DOCUMENT RESUME

ED 109 447 CE 004 296

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TITLE Postsecondary Technical Education and the Energy Crisis.
PUB DATE 12 Dec 74
NOTE 18p.; For related document, see CE 004 297

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS Career Opportunities; *Changing Attitudes; Educational Needs; Employment Opportunities; Employment Projections; Employment Trends; Energy; *Energy Conservation; Manpower Development; *Manpower Needs; *Post Secondary Education; Speeches; *Technical Education; Technological Advancement; Vocational Education
IDENTIFIERS *Energy Crisis

ABSTRACT

The energy problem affects virtually every wage earner in America and cries out for increased involvement by vocational and technical educators. A recent study by the National Planning Association points up the need to project future manpower demands in energy and energy-related industries so that the country's educational and training institutions can provide the mix of graduates to match future needs. Educators also share the awesome responsibility for an advocacy role to maintain the culture. What appears to be needed in schools and colleges, at this moment in history, is a bold new approach for meeting the energy problem head-on. If the two-year postsecondary institutions, both public and private, are to make their greatest contribution during this period of limited energy resources, they must not only help prepare the thousands of technicians and skilled persons for the energy fields, but they must assist in the process of changing attitudes. Colleges must tune in to the shifting job opportunities evolving as a direct result of the changing focus in the energy fields. Only an informed network of postsecondary schools and colleges can be expected to provide a graduate mix that will match the real needs of future energy and energy-related industries. (Author/PR)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF EDUCATION
BUREAU OF OCCUPATIONAL AND ADULT EDUCATION

PROGRAM MEMORANDUM -- BOAE (V) 75-5 DATE: December 16, 1974

SENT BY: Dr. Edwin L. Rumpf
Acting Director
Division of Vocational
and Technical Education

SENT TO: Executive Officers, State Boards for Vocational Education
State Directors of Community and Junior Colleges
State Directors of Vocational Education
Members, National Advisory Council on Vocational Education
Executive Directors and Chairmen, State Advisory Council
on Vocational Education
Regional Directors, OAE
VTE Program Officers
Headquarters Staff

SUBJECT: Postsecondary Technical Education and the Energy Crisis, a paper prepared in the Division of Vocational and Technical Education, BOAE

The attached paper may assist State and local vocational and technical education administrators and their staffs in relating the needs of energy manpower and energy shortages to the overall education concept, and in assessing the interrelationship of the various vocational and technical programs at the secondary, postsecondary, and adult levels as they relate to the energy crisis.

As a matter of interest, the writer was detailed from his position with the Division of Vocational and Technical Education to the Federal Energy Administration for a period of eight months beginning October 1, 1973. Since these were crucial months for the Nation's energy in general, the experience at FEA provided him with insights that are reflected in the paper.

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Attachment

POSTSECONDARY TECHNICAL EDUCATION AND THE ENERGY CRISIS

The effects of the 1973-1974 Arab states oil embargo were global. Americans were first shocked, then incensed at the prospect of queuing up in long lines on an odd-even license number basis for the privilege of purchasing for inflated prices limited amounts of fuel for gas-hungry cars. Although frustration and anger have since faded, the determination to reduce American dependence upon foreign oil imports persists. History tells us that "American ingenuity" is a force to be reckoned with. American ingenuity and determination opened the West, raised technology to the highest levels in the world, and put the first man on the moon.

Concern about a problem which affects virtually every wage earner in America cries out for involvement by vocational and technical educators. What are the implications of the shifting focus in energy occupations for vocational and technical education? First, attitudes must be changed from one of "What the hell--there's plenty more where that came from", to one of "Our supplies are limited, so let's conserve." To do this effectively, one must first understand the scope of the energy crisis; then, concerned educators have an important advocacy role to play.

Prepared by Dr. Albert J. Riendeau, Chief, Post Secondary and Adult Occupational Programs Branch, Division of Vocational and Technical Education, U.S. Office of Education, Washington, D.C. 20202

The Oil Embargo

It was in October 1973 that the Arab states placed an embargo on oil, setting into motion a chain of events which permanently changed the world as we knew it. Almost overnight, American motorists were forced to adjust their driving habits. They had to. In many parts of the country gasoline was hard to find. Then there were frequently long gas pump lines.

Reactions to the embargo were mixed. Some blamed the big oil companies, "Just another way to increase their profits." Others blamed government for being short-sighted. But after the initial shock, the reactions could be measured by the immediacy of the problem.

American industry is vast; fueling it is complex. With winter descending, an assessment of energy needs was made. Priorities were established so that crops could be harvested on time, and public transportation, hospitals, schools and other fuel-hungry institutions would not be forced to shut down. In retrospect, the mild winter of 1973-1974 experienced in most parts of the United States helped immeasurably during those energy-short months.

As the embargo continued, the price pressures which shortages usually cause created an opportunity for the Organization of Petroleum Exporting Countries (OPEC) to establish a price on export oil triple

that of the previous year. Every home in America felt the impact of that action.

Another dimension of the high cost of oil imports was its effect on other countries. America long ago accepted the fact that her citizens' welfare is inextricably bound up with that of the rest of the world. The United States' system of trade and payments with other countries has been carefully developed over the years; destroying this system would affect the welfare of every American. So even if the country could secure its energy position, insulating against the prices established by OPEC, the "One World" of Wendell Wilkie clearly is a reality; America unavoidably is part of that world.

. Project Independence Blueprint

Assessing the energy situation for the nation was a responsibility assigned to the Federal Energy Administration last year. Their report, called Project Independence Blueprint, cost approximately $10 million to develop, and was delivered to the President on November 1, 1974. It describes the United States' growing dependence on foreign sources of energy and suggests some positive programs designed to reduce America's vulnerability to future energy supply disruptions and price increases. Based upon task force studies and testimony given at ten public hearings held around the country by the FEA, Project Independence identifies American energy resources and suggests ways for reducing United States dependence upon foreign imports.

In a discussion of Project Independence on the television program, "Meet the Press", in August 1974, Secretary of the Interior Rogers C. Morton said: "Our economy, our way of life and our role in world affairs compel us to reduce our dependence on imported oil to a manageable level. We can only attain this goal by a vigorous balance and deliberate combination of energy conservation and resource development."

Oil is Changing Our Life Style

One thing appears certain: Americans, like it or not, are now face-to-face with a future in which frugality is becoming a life style. Other nations are observing this transformation with interest. And well they might, for with only five percent of the world's population, the United States "consumes nearly 40 percent of all the energy and minerals produced globally each year," reports U.S. News and World Report (December 9, 1974, p. 46). Armed with a variety of facts, figures and opinions, "ecologists, economists, and geologists are telling Congress and anyone else who will listen that the nation can no longer afford its lavish consumption habits," says U.S. News and World Report.

While oil seems to be bearing the main burden of the nation's thirst for more energy, other energy sources are assuming expanded roles with each passing month. Natural gas, coal, and nuclear power are important sources of our present energy, and they have tremendous potential for expansion. Coal producers, husbanding America 's most abundant energy resource attribute their failure

to expand during the past 20 years to competition of lower cost petroleum and gas, and to environmental considerations. Similarly, the construction of additional nuclear power plants has been delayed by environmental, economic, and technical problems. As a consequence, oil has been meeting an important share of America's energy demands.

It was inevitable that so heavy a reliance on oil, a limited natural resource at best, would lead to ever increasing needs for imports to supplement domestