creatively seek out sources of funding to augment traditional DOE and U.S. Education Department (USED) sources. To serve as examples, the NSTA will collect and compile the funding histories of various energy education activities. These histories will illustrate interesting examples of successful bids for funds from federal, state, foundation, and industry sources. Winning such funds is now not only interesting but essential to the future of energy education in the light of the programs that have in the past supported energy education, budget cuts in DOE and the anticipated cuts in state support.

LOCAL SUPPORT

Principals are the key people in schools. To cultivate their support for energy education PEEC will: 1) invite representatives from state principals organizations to be a part of the network effort described above; 2) offer to the principals associations journals an article describing the Practitioners Conference results and the existing opportunities for cooperation and assistance in energy education; and 3) foster and support contributions from energy education practitioners to local principals associations publications.

POLITICAL SUPPORT FOR ENERGY EDUCATION

PEEC will place an article in the December 1980 Energy & Education which will serve two functions. It will remind the energy education community that with the change in administration, now is a particularly important time to inform the new Congress and the new administration about energy education concerns. Furthermore, as those responsible for energy and education (and therefore energy education) are identified, the article will ask energy educators to identify key contacts that they can make.

PEEC will also send letters to other educational organizations urging them to give the energy education message to their contacts in the DOE and USED transition teams.

A letter summarizing the results of the Practitioners Conference on Energy Education will go to the appropriate legislative liaison persons at Edison Electric Institute, American Petroleum Institute, American Gas Association, etc., expressing appreciation for their support and urging them to use their influence with those who are developing policy and management for the new administration to strengthen energy education.

TEXTBOOKS

In order to integrate energy education into the curriculum, energy education must have a place in textbooks. We agree that the best way for energy education to make an effective impact on basal textbooks may be to work through textbook authors. Meetings with textbook authors are planned for the

NCSS annual meeting in New Orleans (November 1980, social studies authors), and for the NSTA national meeting in New York (April 1981, science authors). Perhaps the publishers of student periodicals (for example, Weekly Reader) should also be invited to these meetings.

STATE ENERGY EDUCATION POLICY

ECS is urged to communicate soon and often about progress in their pilot state energy education policy project with people in other states who are involved in energy education policy development.

NEED

Energy education practitioners are reminded of the opportunity offered by National Energy Education Day (NEED). We urge them to initiate and cooperate with activities on that day.

Recommendations

1. There is a need for an energy education network to coordinate the efforts of various education groups and to foster the implementation of energy education, primarily through teacher workshops. The educational community also needs to be connected to technical and informational resources. Hence the need for a clearinghouse is organizational as well as facilitative. Therefore, support should be increased for an energy education clearinghouse.

   - The NIE and ERIC should broaden their missions to include energy education materials, projects and resource people.

   - The energy education network proposed by the NSTA's Project for an Energy-Enriched Curriculum and the Education Commission of the States should be developed.

2. Greater financial support of energy education is needed. Unconventional sources of funding must be uncovered and publicized to augment funding from the U.S. Department of Energy and the U.S. Education Department which is now in jeopardy. Some unusual project funding case histories should be collected for use as examples of successful strategies.

3. Greater local support of energy education is needed. Teachers' effectiveness is strongly influenced by the attitude of their principals. Therefore, principals should receive information about the opportunities for their cooperation and assistance with energy education.

4. A political base of support for energy education must be cultivated. Political activities supporting energy education are an urgent priority in light of recent changes in government. Educational organizations, agencies involved in energy education, and interested individuals are urged to make their concerns about energy education known to their state and national representatives.

5. More information about energy should be included in textbooks in many disciplines, because textbooks are the most basic and long-lived materials in the classroom.

   - We support activities that would inform textbook authors about energy.

6. There is a need to enhance cooperation among schools and the various energy industries. Therefore, a standing committee of representatives from national education organizations should be established to foster and facilitate industry support of energy education.

The 1981 Practitioners Conference supports these specific activities in energy education:

- U.S. DOE Faculty Development Program

  The U.S. Department of Energy Faculty Development Program provides necessary and effective inservice training. This program has our full and hearty support.

- State Energy Education Policy

  We urge ECS to communicate soon and often about progress in their pilot state energy education policy project with people in other states involved in energy education policy development.

- National Energy Education Day

  The Practitioners Conference recognizes the opportunity offered by NEED. We urge energy educators to initiate and cooperate with activities on that day.

Overview

The 1980 Third Annual Practitioners Conference on Energy Education brought together more than 70 leaders in energy education at the Land Between the Lakes, an education and demonstration area of the Tennessee Valley Authority (TVA) near Brandon Springs, Tennessee. These participants (listed on page 89) were asked to describe and evaluate the current achievements, needs, and future directions of energy education. The participants included outstanding classroom teachers, curriculum experts, administrators, and representatives from private associations, business and government.

Joan Martin Nicholson, Director of Public Affairs of the Environmental Protection Agency at that time, opened the conference as the keynote speaker (page 19) calling for an interdisciplinary approach to solving our energy, environment and economic problems. She spoke of the need to confront these problems in a timely and serious manner. "We aren't going to make any meaningful progress in resolving our economic, energy and environmental problems unless and until we recognize the folly of regarding environmental, economic and energy matters as antithetical to each other . . . the challenge we all must face, and must recognize, is how to strike a compatible balance between human activities and the sustaining capacity of natural environmental systems." She pointed out that educators face the same compartmentalized structure in academia. Thus, the sense of connected-

ness, which holds the key to resolving our major problems, is forgotten. It is the tremendous responsibility of educators, she said, to put forth durable and consistent efforts to teach integrative thinking to tomorrow's decision makers. (Ms. Nicholson is now the Business/Industry Liaison Officer with the UN Environment Programme, 2101 L Street, N.W., Suite 209, Washington, D.C. 20037).

The keynote speech was the first of three sessions designed to provide up-to-date information, familiarize the participants with each others' efforts and areas of expertise, and raise some initial questions. Next, the participants attended a poster session (page 71) designed to acquaint them with the spectrum of energy education programs and projects represented at the conference. Display presentations were visited informally, after which several films were shown and discussion ensued.

The third session, a panel on Developments in Energy Education, (page 29) opened the second day of the conference. John Fowler, Director of the Project for an Energy-Enriched Curriculum (PEEC) at the National Science Teachers Association (NSTA), began the panel with a review of the recommendations from the two previous Practitioners Conferences. He noted gains in materials development and dissemination, and pointed out the continuing needs for a clearinghouse, more teacher training, greater emphasis on the evaluation of the impact of energy education on students, and incorporation of energy concepts into textbooks. He concluded his overview by looking toward future prospects: National Energy Education Day, the National Conference on Energy Education to be held in conjunction with the National Council for the Social Studies (NCSS) in Detroit in November 1981, and the establishment of an energy education network proposed by the Education Commission of the States (ECS) and NSTA.

Don Duggan, U.S. Department of Energy, talked about the accomplishments and uncertain future of energy education programs in DOE. He described the top down/bottom up approach of DOE programs which have covered a gamut of activities from working with state officials to sponsoring teacher workshops.

Shaw Blankenship, Enviromental/Energy Education Program, TVA, talked about the formal and nonformal components of TVA's energy education program as well as the regional services, program development and research for environment and energy education sponsored by TVA. Ann Wright, Land Between the Lakes, then spoke about the specific energy programs in use at the site of the conference and those designed for the general public who visit Land Between the Lakes.

John Disinger, Associate Director, Educational Resources Information Center, Clearinghouse for Science, Mathematics, and Environmental Education (ERIC/SMEAC), gave a basic overview of the function and history of ERIC. He responded to the discussion of an energy education clearinghouse, pointing out operational necessities as well as ERIC's interest if funding were available.

John Vincenti, State College Area School District and member, NCSS Science and Society Committee, talked about the need for energy to be presented as an interdisciplinary educational endeavor. He recounted the efforts of the Science and Society Committee to help social studies teachers present the topic of energy as a whole, inclusive picture.

The panel concluded with Janet Dove of the American Petroleum Institute (API). She described industry as a resource of up-to-date information and technical expertise. She noted some of the energy education programs undertaken by the oil companies

and pointed out the need for cooperation between the private sector and the education community in order to provide useful material.

Questions fielded by the panel after the presentations focussed mainly around sources of funding and the role of industry in energy education.

These three sessions culminated in an advisory session for the Policy working group. The task of the Policy group was to address concerns of the conference as a whole, pinpoint priority issues, and recommend courses of action to address these issues. (Their report was adopted by the conference, becoming the Conference Consensus, page 3.) To facilitate input to the Policy group, the practitioners divided into small discussion groups. One member of the Policy group sat in each discussion group and recorded the ideas and insights generated by the discussion. Reports from these groups reflected many areas of common concern. The Policy group selected five priority items.

Of first priority was the need for both an energy education network and an energy education clearinghouse. The conference recommended that NIE and ERIC broaden their missions to include energy education materials, projects, and resource people.

A second area of priority was funding sources and strategies because federal sources of funding, which have been the mainstay of energy education, are being severely reduced in 1982. Also of priority was the need for local support for energy education.

The need to include energy education materials in textbooks was seen as a priority since textbooks are basic and long-lived in the classroom. Political activities in support of energy education were given priority in light of the recent change in government. Finally,

state energy education policy and National Energy Education Day were also briefly addressed by the Policy group.

Each participant contributed to one of six working groups. Each working group was formally allotted five and one half hours in which to complete a specific task. The School as Energy Education Laboratory (page 41) considered the potential for interaction between energy education in the classroom and energy conservation and efficiency modifications to the school building. The group produced a set of goals and implementation strategies, pairs of anticipated obstacles and approaches, and a list of references and resource people. Selecting Energy Education Materials (page 47) produced criteria by which to determine the usefulness of materials on energy. Ways to use inaccurate, incomplete or otherwise biased material in the classroom were also suggested. Evaluation of Energy Education (page 51) described the type of evaluation that would most accurately measure the impact of energy education on students. The report mentions the lack of baseline data for measurement of both cognitive and affective impacts of energy education programs.

Public and Private Partners in Energy Education (page 57) outlined procedures by which to initiate cooperative educational efforts between schools and the energy industries. Opportunities for industries to support energy education were suggested. Local Implementation and Support of Energy Education (page 61) framed a set of conditions necessary to successful classroom implementation of energy education materials, and recommended strategies by which to enlist community support. A sampling of successful locally developed projects was included for reference. Training Teachers for Energy Education (page 64) developed a rationale for incorporating energy education into pre- and inservice teacher education, and suggested some strategies by which to accomplish it.

The last day of the conference was devoted to consolidating the results of the various working groups. Each group reported to the rest of the conference on their approach to their task and its completion. Comments from other participants on each groups' conclusions were accepted and revisions were made. Recommendations from the working groups were approved (page 9), and the Policy working group report was adopted by the whole conference.

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Keynote Speaker

Joan Martin Nicholson, EPA

One of my favorite stories is about three people living on an island. Theirs is a happy existence until one evening the three are visited by the Fates. The Fates inform the three that within 24 hours they will be inundated by a huge tidal wave and that their island will disappear under the sea. But, say the Fates, you can each have one wish granted. Well, the first person chose to travel the world and visit all the high spots--the night clubs, taste the best wines and meet the beautiful people. The second chose to visit all the capitals and historic spots in the world. But the third person was very thoughtful for some time and then that person said, "Bring me all the books ever written on how to live under the sea." That, my friends, is how we all sometimes feel when confronting environmental challenges--and it requires that pragmatic an approach.

We hear with frequency about how the networks of nature are interrelated, interdependent, interconnected. How one's waste product becomes another's source of food. How one's grave can become another's womb. How one person's today can make possible another's tomorrow. However, the legacy of our industry/technology oriented society has been to think of systems and knowledge as separate.

The western tradition has been to view problem solving as a linear process--with a beginning and an end. Yet, natural systems which support all of our

actions interlock in cycles. I am often amused at posters which say "The Environment--Protect It." In fact, it protects us--it makes our very existence possible. Our western ways seem intent on destroying the interlocking biotic systems upon which all is dependent. If all people, not just the naturalists, better understood nature's patterns, we would see the obvious need to revise our human systems such as housing, feeding, transporting, and educating people. Such understanding would lead us to interconnect our systems and nature in mutually supportive ways. In the long run, this proves to be the most effective and economically viable way to conserve natural resources.

Because of how we look at systems, we look at the energy crisis, inflation, unemployment, etc., as separate and only sporadically connected problems. We play the game of poker in trying to find solutions, which is the wrong game with the wrong objective, to win the round. We should be playing chess--using long-term strategies.

Education, unfortunately, contributes to this lack of connection. Compartments in education were originally meant to control information; but with compartments, and careers in line with those compartments, we forget our connections and we lose our sense of connectedness.

The challenge before us is to be able to make long-term assessments in a time frame that is rapidly shrinking. Time for problem solving was much longer when population, levels of production and consumer needs were less.

Today we are increasingly focusing on the interrelationships between economics, energy and the environment. These constitute a complex web. It is difficult for us, with our day-to-day concerns, to get a

handle on how they relate. We must look at these three issues very differently than we do at present.

At present students often study the environment as a set of biological systems unconnected to our bodies. But, for example, our bodies are 60 percent water and drinking contaminated water will contaminate us. This failure of education in the classroom is reflected among teachers: the disciplines don't understand each other's languages or the connections between the disciplines.

We aren't going to make any meaningful progress in resolving our economic, energy and environmental problems unless and until we recognize the folly of regarding environmental, economic and energy matters as antithetical to each other.

To begin with, the natural systems of the environment are the bases of the economic activity which depends on energy. Land, air and water resources are the underpinnings to all human activities. Our energy resources were created by the interplay of natural environmental systems. The production of food and fiber, the basis of our economic system, is totally dependent on these natural systems. Given this, the challenge we all face, and must recognize, is how to strike a compatible balance between human activities and the sustaining capacity of natural environmental systems. That challenge forces us to redefine problems and to devise new ways of solving them. If we fail to do this, we are jeopardizing our jobs, our food supply, our health and all other matters critical to our lives in the long term.

We are the most energy intensive society in the world. While we constitute only about six percent of the world's population, we consume more than one-third of the total energy output. Thirty years ago Buckminster Fuller estimated that the average Ameri-

can had, at his/her beck and call, the energy equivalent of 153 people in terms of human energy. Today, based on fossil fuel energy, each person has the equivalent of 400 people.

Current estimates about how long fossil fuel supplies will last are at best a confusing array of predictions. Nevertheless, all estimates recognize the fact that fossil fuels are finite. Less well recognized is the fact that the environmental systems that produced these fuels are also finite. The air sheds, watersheds, and land resources are the systems I speak of here.

Many contend that to have a strong economy we must have an abundant supply of energy to support jobs. This contention is not borne out in fact. The fact is that over the last six years, we have used more energy than ever, but unemployment has not dropped in proportion to the energy consumed. Meanwhile, increasing medical costs during this time reflect in part an increase in pollution partially caused by energy production.

The irony is that until very recent times, water, land and air were free commodities. Now we not only are paying increased medical bills, but increased taxes to reclaim air and water.

It is very difficult to comprehend why we have changed from designing systems which took advantage of the free support of natural systems to those that don't. Specifically, look at the buildings we design. We spend millions of dollars in creating engineering systems to cool buldings and circulate air. We use a lot of energy in the cooling process. Windows no longer open to take advantage of natural air currents. The sun's patterns could reduce costs considerably if we used heat and light from the sun more effectively. It is embarrassing to explain to people from developing countries why the "most sophisticated" nation in the

world disposes of its human waste by dumping it in rivers and lakes, which are also used for drinking water, only to incur considerable expense and use finite energy to retrieve the same waste as sludge.

Each natural system can absorb and convert only a limited amount of pollution. We must learn to operate within this pollution allowance. When this allowance is exceeded, it becomes enormously difficult and expensive to reclaim the system so that it can sustain people. Our economic responsibility is to control pollution in the most efficient manner we can. The most efficient way is to prevent it from occurring in the first place.

Until recently, corporate institutions did not include an assessment of environmental systems in their development policies. Corporate institutions based their analysis solely on the economics of production and marketing. Employees are rewarded for increasing production and/or marketing activities. There is no institutional mechanism which rewards corporate employees for practicing environmental protection. There is no mechanism that gives a company manager points for guaranteeing that the environmental systems on which corporate activity ultimately depends, will continue to be viable. The absence of such a mechanism is the basic rationale for the existence of federal intervention to protect the environment. A network of regulations, odious to corporations, is the result.

There is the problem of capital funds for environmental protection. Today money is expensive. Corporations go to these markets for funds to spend on environmental protection. This expenditure is designated, in the corporate world, as a nonproductive expenditure; that is, capital not used to generate more products or demand. Furthermore, the corporation must pay interest on the loan it takes out to meet

environmental standards. Is it lost capital? A nonproductive expense? It depends on what pocket you're looking into.

If you or I went in a factory and started slugging away with sledge hammers at their delicate equipment, we would be locked up. But, in fact, too many corporate production practices slug away at the very delicate mechanisms of nature which are the basis of corporate productivity. And when natural systems become so contaminated that people must pay higher local and state taxes to clean them up, then they have less to spend as consumers. The costs of pollution are further reflected by higher health insurance premiums, which both the corporation and consumer must pay; lost production time because of illness; higher municipal and state taxes; greater energy needs to obtain potable water; damaged soils from nearby farms--our food banks; lost recreational use of rivers and beaches; the loss of community income from recreation-related employment.

These are debits we all incur when we look at energy, economics and environment as unrelated and separate. The mentality that sets the three "E's" against each other is much like the win/lose mentality of sports. That approach doesn't work because if any one "E" wins, we all lose.

Educators especially must integrate the issues. Today's students will call tomorrow's shots as we borrow today against their tomorrows. We need to connect what they learn. Educational input must be durable and consistent so that they integrate solutions. Educators can demonstrate through their own approaches how the disciplines are interwoven, how one discipline can illuminate another. Limits are imposed by compartments. Yet new options come from a synthesis of old knowledge.

How we use energy has profound effects on both the environment and economics. As we turn to increased strip mining, oil shale production, and nuclear power, we must be certain that environmental systems can continue to support production activities such as farming, fishing, tourism, etc. How sound is it to pick cherries in Oregon, ship them to New Jersey to be dyed red, (formerly with #2 dye which is a proven carcinogen) then ship these same cherries back to Los Angeles for packing and distribution? How many hydrocarbons does interstate trucking spew in the air? What do those cherries cost by the time they reach the consumer? How much does the farmer get? It would be interesting to assess the real cost.

When we focus on economic expediency and ignore environmental considerations, we may be denying ourselves a stable job future by creating "false bottom" needs. A false bottom need is created when millions of dollars are spent to convince people they need a product that they don't really require, yet which contaminates or depletes limited natural resources. For instance, the promotion of redwood over cedars which grow readily among the redwoods. Harvesting cedars requires selective cutting and means many small pieces of wood. So cedars are sprayed with herbicides and the more profitable redwoods are cultivated. But redwoods don't grow fast enough, and reforestation programs on land owned by the timber indusry are not sufficient to meets the "public" demand. Many jobs are created by "false needs" yet these jobs are too often in jeopardy as pollution problems affecting airsheds and watersheds produce court injunctions and public outrage.

Paper diapers, a false bottom need (forgive the entendre), are turning out to be a mixed--and costly--blessing. Plastic-lined paper diapers are overloading the capacity of community waste treatment facilities. Running up costs, as well as energy consumption.

We are greatly in need of economics education. As with energy, however, teachers must be well-educated on the subject themselves. The selection of Gross National Product (GNP) as a main criterion for evaluating the nation's economic health has served to mislead the public on energy and employment issues.

GNP is the market value of all goods and services produced in the economy over the course of a year. As far as GNP is concerned, only those activities that contribute to production are measured. GNP includes expenditures for desirable items--such as for energy, housing, education, food, etc. But it does not take into account whether they are made available efficiently or safely. GNP also includes the cost (but not the benefits) of items not generally considered as production--such as, disease treatment, pollution clean-up, as well as unemployment insurance, workmen's compensation, welfare payments, etc. In fact, several noted economists have criticized the GNP on the basis that goods and services that relate to the quality (rather than the quantity) of life are omitted.

What the GNP formula actually implies is that if two generals go off to war and upon arrival the war is called off, there is no benefit to the GNP or national productivity because no tanks, guns, new planes or other tools of war were needed and therefore produced.

From the environmentalist's perspective, the story is about the same. For in cleaning up the air, land, and water, and accomplishing pollution prevention, there will be no doctor bills, operations, need for new hospital beds, doctors, etc. Therefore a healthy person, or a person who did not get sick, will not show up in the GNP calculations. At least in the farm subsidy program you can get paid for not raising crops or livestock.

The indicators do not reflect the economic world in which we live. By any measure you care to make, a bankrupt environment ultimately leads to a bankrupt economy.

We are fortunate that change is always an option of the future. As we look to the future, is interrelating the "Three E's" pie-in-the-sky dreaming?

If I have a job as a housekeeper, and I have accumulated three large bags of trash in cleaning my house, what would people think if I took those three bags of trash and put them on my next door neighbor's porch and then rang the bell and said, "These bags of debris have come from doing my job. It is your responsibility to get rid of them." This, in fact, has been the mentality of the old frontier.

Today, there is a new frontier. A frontier of technology, integrated systems, and the challenge of designing preventive processes.

In 1883, Frederick Jackson Turner pointed out that the United States had reached the limits of its natural frontier. "As a country," he said, "we can no longer evade the necessity for settling down and making the most of our resources: It's impossible to overcome the evils of gutting out the forest, mining the soils, annihilating the wildlife merely by pulling up stakes and moving on to a virgin area." History is replete with powerful civilizations which were destroyed by neglecting the natural environmental systems which supported them.

Educators have a tremendous opportunity--and responsibility--to synthesize knowledge, to get it out of the convenient boxes of academic disciplines, to have knowledge relate to people in their communities, to introduce humanism to science and technology.

We need to design systems and products which:

1. Avoid damage to the natural environment.
2. Lead to a reduced consumption of finite natural resources including energy resources.
3. Encourage the use of materials which can be recycled within the natural systems or within our industrial systems.
4. Avoid planned obsolescence.
5. Are sensitive to employment needs, abilities and opportunities.
6. Are cost competitive in the marketplace.

There are no limits to growth, to innovation, to creativity, to the human spirit. The limits are to space, to waste, to how long we confront issues the same old way. For the first time in the history of our species, we cannot foul our nest and move on. We have to remain where we are--in our urban decay--in our suburban sprawl, on our poisoned land, by our contaminated streams. We can either sound the note of doomsday, or integrate our ways with nature, becoming more economically efficient and sustainable. Teachers in particular must cultivate the process of integration in their students. For the bill has come due; paying it is the real challenge of the decade to come.

Panel

Developments in Energy Education

Seven of the conference practitioners shared their perspectives on energy education through a panel presentation and discussion. The panelists covered a cross-section of practitioners. They represented education, industry, government and the private sector. They included teachers, program directors and administrators.

The first panelist was John M. Fowler, Director, Project for an Energy-Enriched Curriculum (PEEC). He used the recommendations from the two previous Practitioners Conferences to measure the achievements of the past year or so and to point out the needs that remain unmet.

According to Dr. Fowler, the biggest gain over the past years has been the increase in materials development. Background materials are fairly plentiful. Classroom materials are also numerous. PEEC has 39 classroom units; Energy & Man's Environment has a large body of material; and materials sponsored by local projects and utilities are also widely available to teachers. Production is no longer the problem it was two years ago: high quality material is still needed, but there is no serious gap per se in the existing materials.

The development of dissemination channels has also proceeded well. Workshops for teachers include

the summer institutes sponsored by DOE and similar summer courses supported by NSF. Inservice workshops for teachers have also been designated and funded by state governments, and energy education sessions have been put on by utilities and the energy industries. The Education Commission of the States (ECS) conducted a survey of activities in energy education like these in each state. From this survey, a program evolved in which ECS is working with seven pilot states to help each one develop an energy education policy.

There are some recommendations that have not been addressed and that continue to be important. No clearinghouse has been established for energy education materials, resources or resource people. There is still no large-scale federal support for pre- or inservice teacher training, and no evaluation of the impact of energy education programs on students has been undertaken. The impact of energy education on textbooks--those representatives of the ongoing, established curriculum--has been very small.

The assessment was concluded with a look at some of the bright prospects for energy education in 1981. National Energy Education Day, March 20, 1981, was mentioned as a day to raise awareness in schools across the country and begin projects/programs that would extend further into the school year. The development of the network organized by ECS and the Energy and Education Action Center to link State Energy Offices and State Education Agencies was encouraged, and a proposal to combine this ECS network with the PEEC network was outlined. Finally, the National Energy Education Conference, a large conference open to the public to be held in Detroit in November 1981, was announced.

The second panelist was Donald D. Duggan, Chief, Education Division, Office of Consumer Affairs, U.S.

Department of Energy. He remarked on the past accomplishments and future uncertainties of DOE.

Mr. Duggan began with a status report on DOE. Reprganization is certain, and its disappearance as a distinct agency is possible. However, energy education may survive if people will speak for its vitality. The cultivation and continuation of local programs will demonstrate the impact of energy education. The effect of local commitment cannot be overestimated, Duggan said.

DOE has spent about $5 million annually on energy education through the Education Division. A top down/bottom up approach has been used to motivate widespread activity in energy education. Most of the programs are, grassroots programs--PEEC, The Oak Ridge Associated Universities science activities, etc. These programs were designed to develop and disseminate materials and teacher training. $1.7 million has been allocated to teacher training. The Faculty Development Program made about 100 grants in 1980. These included summer workshops for high school and college teachers and inservice workshops for elementary teachers during the school year. These faculty development efforts have reached many teachers.

To work from the top down, DOE has tried to work through mechanisms already established in each state, much like the ECS project on energy education policy in which they are working with state agencies. There does not seem to be much commitment to energy education on the state level, however. A DOE conference was slated to be held in Iowa for key people in the state education agencies. The grant for this conference was designed to pay only half the travel, and only about 35 states were committed to send their people. This lack of commitment was

reflected in the ECS survey. ECS found that only three states had allocated state funds for energy education.

There have been structural problems that have posed some obstacles to the development of energy education. For example, DOE distributes their materials free. However, the costs of printing, especially paper, have soared with inflation and the printing budget of the Education Division has been cut steadily from $1 million to a quarter of a million dollars. Also, to be included in what is taught in the classroom, energy education must make an impact on textbooks, and that is a slow process.

The next two panelists represented the Tennessee Valley Authority (TVA). Shaw Blankenship, Environmental/Energy Education Program, talked about the formal and nonformal components of TVA's environmental and energy education programs.

Energy, a "new" addition to the environmental education program, is one of several programs sponsored by TVA. (Included are programs in cultural resources, natural resources, agricultural development, community development, solar energy, energy conservation and energy production.) Both formal and nonformal components of the energy education program have been cultivated. The nonformal approach has been implemented with energy trails, energy exhibition centers made from older powerhouses, and interpretive programs for the public on energy themes. Land Between the Lakes stands as a unique example of a variety of energy education demonstrations. Some workshops on energy education have been held at these facilities.

Formally, programs in energy have been founded on the idea of partnership. Since TVA is a federal agency built on a conflict of interests--power and

natural resources--a major effort has been made to work through existing systems to boost credibility. Five centers for environmental and energy education have been established in the seven state TVA region with matching funds from local universities. These centers serve four purposes: 1) they are used for pre- and inservice teacher training; 2) they provide regional services such as furnishing consultants to local schools; 3) they facilitate program development in areas such as college degrees and teacher workshops, for example; and 4) they sponsor research for environment and energy education at the regional universities.

Ideally, TVA would like to have 17 such cooperative programs to provide access to every county in the seven state area.

Also representing TVA was Ann Wright from Land Between the Lakes (LBL). She discussed the energy education program at this particular site.

The energy education program at LBL is based on both activities for the general public and the use of energy efficient facilities. For example, the visitors center has been a solar facility for enough time that its space and water heating systems are out of date. The interpretive center at the Homeplace 1850, a renovated working farm from the mid-19th century, is heated by wood stoves and cooled with heat pumps. The amount of energy used for space conditioning there has been reduced 50% due to the earth-berm design. TVA as a whole now emphasizes retrofitting old structures and designing energy efficient new buildings. Consuming energy is no longer promoted. LBL can boast an earth-sheltered building, a building heated by a trombe wall and a demonstration gasohol program.

Programs at LBL are designed to complement the tourism industry in the surrounding area. Visitors to the project are encouraged to conserve energy during their stay. Family campers at Rushing Creek campground are provided with group transportation to other parts of LBL to cut down on gasoline use. Seminars and demonstrations are offered on wood lot management, residential solar (passive is emphasized, but active hot water is included), and how to distill alcohol to fuel vehicles.

The energy education program at Land Between the Lakes uses both the "soft sell" and "hard sell" approach to reach the one million people who visit annually.

The next panelist was John F. Disinger, Associate Director, ERIC Clearinghouse for Science, Mathematics and Environmental Education (SMEAC). He discussed the activities of ERIC/SMEAC in energy education, briefly outlined the objectives and activities of the ERIC system, and noted some ways in which ERIC might be involved in an energy education clearinghouse.

ERIC, the Educational Resources Information Center, was established in 1966 in the U.S. Office of Education, and now is part of the National Institute of Education. ERIC is decentralized, composed of 16 clearinghouses around the country, with a central office in Washington, DC. The system's task is to provide information dissemination and retrieval services for the entire realm of education. SMEAC began as a science education clearinghouse in 1966, and early on added mathematics education and environmental education to its mission. Therefore, energy education is clearly within the scope of this clearinghouse.

There are more than four thousand documents related to energy in the ERIC system, but energy

education is only one of several emphases. ERIC/SMEAC received grants from the Energy and Education Action Center to produce a newsletter and several fact sheets. More than 15,000 copies of each newsletter and fact sheet were produced and distributed, but requests have exceeded 50,000 for each; clearly, more support was needed.

Dr. Disinger recognized the need for more extensive clearinghouse activity in energy education; there is much appropriate material in existence that is not in the ERIC system. However, ERIC does have the most extensive energy education listings currently available in the nation, and continues to expand the listings monthly. If funding were available for expanded clearinghouse operations in energy education, it is likely that ERIC and/or ERIC/SMEAC would bid on the project. If not, ERIC and ERIC/SMEAC will be pleased to work with others involved in energy education clearinghouse activities.

To make such an undertaking practical, any energy education clearinghouse function should be computer-searchable using standard formats. There should be some provision by which to make the documents available to those who use the clearinghouse. These are features that make ERIC a useful system.

An ERIC search can shake loose a lot of material. There are several ways to get a search done. There are 700 "standing order" microfiche collections housed in libraries around the world, mostly in the United States. If one of these collections is convenient to the user, a manual (non-computer) search can be conducted there. Searches can also be purchased from commercial vendors, or bought as a "package" search for journal articles, fugitive documents (those not found in journals), or both.

To continue ERIC/SMEAC's emphasis on energy education, participants were encouraged to submit copies of their own instructional materials to be considered for inclusion in, and dissemination through, the ERIC system.

Next, John R. Vincenti, teacher, State College Area School District, Pennsylvania, and member, National Council for the Social Studies (NCSS) Science and Society Committee, spoke on energy education from the standpoint of the social studies.

He reiterated that energy is not only a science topic. The Science and Society Committee of NCSS has spent considerable time on the aspects of energy that are not strictly scientific, i.e., environment, resources, history and evolution of technology, politics, economics, and social impacts. Incorporating energy into the social studies curriculum, while either consulting teachers of other disciplines or team teaching, can bring about an atmosphere of cooperation and communication which conveys the wholistic nature of energy studies. Such programs have been initiated, but follow-up is essential to effectiveness. In Pennsylvania follow-up was provided at the Penn State University Seminar on Energy in October 1980, which revealed successful incorporation of "real-life" implications into these teachers' classrooms.

In 1971 NCSS published their first guidelines for energy edcuation in social studies classrooms which emphasized curriculum relevancy. These guidelines have been revised through the years and lead to the goals of the Science and Society Committee for 1981: 1) contact state offices of education to promote National Energy Education Day; 2) involve social studies teachers with science teachers in teaching energy; and 3) to pursue Faculty Development grants from DOE to enhance commmunications and energy education curriculum.

The panel closed with a talk by Janet Dove of the American Petroleum Institute (API), the largest national trade association representing all segments of the petroleum industry--exploration, production, refining, transportation and marketing.

The petroleum industry has a long history of support to education. Through company foundations, and other grants, the industry supports research, various education projects, and provides scholarship monies. The results of a recent informal survey, with ten companies reporting, showed about $40 million had been spent annually in support of education. Several companies produce films and classroom materials. Many companies actively participate in efforts to provide speakers to schools. Company personnel work with educators to explore cooperative efforts to bring energy information into the classroom. One current effort supported by six companies is the "Energy Adventure" van program developed by Oak Ridge Associated Universities. The program presents 35- to 50-minute demonstration-lecture assembly programs to high school students.

API's role in education has been to act as a clearinghouse for information, resources and advisory services. API also acts as a liaison with the educational community, and provides developmental services in education programs. One of API's primary energy education activities since 1977 has been the Energy Economics Forum program. This is a one-day teacher workshop designed to introduce teachers to the actual operations of the petroleum industry, provide educators with petroleum industry economic data, and give educators and petroleum industry representatives an opportunity to communicate through informal dialogue sessions. More than 25 workshops have been held, attended by some 1,300 teachers. This program is one example of a cooperative industry-education effort. It began in Florida when teachers

approached API's Florida Petroleum Council with the idea of an energy workshop program for teachers. The program was developed, with teachers and industry people working together. It continues to be a cooperative effort among individual school districts, API and company people working together on program development.

As work with energy education curriculum proceeds, the need to seek current energy information becomes apparent. Industry can be a useful resource to educators and provide timely data in a field where the information changes rapidly. Some of the frequently used classroom materials are not conventional classroom texts, but rather booklets, brochures, fact sheets and background papers from industry which are frequently updated. Teachers should be encouraged to look to industry as a resource for energy information.

Each aspect of energy is so intertwined with the many other aspects of our lives that each energy decision we make must be approached not with just one special interest in mind, but rather by looking at the whole energy picture. This is a difficult task. While industry can provide technical expertise, educators may be uniquely equipped to deal with many of the social issues of energy. Both are very much a part of the overall energy picture. It is through cooperative efforts among industry, educators, government and others that all perspectives of the energy picture may be included. Through such efforts quality energy education materials will be developed.

Working Groups

THE SCHOOL AS AN ENERGY EDUCATION LABORATORY

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EVALUATION OF ENERGY EDUCATION

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The School as an Energy Education Laboratory

The school building is a microcosm of society, reflecting its composition and values--the school is a community within a community. As such, the school and those who use it have an opportunity to initiate activities dealing with issues of national concern.

One of the significant issues facing society today is the question of energy--both its supply and its efficient use. Preparing society to deal effectively with energy issues is a proper task for educators at all levels and in all disciplines.

The school building offers a unique opportunity to learn about energy in a real life situation. Schools are accessible and highly visible in our communities, and are, therefore, especially useful as models of energy efficiency.

Programs currently exist which can help the school facility become energy efficient. To complement and capitalize on these management efforts, educational programs that use the school as an energy conservation laboratory need to be developed. Then students can study energy not only on a theoretical basis, but on a practical level as the building envelope and the energy systems are modified to reduce consumption.

GOALS

- To develop an awareness that energy consumption can be reduced, often with no investment of money.
- To avoid purchasing energy that would be wasted, and thus indirectly to provide better funding for instructional materials and programs.
- To give students the opportunity to have a positive effect on the school and the community.
- To teach students about energy and its efficient use in a practical and relevant way.
- To reinforce classroom learning by the application of academic skills to the "real" world.
- To provide an opportunity for young people and adults to interact on an equal basis with a sense of common purpose.
- To introduce students to career opportunities in energy-related fields.

IMPLEMENTATION STRATEGIES

There is a need to develop implementation strategies by which to utilize the schoolhouse as an energy conservation laboratory. NSTA/PEEC would be an appropriate group to develop these strategies.

Objective: To utilize the school as an energy conservation laboratory.

Process: Establish an NSTA/PEEC implementation task force, including, for example, an administrator, board member, teacher, student, resource person, maintenance person, parent representative, etc. Charge the task force to: identify resources, e.g., student energy audit materials, existing instructional materials on the "schoolhouse as lab"; identify key community resource persons; and arrange workshops to develop teacher competencies, e.g., how to conduct energy audits.

Disseminate information throughout the community to broaden the program's base of support.

Develop an awareness of the program objective among constituents within the educational community through boards of education, administrators, teachers, maintentance personnel, students, parents and other community groups.

Develop an implementation model for use in the local school district.

Outcome: Make recommendations to appropriate persons, e.g., chief school administrator, physical plant supervisor, school board.

OBSTACLES AND APPROACHES

- Most teachers do not have energy management experience and are not familiar with energy management resources.
  --Staff development through inservice training can prepare teachers for the program.
- The responsibility for an "official audit" should not rest only with teachers and students.
  --An "official audit" should have the cooperation of school officials, technical experts, and the community at large.
- The schoolhouse as a laboratory program should be primarily a learning tool--not an economic venture or an end in itself.
  --The program should extend beyond the study of a single structure into general conservation awareness in the home and community.
- Because of rising prices, subsequent years of the school audit will become economically more difficult. Less financing will be available for retrofits.
  --The "costs avoidance" aspect of the program should be considered a resource, not a deficit

expenditure. The amount of money that is not spent on utility bills (which will increase as the price of fuel rises), could be used for energy improvements within the building. Alternately, a portion of this money could be returned to the building principal for instructional materials.

- Implementation of the schoolhouse as laboratory program may be deterred by: 1) teacher resistance to program; 2) student resistance to program; 3) administration resistance to program; or 4) school board resistance to program.
  --The implementation stage at all levels should be a positive and encouraging experience.
- An interface with the National Energy Conservation Policy Act Title III (Schools and Hospitals Act) may be lacking.
  --All avenues of cooperation should be considered. Communication should be maintained among the various segments and people concerned with energy in the school district.

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(Orders must be prepaid or purchase ordered.)

- Energy Conservation Homes and Schools: A Classroom or Do-It Yourself Project. Dale L. Mordue. Mankato State University, Mankato, Minnesota.

- Managing Your School's Energy Dollar. Energy and Education Action Center, U.S. Department of Education, Washington, DC 20202.

- Providing for Energy Efficiency in Homes & Small Buildings.

  Part I Understanding and Practicing Energy Conservation in Buildings
  Part II Determining the Amount of Energy Lost or Gained in a Building
  Part III Determining Which Practices are Most Efficient and Installing Materials
  Part IV Student Workbook
  Part V Teachers' Guide

  Produced by American Association for Vocational Instructional Materials (AAVIM). Available free of charge from: U.S. DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

  Audio Visual Aids
  Slide-tape presentations available for purchase to accompany Part I ($85.00) and Part III ($98.00). Available from: AAVIM, Room 120, Engineering Center, Athens, GA 30602.

- Schoolhouse Energy Efficiency Demonstration (SEED), a public service program.
  1. The Fourth R, a 16mm film depicting approaches to school energy management.
  2. The Fourth R: Resourcefulness in School Energy Conservation, a booklet accompanying the film.
  3. Someting Special From SEED, a report on the SEED study which includes a Technical Manual for energy managers.
  4. Something Special for Teachers, a program developed for teachers to assist them in using the school as a laboratory for teaching energy and its efficient use.

These materials can be obtained by writing: Tenneco Inc., Public Affairs Department, P.O. Box 2511, Houston, TX 77001.

- Calvin Anderson, Director of Energy Conservation, Jefferson County Public Schools, Lakewood, CO.
- National Council for the Social Studies. 3615 Wisconsin Avenue, N.W., Washington, DC 20016.
- National Science Teachers Association. 1742 Connecticut Avenue, N.W., Washington, DC 20009.
- State Energy Office and Energy Curriculum Directors in State Departments of Education.

Selecting Energy Education Materials

Like all Americans, educators face a constant flow of energy facts and myths, energy information and misinformation, and energy policy proposals and counterproposals. This flow has aroused in many educators an interest in energy education. However, the flow of energy commentary has also brought pressure to initiate instruction about energy concepts, issues, and public policies. The flood of energy education materials that has appeared both responds to educators' interest and contributes to the pressure they experience. Commercial interests ranging from oil companies to chambers of commerce are sending prepared materials into the schools. Publishing firms are beginning to turn out materials and build energy topics into new textbooks. Federal and state agencies are developing energy education policy, and educational organizations have drafted energy curriculum for teachers working with students, K to 12. These efforts offer educators an array of audiovisual and print energy education materials.

It is not uncommon for some of these materials to favor a particular energy future due to their origin. Teachers should be encouraged to evaluate materials carefully before using them in the classroom. However, the identification of bias in various materials should not be the sole cause for their rejection. Biased or incomplete materials can be used by

teachers in a number of ways which are discussed below. Above all, teachers should remember that the sponsor of energy education materials is not a client to be served. It is the students' best interests that are primary.

Critical thinking encompasses an important set of skills which can be reinforced by the proper use of biased energy education materials. The following suggestions could help make some of the less objective materials available in energy education useful to teachers.

- Initiate class discussion about the origin of the materials and the direct and implied messages of the materials. Many students will be able to detect the bias, which can serve as a springboard for discussion of the complexities of an energy problem.
- Try to find materials which present another view of the topic. In some cases, materials with another slant are readily available. In other cases they are not, and the teacher may have to develop the materials. The input of the class would be valuable to this development process.
- Encourage students to research another point of view. Such an activity can hone research skills and supply further information about the topic.
- Frequently, there will be several different points of view among the students in each class. A debate is a good way to allow different points of view to be aired.
- Outside speakers with different points of view are often an appropriate way to balance the bias in classroom materials. Identify and discuss the speakers' biases with students.
- In some cases, the biases expressed in a film or book (or other materials) will provoke a response from students that goes beyond the classroom activities. Such a response could take the form of writing letters, calling legislators, etc.

- When using incomplete and/or slanted materials teachers should try to evaluate what students are learning very carefully. In addition, teachers should be sure that they know sufficient background information to present another side to a controversial topic before exposing students to biased materials.

The following questions will help classroom teachers trace the bias and determine the usefulness of energy education materials.

1. Who produces and/or sponsors the materials? Who distributes the materials?
2. Have the materials been cosponsored or reviewed by other organizations?
3. What is the copyright or publishing date? Are the materials out of date? (Less recent material is not always out of date.)
4. Is the information accurate?
5. Are there other sources available to check the accuracy of the information?
6. Does the material contain sexual, racial, occupational or regional stereotypes?
7. Is there an obvious message? Is there a hidden message? Can you reasonably balance the bias?
8. Does the material help students explore their own interests, attitudes, and values?
9. Are activities and reading level appropriate for your students?
10. What is the overall cost of the materials and equipment necessary to present the lessons?
11. Does information presented need to be supplemented with additional materials?
12. How available and replaceable are the materials?

Editor's Note: Other groups have also developed criteria for materials selection. Several examples are given below.

- A Guide to Evaluating Energy Education Curricula has been published by Western Sun (Suite 800, 715 SW Morrison, Portland, OR 97205). It is designed to be useful to curriculum developers working on design problems; to states or school districts documenting the strengths and weaknesses of several different curricula; and to classroom teachers trying to evaluate one or several lessons or curricula. The Guide facilitates a thorough examination of each component of an instructional unit (goals, rationale, objectives, instructional content, method, audience, impact) and provides a basis for equitable comparison.

- Guidelines for the Production, Distribution and Use of School Materials, Programs and Activities have been established by the Educational Services Committee of the Edison Electric Institute (1111-19th Street, N.W., Washington, DC 20036). The purpose of the Guidelines is to help community agencies produce effective, high quality programs, materials and activities for schools. EEI emphasizes the need to teach students how to think, not what to think.

- The Science and Society Committee of the National Council for the Social Studies (3615 Wisconsin Avenue, N.W., Washington, DC 20016) has developed some Guidelines for Energy Education in Social Studies. These Guidelines can pilot schools, communities, teachers, departments and school districts that want to introduce multidisciplinary energy education programs. Furthermore, they can provide a baseline by which to assess instructional programs and materials for teachers and students. The Guidelines include ideas about relevancy, energy literacy, methodology and strategies by which to introduce energy education into the curriculum.

Evaluation of Energy Education

An important facet of any educational enterprise is its accountability to society. To be accountable, the value of such an enterprise must be determined. Evaluation is a process of gathering and studying data to make this kind of determination. The responsibility for effective evaluation lies both with the developers and the implementers of energy education materials. Those who support materials development should pursue ways to formulate and quantify the impact of their materials. Those who implement energy education should seek ways to synthesize feedback from everyone involved (e.g., teachers, students, administrators, parents, teacher educators). Such a synthesis should be directed to the materials developers.

NEEDS

A multidisciplinary conceptual framework must be identified for energy education. (Note: A Conceptual Framework for Energy Education is being developed through a contract from the Education Division of the U.S, Department of Energy.) Learner outcomes specific to the concepts, content and skills appropriate to various disciplines should be identified.

A lack of base-line data by which to measure the cognitive and affective impacts of energy education has been observed. Viable assessment devices must be developed to provide a data base which then may be used to evaluate students, educators and programs.

RECOMMENDATIONS

- Energy education programs should be evaluated on the basis of some basic Energy/Environment/Economic concepts such as those identified by the Project for an Energy-Enriched Curriculum, Energy and Man's Environment, Minnesota Department of Education, Texas Department of Instruction-Energy Education, etc. However, evaluation should assess both cognitive and affective domains of students and educators.
- Evaluation should be practiced for both formative and summative purposes.
- Research and development of evaluation in energy education should include: a statement of concepts and students outcomes (cognitive); investigation of the impact of knowledge on attitude and the subsequent impact of attitude on behavior (affective); instrument development.
- Existing evaluation devices should be identified and analyzed for useful measurement items.
- A measurement and evaluation item bank should be established for use by agencies involved in energy education programs. The Purdue Cafeteria could serve as a model. (The Purdue Cafeteria system consists of many evaluation items from which local evaluators may choose. Thus flexibility and wide applicability are assured.)
- The results of any such evaluation should be collected into a data bank that is accessible to the public.

AGENCIES INVOLVED

- Agencies directly involved in energy education should be encouraged to lead evaluation efforts.
- Educational and industrial agencies that are not directly involved in energy education should help establish a universal evaluation device and store the collected data.

- Major energy education evaluation research and development should be supported by industry foundations, government agencies, universities, national professional associations, research organizations, etc.

MODELS OF EVALUATION

- State Level: An Assessment of Knowledge and Attitudes in Minnesota Schools. This 45-item evaluation was devised by the Minnesota Department of Education and the Minnesota Energy Agency. About 3600 students in grades 6, 9, and 12 took the test in March 1980.

  Students across the grade span showed strength in their knowledge of such things as energy conservation techniques (insulation), gas production sequences, and time-change relationships. However, students' knowledge of energy sources, including alternative sources, seemed quite weak. They had little knowledge of either energy consumption in the various economic sectors or the different kinds and effects of pollution from energy production.

  In the attitudes section, students at all grade levels indicated concern about the energy problem. Students perceived the problem as real and immediate, not only of concern to future generations.

  Detailed results of the test and methods of construction are available. Contact Roger Wangen (see participants list).

- District Level: A major assessment of energy education has been launched in the Springfield, Missouri school district. For further information and results contact A.C. Brewer (see participants list).

- Teacher Education Program: Middle Grade Teacher Faculty Development Project. The evaluation strategy used in this project was designed to yield data which would reflect the level of achievement of the project's stated objectives. Formative and summative evaluations were used. Instruments and procedures are outlined in the report on the project and can be obtained from Tom Edwards (see participants list).

- Private: A Guide to Evaluating Energy Education Curricula has been published by Western Sun (Suite 800; 715 SW Morrison, Portland, OR 97205). It is designed to be useful to curriculum developers working on design problems, to states or school districts documenting the strengths and weaknesses of several different curricula, and to classroom teachers trying to evaluate one or several lessons or curricula. The Guide facilitates a thorough examination of each component of an instructional unit (goals, rationale, objectives, instructional content, method, audience, impact) and provides a basis for equitable comparison. The impact section analyzes the interaction of each component with students and the consequent effectiveness of the material.

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Public and Private Partners in Energy Education

Cooperation is needed both to bring together the talents of the private sector and education, and to address more effectively the energy education needs of our society.

Developing good energy education programs for students requires two kinds of expertise: educational and technical. Teachers are best able to provide methodology and structure while the private sector possesses information that can provide a technical base.

In addition to technical information, the private sector often has financial resources which are needed to develop and implement educational programs.

However, we also recognize that real dangers exist in permitting the private sector into the educational system at any level without careful consideration of the services and materials offered.

The goal of cooperation between the private sector and education is to bring about an awareness within our communities and throughout our society of energy resources, production and conservation. We have designed the following sections to support and extend this cooperation.

INITIAL DIALOGUE

Dialogue can be initiated by industry, special interest groups, teachers or administrators. An "interface" committee should be established to represent all those concerned with the project. The interface committee could facilitate dialogue, establish techniques to determine the value and bias of proposed strategies, and evaluate the potential and actual effectiveness of such strategies.

The size of the interface committee should be appropriate to the size of the cooperative project. A state-wide interface committee could be composed of:

- A state utility representative, possibly a state utility commissioner, or P.U.C. public information education person (this position could be considered under the utilities' public information mandate);
- Another representative of an energy industry prevalent in that specific state (e.g., coal company person in Indiana, oil in Texas);
- A representative from each of several state level energy and education agencies (e.g., state energy office, education agency, state school organization representative);
- A state legislator or state senator, who may also be on an energy or education committee in that state, who could lend some insight and clout to the committee;
- Other representatives including teachers, environmentalists, consumers, students, etc.

A local committee would be much smaller and would be composed mainly of representatives from the cooperating school or schools and the sponsoring utility or industry.

OPPORTUNITIES

Industry has access to resources that could be useful in the classroom. Schools and/or teachers can request such information from industry or industry can offer its resources to educators. Some specific opportunities for cooperation are listed below.

- Industry can offer current, detailed technical data.
- Students can take field trips to local industry for a close look at current technologies and practices.
- Industry can support a laboratory equipment loan program.
- Industry can establish/maintain energy libraries.
- Industry can offer administrative and managerial experience to schools for large energy activities (energy fairs, displays, etc.).
- Industry can sponsor speakers for classes, etc.

Teachers and schools comprise a resource from which industry could benefit. Teachers can offer:

- Pedagogical expertise;
- Review of materials;
- Facilities for field testing.

Industry can provide funds for innovative projects. However, the content of these projects should be determined by the teachers or schools who will use them. Funds can be given or granted to support:

- Teacher inservice workshops.
- Operations of the interface committee (e.g., mileage, expenses, honoraria, release time).
- Large school energy activities (energy fairs, etc.).
- Leaves of absence for teachers to increase their energy expertise.
- Internships for teachers in industry.
- Summer workshops in cooperation with local institutions of higher education.

Local Implementation and Support

The viabillty and effectiveness of an energy education program depend on classroom implementation of energy education materials and community support for the effort.

Integrating energy education and the conventional curriculum is a complex process that involves adapting energy materials to the school's curriculum and the class's needs. Infusion is one method of adapting materials to fit both the curriculum and the student. In the case of energy education, infusion is the process of teaching a traditional concept, fact or event from an energy standpoint. Other methods of integrating energy and the conventional curriculum include teaching a separate course or mini-course on energy or sponsoring school-wide energy activities. These methods allow teachers to use skills and talents in their personal area of expertise and engage their individual creativity. Pre- and inservice training should be available to help interested teachers pursue these methods of integration.

Each teacher is responsible for his/her individual efforts in the classroom, but the wider educational environment should support the integration of energy education. Local school districts should encourage teachers to become involved in energy education. For example, local districts could make a variety of energy education resources and methods available to teachers. Incentives could also be provided. Such

incentives could take the form of opportunities to attend workshops and professional meetings, reimbursement for attendance, etc.

The vital support of parents and community resources can be gained by publicizing the program's goals and achievements. An energy education interest group, composed of various members of the community (e.g., parents, business, civic groups) could provide tangible support and guidance for energy education in the schools. (See School as an Energy Education Laboratory report, page 41.)

Energy education involves students in making real decisions and solving real problems. Incorporating energy education into the curriculum is a process that must proceed on many levels and that will require continuing support and commitment from teachers and the larger community.

A FEW LOCALLY DEVELOPED PROJECTS

- Home and School Energy Conservation courses and programs. Dr. Walter C. Quint, West Deptford High School, Old Crown Point Road, Westville, NJ 08093.
- Lee County Schools Energy Education. - William F. Hammond, Coordinator of Science and Environmental Education, 2266 Second Street, Fort Myers, FL 33901.
- Pacific Power, San Diego, CA.
- Project for an Energy-Enriched Curriculum, Workshop Handbook, NSTA.
- St. Paul Energy Committee of 100+. Subcommittees on: Education, Existing Housing and Zoning, New Housing and Construction, Transportation,

- Large Energy Users. Contact: Office of the Mayor, St. Paul, MN.

- Teachers Guide to Energy Resources in Kentucky. Center for Environmental Education, Murray State University, Murray, KY.

- Title IV-C Adapt and Adopt experiences--e.g., ICE Project, Bob Warpinski, Green Bay, WI, May 1979.

- "A New Source of Energy for the Nation's Schools." Energy Management Team. H. Norman McRae, 1026 Mohr Lane, Concord, CA 94518.

Training Teachers for Energy Education

There is an increasing awareness of the central position of energy in our lives and the ways energy is related to everything we do. Education personnel, therefore, need specific preparation to deal with present and future energy concerns. Inservice and preservice programs should provide the knowledge, skills, and attitudes necessary for educators to facilitate the development of an energy-literate populace. Futhermore, inservice and preservice energy education programs should prepare educators, and through them, their students, to participate in the social and political decisions that will be made about energy. Ways to incorporate energy education into pre- and inservice training are suggested below.

PRESERVICE

- Develop a training program for interdisciplinary teams (science and social studies professors) to demonstrate ways in which energy education can be integrated into both a specific course and a whole curriculum.
- Emphasize graduate and post-graduate research and study of energy education preservice models for theses, dissertations, faculty research.

- Encourage and promote the inclusion of energy education in the guidelines of accreditation agencies (e.g., NCATE, North Central, Southern Association).
- Demonstrate teaching methods and activities using energy materials (e.g., use energy lessons in micro-teaching activities).

INSERVICE

- Display, distribute and demonstrate energy education materials and programs. Get on the program at appropriate teachers' meetings, conferences or workshops. (For example, PEEC should make presentations at the Detroit National Conference and at the national, regional and state NSTA and NCSS meetings.)
- Continue to award DOE Faculty Development grants because they are an excellent vehicle by which to disseminate energy education information to elementary, secondary and college teachers.
- Present workshops both for educational units (i.e., state departments of education, teacher centers, supervisors, school districts) and for specific groups of leaders and teachers. Design workshops to meet teachers' energy education needs. Regional Energy Education Network representatives could sponsor some of these workshops.
- NSTA should establish a toll-free hotline to disseminate information to educators on energy education materials, networks, conferences, etc.
- Promote energy education through articles in professional journals and presentations at professional meetings.

SAMPLE TEACHER EDUCATION EFFORTS

Energy Education for Elementary and Secondary Teachers: During the past four years the Department of Secondary Education at Iowa State University, funded by the National Science Foundation, has conducted year-long workshops for elementary and secondary teachers.

The project is designed to bring about 30 teachers into close interaction with scientific leaders from the public and private sectors. Typically, class evenings are spent listening to a lecture on some aspect of energy and discussing the lecture with the scientist. A variety of curriculum/laboratory activities are also offered to help teachers incorporate energy concepts into their school curriculum. Both on-campus and off-campus field trips are used to supplement classroom activities.

Implementation in the classroom is emphasized and presentation to the community is also encouraged. Out of this program has come a group of teachers well prepared to teach energy.

Faculty Development Program: The Illinois State University has sponsored a Faculty Development Program, funded by the U.S. Department of Energy, for middle grade (4-9) science teachers. The program objectives are wide-ranging. It is designed to expand the teachers' grasp of energy and related subject matter and make them aware of the variety of energy education material, for example, the many laboratory investigations and classroom demonstrations that illustrate fundamental energy concepts. Firsthand,

on-site information is provided about the production, distribution and problems of generating electricity with oil, coal or nuclear. Finally, communication and cooperation are established between energy educators at the middle grades level and the university level.

Pennsylvania Inservice Workshops on Energy: The State of Pennsylvania offers inservice workshops to teachers at all grade levels across the state. The workshops, like energy education itself, are cross-disciplinary and include science, social studies, English (communications), industrial arts and home economics. These inservice workshops are funded by the Pennsylvania Governor's Energy Council and implemented by the Pennsylvania State Department of Education.

Energy: A Humanizing Experience: The Energy Awareness Project at the University of Houston at Clear Lake City, has conducted a three-week Energy Curriculum Institute for teachers for several years during their summer session. The Institute is supported by the Shell Companies Foundation, Inc.

The goals for the Institute are twofold. The first goal is to provide as much factual and conceptual information as possible about energy sources and demands, energy conservation, energy and global interdependence, energy and the economic system, and the energy industry in Texas. The second goal is to provide an opportunity for the teacher participant to design and develop an instructional unit in science, language arts, social studies or fine arts.

The Institute is nontechnical and features prominent speakers on energy topics and curriculum design and development.

Energy Economics Forum Program: The Energy Economics Forum Program is a series of one-day inservice teacher training workshops, which was initially developed as a pilot program sponsored by the American Petroleum Institute (API) in July 1977. Since that time, some 1,300 elementary and secondary teachers have attended forum programs. Follow-up evaluations of the forums show that the teachers rate the sessions generally useful and worthwhile, and are pleased with the teaching materials distributed for classroom use. Many teachers' suggestions have been incorporated into later forum programs.

The Energy Economics Forum objectives are: to introduce teachers to the actual operations of the petroleum industry; to provide educators with petroleum industry economic data; and to provide educators and petroleum industry representatives with the opportunity to communicate through informal dialogue sessions.

The Energy Economics Forum program sponsored by API is a 1978 recipient of a Distinguished Service Award from the Freedoms Foundation at Valley Forge for its contribution in the field of economic education.

Poster Session

ATOMIC INDUSTRIAL FORUM
Les Ramsey

AIF will provide teachers with single copies of a set of ten brochures related to the nuclear industry as well as up to three free copies of reprints on a wide variety of subjects.

Source of Materials: Atomic Industrial Forum

Contact Person: Les Ramsey
Atomic Industrial Forum
7101 Wisconsin Avenue
Washington, DC 20014

Price: Free

Grade Level: 7-adult

CAREER SPECIALTY: ENERGY & ENVIRONMENT

Allan Hida

Our program consists of special classes which students take in addition to their regular courses. The school has been provided with funds to purchase equipment and supplies to make these courses possible. Our program features courses in Energy Issues as well as Ecology of the City, Environmental Science, Earth Science, Environmentalism/Environmental Law, etc.

The program is a part of the Milwaukee Public Schools commitment to desegregation. Funding comes from Title VI Magnet Program, ESAA and Board Funds. Program descriptions are available.

Source of Materials: Varied

Contact Person: Allan Hida, Program Implementer
Madison High School
8135 W. Florist Avenue
Milwaukee, WI 53218

Price: NA

Grade Level: 9-12

ENERGY/ALTERNATIVES AT A RESIDENTIAL ENVIRONMENTAL EDUCATION CENTER

John J. Padalino

A solar demonstration project for hot water and space heat is underway at Keystone Junior College's Pocono Environmental Education Center in northeastern Pennsylvania. It is the first National Park Service installation in the mid-Atlantic region. Energy conservation, energy education and alternative energy efforts at a large residential environmental study center (serving approximately 20,000 persons annually) are documented in a slide presentation.

Source of Materials: Pocono Environmental Education Center

Contact Person: John J. Padalino
PEEC
Box 268
Dingman's Ferry, PA 18328

Price: NA

Grade Level: Early adolescent to adult

ERIC MATERIALS FOR ENERGY EDUCATION

John F. Disinger

The ERIC Clearinghouse for Science, Mathematics, and Environmental Education (ERIC/SMEAC) has been located at the Ohio State University since 1966. Several thousand documents and journal articles have been reviewed and processed relating to science education, mathematics education and environmental education. More than 4,000 of these documents are related to energy. These materials include curriculum guides, research reports presented at regional and national meetings, evaluation reports, teacher's guides, and descriptions of educational or research programs.

Source of Materials: SMEAC Information Reference Center

Contact Person: Dr. John F. Disinger
SMEAC Information
Reference Center
1200 Chambers Road
Room 310
Columbus, OH 43212

Price: Varies

Grade Level: K-12, teachers at all levels

HOME ENERGY TEST: AN ENERGY AUDIT TO INCREASE AWARENESS AND CONSERVATION

John R. Vincenti

The Home Energy Test is a simple energy audit that can be used by students with their families. It is designed to increase energy awareness and promote techniques to save energy and money in the home. The Home Energy Test incorporates the goals of the Centre Region Council of Governments which designated 1980 as "Energy Conservation Year." The Home Energy Test deals with attic insulation, windows and doors, weatherstripping, thermostat control of space and water heat, furnace maintenance, air infiltration and automobile mileage. The program is part of a unit entitled, "Energy: Issues, Information, Insight, Implications, Investigation and Impact."

The Home Energy Test is administered in three phases. Phase I introduces terminology in the questionnaire through AV aides and contact with building suppliers or hardware store personnel. Phase II, the audit, is done in the home. Phase III uses a school report card facsimile to review and rate the test.

Source of Materials: Centre Region Energy Conservation Program
Governor's Energy Council

Contact Person: John R. Vincenti
1344 Curtin Street
State College, PA 16801

Price: NA

Grade Level: 6-adult

INTRODUCTION TO ENERGY EDUCATION RESOURCE CENTER

John W. Keenan

The Energy Education Resource Center provides an information and materials resource facility for teachers who want to implement energy curricula. The Center provides a place where teachers can find resources on a wide variety of energy-related topics. The Center also offers energy education specialists who can assist teachers with their selection of an existing program or with the implementation of their own original concepts. Experimental and demonstration equipment is provided to these teachers on a free loan basis so that classroom presentations may be more lively and informative. Such equipment includes bicycle generators for demonstrating electrical power production and a TRS-80 microcomputer with which students can study the cost effectiveness of home and school energy saving efforts.

Source of Materials: University of Hartford

Contact Person: John W. Keenan
Energy Education Resource Center
University of Hartford
West Hartford, CT 06117

Price: Varies, free to schools in Connecticut

Grade Level: K-12

LIVE MOBILE ENERGY EDUCATION PROGRAMS

Ron Weinberg

The Oak Ridge Associated Universities have developed a series of live mobile energy education programs for schools and civic clubs.

One such program, "Energy Adventure," is a live assembly program that presents an interdisciplinary approach to the mosaic of social, economic and scientific concepts that constitute our energy dilemma. "Energy Adventure" deals with the history of energy use in our society, the fundamental importance of energy, some of the economic principles that govern its use and distribution, and the importance of coming to grips with the problem.

"Energy Today and Tomorrow" is another live educational program that can raise students' awareness of the energy issue. The program covers what energy is; fuels and methods used for producing electricity; possible future ways to make electricity; where and how energy is used; the environmental, social and economic problems associated with energy use; and ways to conserve energy. The specially trained science teacher who presents the assembly program uses a truckload of unusual instructional devices to help make a clear and memorable presentation.

Source of Materials: Oak Ridge Associated Universities

Contact Person: Ron Weinberg
P.O. Box 117
Oak Ridge, TN 37830

Price: Free

Grade Level: 8-12

NEW YORK POWER POOL'S ENERGY EDUCATION ACTIVITIES

Richard J. Leonard

The member systems of the New York Power Pool have energy education programs and materials that are available to schools within their respective service areas. The New York Power Pool coordinates the scheduling of the "Energy Today and Tomorrow" and the "Energy-Environment Simulator" programs. These materials are only available in New York.

Source of Materials: Member systems of New York Power Pool

Contact Person: Richard J. Leonard
NY Power Pool
3870 Carman Road
Schenectady, NY 12303

Price: Free

Grade Level: K-12

PROJECT FOR AN ENERGY-ENRICHED CURRICULUM NATIONAL SCIENCE TEACHERS ASSOCIATION

PEEC Staff

Through its Project for an Energy-Enriched Curriculum, sponsored by the U.S. Department of Energy, the National Science Teachers Association has produced a series of energy instructional packets for elementary and secondary schools. Written by social studies and science teachers, these materials are designed for convenient infusion into the existing curriculum. They feature a wide range of activities which encourage direct student participation while introducing basic energy concepts.

Of the total 44 instructional packets, 15 are in final form. The remaining packets are in the process of field testing, revision and printing.

Fact Sheets on Energy Technologies are also available. They cover bioconversion, wind, solar, geothermal, conservation, nuclear, coal, storage, fuel cells, synfuels, and appropriate technology.

NSTA also publishes Energy & Education, a bimonthly newsletter serving the growing number of teachers, administrators and civic groups involved in energy education. Regular features include editorials by outstanding authorities in the fields of energy and

education, listings of new free and inexpensive materials, book reviews, current data on the energy situation, and a calendar of coming events. Energy & Education is available free of charge from NSTA.

Source of Materials: DOE Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

Price: Free

Grade Level: K-adult

SCHOOLHOUSE ENERGY EFFICIENCY DEMONSTRATION (SEED)

Donna L. Rybiski

SEED, a public service program, is designed to assist schools in reducing the impact of the rising cost of energy by defining good energy management programs and recommending low-cost, quick-fix solutions to energy inefficiencies.

SEED has two components, technical assistance and public awareness. The technical component conducted 20 demonstration energy audits of representative schools. Their findings indicated that low-cost solutions (pay-back period of two years or less) and effective energy management programs could reap substantial energy savings--48.6% in the typical school. Many of the improvements SEED recommended can be funded from the operating and maintenance budget.

The public awareness component of SEED was designed to assist the school administrator in generating community support for school energy conservation. These items were developed as a part of the public awareness efforts: "The Fourth R," a motivational film; "The Fourth R: Resourcefulness in School Energy Conservation," a companion to the film describing

school energy problems and typical solutions. "Something Special from SEED" is a report on the activities of our first year, including a "Summary Section" of the 20 school study, a "Classroom Guide" for students to learn about energy conservation, and a "Technical Manual" for conducting energy audits in schools.

Source of Materials: Tenneco, Inc.

Contact Person: Donna L. Rybiski
Tenneco, Inc.
Public Affairs Department
P.O. Box 2511
Houston, TX 77001

Price: Free

Grade Level: K-12

SCIENCE ACTIVITIES IN ENERGY AND ENERGY MATERIALS FOR COMPUTER

Bob Content

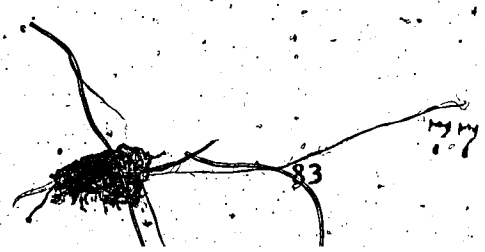
With DOE support, the Oak Ridge Associated Universities have developed experience-oriented science activities in energy for students including some computer programs.

Source of Materials: Oak Ridge Associated Universities

Contact Person: Bob Content & Jim Duniow
Oak Ridge Associated Universities
P.O. Box 117
Oak Ridge, TN 37830

Price: Free

Grade Level: 4-12



SOLAR HOMES AND ENERGY AUDITS

Alan Humphreys

I won the 1978 Minnesota Energy Agency Alternative Energy Home Design contest. From that effort I have developed a simplified version of the heat load calculations (which are used to determine how much collecting space is needed). Upper elementary and middle school students can conduct their own home energy audit with teacher help. The calculations are not engineering-precise, but if students are careful, answers will fall within 10% of the actual heat load.

Source of Materials: Alan Humphreys

Contact Person: Alan Humphreys
370 Peik Hall
Department of Curriculum and Instruction
University of Minnesota
Minneapolis, MN 55455

Price: Free

Grade Level: 4-8

TAKE THAT, YOU ENERGY MONSTER
Jenny Younger

"Take That, You Energy Monster," a puppet drama, was developed in 1978 to teach young children in Bozeman, Montana about energy, energy conservation, and alternative energy resources. Now, two years later, the League's puppets are being used in 30 states and Canada.

Energy Monster and his puppet friends, Insulator Man and the Sun Princess, are extremely successful in teaching children and adults about energy. The natural charm of puppetry lends an interest factor that is hard to duplicate in other teaching tools.

Energy puppet teachers' kits, large production-size sets, and videotape training films are available from the League of Women Voters of Montana.

Source of Materials: League of Women Voters of Montana

Contact Person: Jenny Younger
LWV Energy Puppet Show
5555 Black Bear Road
Bozeman, MT 59715

Price: $35-65

Grade Level: K-6

TEENAGERS AS ENERGY ADVOCATES

Carol Wilson

Wallingford Auditing Technical Team (WATT) is a group of 12 high school students (grades 9-12) who have performed energy audits of all Wallingford schools and 18 of the town's municipally-owned buildings in the past year and a half. Because of these audits, the school system has used 21% less electricity (1.6 million kWh) and 33% less oil (270,000 gal). WATT has given teacher workshops, classroom lessons, and awards to people who save energy. Their efforts have saved the town a total of $260,000 in one year. An outline of the WATT program and how others can be organized are available.

Source of Materials: Carol Wilson (and any State Energy Office)

Contact Person: Carol Wilson
Sheehan High School
Wallingford, CT 06492

Price: Free

Grade Level: 7-12

80

THE TIME FOR SAVING ENERGY IS NOW. . . DON'T LET TIME RUN OUT ON YOU!

John Colozzi

As part of the Tennesee Energy Authority's "October is Energy Month" activities, I held a statewide poster contest for 6th grade students in Tennessee. We chose one first place winner, two second place winners, and four third place winners who were awarded savings bonds. The winning posters were incorporated into a 24" x 36" glossy color poster-calendar (1981). The central design is an hour glass almost out of sand which reflects the theme, "The time for saving energy is now . . . Don't let time run out on you!"

In the Energy Education Section, "October is Energy Month" emphasized grades K-6 because I believe that this level needs the greatest development of energy education in Tennessee at this time.

Source of Materials: Tennessee Energy Authority

Contact Person: John Colozzi
Tennessee Energy Authority
Suite 710 Capitol Boulevard Building
Nashville, TN 37219

Price: NA

Grade Level: 6

81

Participants

Rodney Allen
Professor
Department of Curriculum and Instruction
College of Education
The Florida State University
209 Education Building
Tallahassee, Florida 32306

Has conducted numerous workshops and institutes on energy/environment education for high school teachers in the U.S. and Canada; has directed teacher institutes supported by the U.S. DOE; writer for PEEC; author of many articles on energy, ethics and education.

Paul Bauman
Policy Analyst
Education Commission of the States
300 Lincoln Tower
1860 Lincoln Street
Denver, Colorado 80295

Energy education coordinator for a state energy office; co-creator of a network for state energy educators; as Conservation Specialist for Department of Energy, provided training and technical assistance to state and local agency energy offices; Assistant Director of State Energy Education Policy project.

Bernard W. Benson
Director
Center for Environmental/Energy Education
Department of Curriculum and Instruction
The University of Tennessee at Chattanooga
Chattanooga, Tennessee 32402

U.C. Foundation Professor of Education; directed several NSF Pre-College and USOE Metric Education grants; worked as consultant to ISIS project and to ETS regarding National Teachers Exam revision; taught science methods, environmental education and energy education.

Shaw Blankenship
Environmental and Energy Education Program
TVA Forestry Building
Norris, Tennessee 37828

Richard W. Brancato
Executive Director
State and Local Assistance Programs, CE-20
Assistant Secretary for Conservation
and Renewable Energy
U.S. Department of Energy
Washington, DC 20585

Executive Director of DOE's energy conservation grant programs from 1980 to present; detailed from DOE to White House Staff with responsibility for energy-related educational, outreach and informational programs, 1979-1980; directed planning and analysis activities for DOE's outreach and public information activities, 1977-1979; developed and drafted legislation on energy conservation programs.

A.C. Brewer
Science Coordinator
The School District of Springfield R-12
Administrative Service Office
940 North Jefferson
Springfield, Missouri 65802

Springfield Public Schools, 1945 to the present; Science Coordinator, 1960 to present; designed and implemented energy and environment courses for eleventh and twelfth grade students; Director of a Title IV-C energy education program (in its second year); active in the Southwest Missouri Solar Energy Association; has presented programs on the "Energy Simulator" to local schools and civic clubs; promotes energy conservation as well as the development of alternatives to fossil fuel-produced energy.

J[redacted]own
E[redacted]y Teacher
R[redacted]ox 158A
Liston, Indiana 46149

Attended Indiana State Energy Education Workshop, 1979; chosen by Department of Public Instruction, State of Indiana, to train other teachers to use state's energy education materials, spring 1980; implemented "Energy Month" in her school involving all faculty and students, September 1980.

Margot Brown
Energy Specialist
Nassau County Division of Energy
One West Street
Mineola, New York 11501

Responsible for various energy information efforts including: presenting workshops on "Energy Tips for Teachers," "Government's Role in Energy" for students, and a "Careers in Energy" symposium; writing a pamphlet on burning wood; offering energy guidelines

for homeowners on radio; organizing an energy library; has assisted with various other programs such as appropriate technology fairs and an energy conservation program for employees; visited the United Kingdom's Department of Energy and took a solar tour of Israel with Jordan College.

Helen Carey
Senior Editor/Coordinator
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Senior Editor/Coordinator for NSTA's Project for an Energy-Enriched Curriculum.

Richard Clark
Science Specialist
Minnesota Department of Education
Capitol Square Building
St. Paul, Minnesota 55101

Chair, State Energy Task Force; Chair, Secondary Energy Education Curriculum Development Team; conducted statewide energy education assessment; offers 30 mini-grants to K-12 teachers using funds from power suppliers; member, Northern State Power Advisory Committee; Director, Department of Energy Region V Energy Education Consortium.

Lillian A. Clinard
Assistant Director
Energy, Environment and Resources Center
University of Tennessee
327 South Stadium Hall
Knoxville, Tennessee 37916

Responsible for: energy and environmental research and technology transfer; educational materials and program development, Energy Conservation in the

Home which includes a curriculum guide for secondary school teachers, a slide tape program for energy and agriculture extension services, and television and radio spots and programs; Appliance Labeling education packet for home economics teachers; assisting state and local agencies and organizations with energy education planning.

Mary D. Colley
Science Teacher
Liberty Junior School
7055 Dutchland Parkway
Middletown, Ohio 45042

Developed local and county science curricula; developed three day residential camping experience for all sixth grade students in local district; advisor for Explorer Post 962, BSA, a coed group involved in outdoor education.

John Colozzi
Program Manager
Tennessee Energy Authority
Suite 710
Capitol Boulevard Building
Nashville, Tennessee 37219

Program manager in energy education for State of Tennessee with the Tennessee Energy Authority; includes responsibilities for all programmatic functions connected with curriculum development, conferences and academic institutions; liaison person to other organizations involved with energy education.

Bob Content
P.O. Box 117
Oak Ridge Associated Universities
Oak Ridge, Tennessee 37830

Coordinates development of "Science Activities in Energy" series; develops energy exhibits.

Mary B. Crum
Science Consultant
Denmark-Olar School District #2
Beech Avenue
Denmark, South Carolina 29042

Writer for Project for an Energy-Enriched Curriculum; writer for Solar Energy Project; Chair, Subcommittee for Energy Education, S.C. Natural Resources Council; State Coordinator, National Energy Education Day activities, 1981.

John F. Disinger
Associate Director
ERIC Clearinghouse for Science, Mathematics, and Environmental Education
Room 310
1200 Chambers Road
Columbus, Ohio 43212

Interested in making available printed educational materials dealing with energy to teachers, through the ERIC system.

Janet Dove
Staff Advisor, Education
American Petroleum Institute
2101 L Street, N.W.
Washington, DC 20037

Administers and creates API education programs and activities, including API's three year old program of energy economics workshops for teachers (program received 1978 Distinguished Service Award from the Freedom's Foundation at Valley Forge); staff advisor to API's Education Subcommittee; member PEEC Steering Committee; former English teacher.

Judy Driskill
Environmental Education Specialist
Environmental/Energy Education Program
Tennessee Valley Authority
Forestry Building
Norris, Tennessee 37828

Coordinates energy education activities for TVA's Environmental/Energy Education program; energy education liaison person among local, state, regional and national organizations and groups involved in energy education.

Donald D. Duggan
Division of University & Industry Programs
Office of Field Operations Management
Office of Energy Research
U.S. Department of Energy
Mail Stop 3F032
Washington, DC 20585

Charged with responsibility for U.S. DOE programs in energy education for schools, including teacher training and curriculum development; previously with Energy Research and Development Administration and Federal Energy Administration.

Margaret T. Dunn
Science Teacher
Marshall County High School
Route 7
Benton, Kentucky 42025

Teaches three classes of environmental science, one ecology class in which two-three weeks are devoted to energy and environmental problems associated with the production and use of energy.

Thomas F. Edwards
Professor of Science Education
DeGarmo Hall 229
Illinois State University
Normal, Illinois 61761

Professor of Science Education, 1972-present; 31 years secondary and college teaching; director of DOE Middle Grade Teacher Education Project, 1979-80; participant in two NSF-AAAS Chautauqua-type courses on energy (1979-80, Fowler, Lovins); presenter of energy education workshops.

Julia Fellows
Editor
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Edits Energy & Education newsletter, learning packets and special publications; coordinates curriculum writing workshops; conducts inservice workshops on energy education.

John M. Fowler
Project Director
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Currently director of NSTA's energy education projects; author of Energy and the Environment, NSTA's Energy/Environment Source Book and the DOE/NSTA Fact Sheets on Energy Technologies; course director for AAAS Chautauqua-type Short Courses on Alternative Energy Technologies; has lectured and written extensively on energy/environment issues; an execu-

tive editor of Environment magazine; a vice-chairman of Scientists Institute for Public Information.

Bonnie Frimpter
Science Teacher
Lexington Public Schools
Jonas Clarke Junior High School
Stedman Road
Lexington, Massachusetts 02173

Extensive junior high earth and physical science classroom experience with infusion of energy education into existing course/curriculum; developed and directed "Energy Expos" of student built energy devices; Energy Education Resource Agent with Northeast Solar Energy Center (NESEC); directed teacher training workshops and disseminated DOE energy curricula; developed and submitted proposals to NSF PreCollege Teacher Development Program for Energy Education workshops with Boston University for junior high science teachers in New England and DOE Faculty Development Program.

Sister Marita Glisdorf
Science Department Chairperson
Xavier High School
1600 West Prospect Avenue
Appleton, Wisconsin 54911

Wrote an instructional energy unit for grades 9-12 while at an energy workshop at Wayne State University, Detroit, Michigan; incorporated an energy study in her school's science curriculum; taught the "Energy Simulator" to high school students who in turn took it to the elementary schools in the district; member of fund-raising committee for an environmental education building which will incorporate alternate energy forms for demonstration purposes in the area.

Ronald C. Gorsky
Industrial Arts Department
Neptune Junior High School
2300 Heck Avenue
Neptune, New Jersey 07753

Industrial arts instructor in junior high school, 13 years; has taught energy education since 1974; won first place in New Jersey school energy ideas contest, 1979 and 1980; supervised first student-built windmill in the state; worked on wind power course of study for vocational education training at Trenton State.

Ted Hall
Science Teacher
Wayland High School
Old Connecticut Path
Wayland, Massachusetts 01742

Writer for PEEC (1979, 1980); presented workshops to Massachusetts Audubon, Massachusetts Teachers Association, National Association of Biology Teachers; has taught environmental science for the past seven years which includes ½ year energy; participant; 2nd Practitioners Conference and NSF program on Solar Energy and Energy Conservation (summer 1978).

Shirley Hansen
President
Shirley Hansen Associates, Inc.
127 Sequoia
Lake Jackson, Texas 77566

Currently heads own consulting firm whose primary focus is saving education's energy needs; former Director, Schools and Hospitals Conservation Division, Department of Energy; Director, Energy Programs at the American Association of School Administrators for five years; member, Editorial Advisory Board of Energy Management magazine; member, National Energy

Education Day Advisory Council and the Education Commission of the State's State Energy Policy Task Force; author of numerous articles and papers on energy conservation and energy education.

Clyde W. Hibbs
Professor
Department of Natural Resources
Ball State University
Muncie, Indiana 47306

Provided leadership for establishing the interdisciplinary minor in energy resources at Ball State which involves seven departments; teaches three courses (Introduction to Natural Resources, Teaching of Conservation, Integrated Resources Management) in which energy is an important component; participated in two NSF-AAAS Chautauqua-type courses on energy (1979-80, Fowler, Lovins); attended energy workshops conducted by Indiana Department of Public Instruction and Indiana State University; Chair of the College and University Liaison Committee, Environmental Education Association of Indiana, Inc.

Allan Hida
Program Implementer
Madison High School
8135 W. Florist Avenue
Milwaukee, Wisconsin 53218

Participated in a summer workshop to write high school energy materials at the University of Wisconsin-Whitewater; attended a "Coal Mine to Kilowatt" workshop at UW-Superior; writer and presenter for UW-Milwaukee Energy Change Agent Team; teaches a high school class on Energy Issues; currently Program Implementer for the Career Specialty Program; attended an EME workshop for teachers.

Helenmarie Hofman
Associate Director
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Has designed and developed energy education programs and materials; has conducted seminars, workshops, and materials development sessions; has published articles and given speeches on energy education; edited Proceedings of First and Second Practitioners Conferences.

Bernard C. Hollister
Social Studies Teacher
Willowbrook High School
1250 S. Ardmore
Villa Park, Illinois 60181

Participant-writer, Energy Workshop, University of Wisconsin-Whitewater, 1977, 1978; writer for PEEC, Ames, Iowa, 1980.

Jeffrey W. Holte
Elementary Teacher
Central Middle School
8025 School Road
Eden Prairie, Minnesota 55344

Teaches classes on energy and holds annual "energy festival" in middle school; evaluated Minnesota Energy Assessment Test for State of Minnesota; received grant from State of Minnesota for energy project; is working on master's degree in curriculum development--concentration in energy education.

Alan Humphreys
Associate Professor
370 Peik Hall
Department of Curriculum and Instruction
University of Minnesota
Minneapolis, Minnesota 55455

Winner, Minnesota Energy Agency Home Design Contest for a solar home; contractor and subcontractor for solar system, electric system, masonry heating system, sensing system for award-winning home; amateur builder; member, Committee of 100, Education Subcommittee; Energy Advisory Committee to City of St. Paul; Advisory Committee on Energy Policy, St. Paul City Council.

Ann Hussey
Science and Math Teacher
Peru Elementary School
Main Street
West Peru, Maine 04290

Attended a three-week course in "Alternate Energy Sources" at University of Maine; July 1980; conducted a teacher workshop, October 1980, on energy education at own school; presented a slide show about construction of a solar pool at a Maine Science Teachers Workshop, October 1980; received an energy grant from OER for a classroom energy project.

Ed Kasper
Coordinator, Educational Programs
Gulf States Utilities, Inc.
P.O. Box 2951
Beaumont, Texas 77704

Designs and aids in implementation of energy education programs for G.S.U.; nuclear exhibit manager at Texas A & M for 4 years; gave nuclear education programs to over one-half million secondary science students in Texas from 1975-78; teacher of secondary science in Texas public schools for 10 years.

John W. Keenan
Director of Special Programs
University of Hartford
College of Engineering
200 Bloomfield Avenue
West Hartford, Connecticut 06117

Primarily responsible for development and administration of non-traditional educational programs designed to increase student interest in science and engineering; author of children's book, "Energy," which has received wide distribution throughout Connecticut; guest speaker at May 1980 Vermont Energy Scholars Day; guest speaker at Connecticut Conference on Energy Education, October 1980; consultant in development of Powerplay-- An Energy Issues Simulation, and Radiation--A Part of Our World.

Janice Kell
Materials and Communications Aide
Energy Education Project
324 Henson Hall
University of Tennessee
Knoxville, Tennessee 37916

Member of a committee that selected energy education materials for a guide for Adam's County, Colorado Public Schools; museum assistant, American Museum of Science and Energy; wrote teacher's guides and revised conservation and solar science activities in energy; master's thesis on energy education materials; materials specialist for Title IV-C program.

Richard J. Leonard
Communications Specialist
New York Power Pool
3890 Carman Road
Schenectady, New York 12303

Science teaching, 4 years, New Jersey Public Schools; instructional development, 6 years, State University of

New York; Energy Education Coordinator for New York Power Pool, 3 years; graduate of Oak Ridge Associated Universities Energy Education Training Program.

Robert E. Lewis
Science Teacher
Springer Junior High School
Wilmington, Delaware 19803

Science teacher; writer for PEEC, 1978; President, Delaware Teachers of Science; member, Governor's/Science Supervisor Energy Committee; author, Energy Curriculum, State Department of Public Instruction.

Donna Lifur
Environmental/Energy Education Specialist
Environmental/Energy Education Program
Tennessee Valley Authority
Forestry Building
Norris, Tennessee 37828

Coordinates the development and implementation of programs through university-based centers for environmental and energy education sponsored by the Tennessee Valley Authority; acts as liaison for TVA groups in the area of environmental/energy education.

Sam E. Mitchell
Science Chairperson
Thomas Jefferson High School
Federal Way School District 210
4248 South 288th Street
Federal Way, Washington 98002

Conducted numerous energy workshops and presented energy sessions at workshops; has taken energy courses and attended energy workshops in Colorado, Vermont, Georgia, California and Washington; taught course on energy for Seattle Pacific University; off-campus in-

structor for courses in energy for Central Washington University; worked with gifted students in energy audit program in Anchorage, Alaska; wrote energy curriculum units for grades 5-6 in Highline School District, Washington.

Robert Otto
Professor
360 College of Education
Western Kentucky University
Bowling Green, Kentucky 42101

Project Director of NSF Information Dissemination grants in social studies, using PEEC classroom packets; writer for PEEC, summer 1980.

John J. Padalino
Director
Pocono Environmental Education Center
R.D. 1, Box 268, Keystone Junior College
Dingmans Ferry, Pennsylvania 18328

Implemented first National Park Service Solar Demonstration Project in Mid-Atlantic region, based at Pocono Environmental Education Center; directed three NSF-funded outdoor science workshops; hosted and supported NSTA's first REEN workshop; representative, NSTA-Regional Energy Education Network, District III; participant, 1st Practitioners Conference; Board Member, Conservation Education Association; President, American Nature Study Society.

John Pavone
Energy Resource Teacher
Project C.U.B.E.
131 W. Broad Street
Rochester, New York 14608

Works in the Energy Resource Room Program component of a federally-funded project designed to increase minority representation in professional and

skilled careers; program is implemented in cooperation with Rochester Gas and Electric Co.; designed a program that brings together students from five schools to develop an appreciation for the economic, personal and social concerns about energy and to develop a conservation ethic; Chair, Energy Curriculum Committee, 1978 and revised edition, 1979.

Walter Purdy
Manager, Educational Services
Edison Electric Institute
1111 19th Street, N.W.
Washington, DC 20036

Manager of education services for the Edison Electric Institute, the association of electric companies; former elementary and secondary school principal; instructor at elementary, secondary, adult and university levels; 15 years spent developing cooperative energy education activities between the education and industry communities.

Leslie S. Ramsey
Education Services Manager
Atomic Industrial Forum, Inc.
7101 Wisconsin Avenue
Washington, DC 20014

Taught math, physics, nuclear science, and physical science for 11 years at Indiana Area Senior High School, Indiana, PA; past president of Pennsylvania Nuclear Science Teachers Association and American Nuclear Science Teachers Association; currently Education Services Manager of the Atomic Industrial Forum, Inc.

Donna L. Rybiski
Manager of Public Affairs
Tenneco, Inc.
P.O. Box 2511, T-912
Houston, Texas 77001

Manager of public affairs of Tenneco Inc., a multi-industry firm with headquarters in Houston, Texas; responsible for developing and implementing public service programs which express corporate policy for Tenneco and its operating companies; primary program responsibilities are concentrated in the areas of energy, energy conservation and energy education.

James K. Shillenn
Energy Education Specialist
The Pennsylvania State University
College of Engineering
231 Sackett Building
University Park, Pennsylvania 16802

Adapts technical information on energy and energy technologies from the scientific and engineering communities to new instructional settings such as secondary schools, resident instruction and continuing education programs; develops and presents teacher in-service programs and workshops on energy education and energy technologies; assists educators in development and selection of curriculum materials; resource lecturer on various energy related topics for both graduate and undergraduate courses.

Herb Simmons
Associate Professor of Education
360 College of Education
Western Kentucky University
Bowling Green, Kentucky 42101

Uses inquiry approach to energy education; involved in teacher education programs that include energy education; presents workshops on team teaching energy.

Terri Sipone
Science Teacher
Gates Chili Junior High School
910 Wegman Road
Rochester, New York 14624

Developed and implemented an energy unit for her seventh grade students, then expanded the unit and incorporated it as part of the seventh grade science curriculum; currently developing an energy curriculum for gifted seventh grade students; has participated in various energy courses, seminars, and conferences.

Edward J. Skudlarek
Science Chairperson, K-6
Randolph Central School
Randolph, New York 14772

Coordinator of energy education, K-12; science chairperson, K-6; member, West Valley Coalition, West Valley, NY; member, Glover's Mill Energy Project, East Randolph, NY.

Paul Sondel
American Driver and Traffic Safety
Education Association
1201 Sixteenth Street, N.W.
Washington, DC 20036

Served as teacher or administrator for 21 years; got into traffic safety education with the Job Corps in 1965 and has concentrated his career in that field, including doctoral work in transportation and safety education at the Florida State University; aide to the executive director of the American Driver and Traffic Safety Education Association in Washington, DC.

David R. Stevens
Environmental Education Coordinator
Milwaukee Trade and Technical High School
319 W. Virginia Street
Milwaukee, Wisconsin 53204

Currently teaching environmental education; coordinated a wind energy project; has given professional presentations on wind energy; developed energy curriculum for Milwaukee Technical High School Environmental Education program as well as Milwaukee Public Schools Environmental Science Satellite program.

Robert Stevenson
Coordinator, Inservice Education
427 College of Education
Western Kentucky University
Bowling Green, Kentucky 42101

Geophysical exploration team member; petroleum geologist and palentologist; earth science teacher in high school; college-level science methods teacher; inservice specialist in Development and Nuclear Delivery.

Thomas J. Switzer
Associate Professor of Education
1022 School of Education
University of Michigan
Ann Arbor, Michigan 48109

Co-director of NSF Information Dissemination Projects on integration of science and social sciences; fellow, Collegiate Intitute for Values and Science, The University of Michigan; teaches university mini-courses on science and society, and on global education, including world wide energy issues.

Robert W. Varley
Educational Representative
The East Ohio Gas Company
P.O. Box 5759
Cleveland, Ohio 44101

Responsible for design of energy education programs for schools in the service area; current programs include teacher lesson plans on energy for grades 1-3, learning modules for grades 7-12, film library, teacher newsletter; member of the Educational Service Subcommittee of the American Gas Association.

John R. Vincenti
Social Studies Teacher
State College Area School District
1344 Curtin Street
State College, Pennsylvania 16801

Advisor five years, Pennsylvania Youth and Government Program--Model Legislature and Administration; assisted club in adopting solar legislation; presenter or participant at various energy seminars, conferences and workshops; proposal writer, Department of Energy Faculty Development Program and National Science Foundation grants; member, NCSS Science and Society Committee; consultant, Pennsylvania State University, College of Engineering--Energy Education programs.

Roger K. Wangen
Social Studies Specialist
640 Capitol Square Building
Minnesota Department of Education
550 Cedar Street
St. Paul, Minnesota 55101

Co-produced 15 units on energy for junior high school studies and more than 15 units on energy for senior high social studies classes; produced and conducted social studies-energy inservice workshops for about 350 educators at state universities; integrated energy

activities into social studies-humanities workshops; disseminated NSTA's social studies energy materials; member, NSTA's PEEC Steering Committee; member, Minnesota's Governmental Task Force which included assessing student knowledge and attitudes on energy, assessing teacher's perceived needs in energy education, and collecting available classroom materials.

Deborah L. Watkins
Administrative Assistant
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Administrative Assistant, Exective Secretary to John Fowler, general PEEC office manager.

Ron Weinberg
Supervisor, Development
Energy Education Division
Oak Ridge Associated Universities
P.O. Box 117
Oak Ridge, Tennessee 37830

As Supervisor of Development, supervises the Live, Mobile Energy Education Program.

Daniel C. Welker
Science Chairperson
North Schuylkill High School
R.D. #2
Ashland, Pennsylvania

Participated in pilot program, Nuclear Science for High School (PA), 1969-present; member of writing team which produced an energy mini-course entitled, "Environmental Impact of Electrical Power Generation," 1972; Pennsylvania Nuclear Science Teachers Association (vice president 1979-80) and American Nuclear Science Teachers Association (vice president 1979-80; president, 1980-81).

Janet A. White
Research Assistant
Project for an Energy-Enriched Curriculum
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, DC 20009

Researches, writes, edits, contributes to production and graphics for PEEC.

Stanley A. Wilhelmson
Science Teacher
Rose Tree Media School District
901 North Providence Road
Media, Pennsylvania 19063

Teacher of physics and nuclear science, Rosetree Media School District (1969-present); consulting nuclear science educator for Philadelphia Electric Company, developing and pilot testing teacher inservice programs on radiation and energy-related topics, June 1980-present.

Carol A. Wilson
Science Teacher
Sheehan High School
Wallingford, Connecticut 06492

Developed and taught energy unit as part of earth science curriculum; participated and presented workshops at numerous state and regional conferences; published "An Introduction to Energy Sources;" advisor to W.A.T.T. group at Sheehan High School which saved school system $260,000 in energy costs in one year; participant in two DOE summer institutes at R.P.I.;

taught energy to adults and directed several inservice training programs for teachers; has written on energy and edited state Department of Education newsletter on Energy Education; member, town Energy Committee; energy chair, local League of Women Voters; received Appropriate Technology grant (1980) for outreach in community on energy conservation and alternatives.

Casey Woodard
State Director, NEED
61 Hilltop
Cottage Grove, Oregon 97424

Student Body president, Cottage Grove High School; State Director, National Energy Education Day (NEED), responsible for organizing committees, securing funds, directing workshops and teaching about energy.

Jenny Younger
Project Coordinator
League of Women Voters Energy Puppet Show
5555 Black Bear Road
Bozeman, Montana 59715

Project coordinator, League of Women Voters Energy Puppet Show (1978-present); member, Energy Advisory Committee, Montana Energy and Man's Environment; Energy Chair and President, League of Women Voters of the Bozeman area; co-manager, Phase I, and manager, Phase II, Energy Education Project, LWV of Montana, 1977-79.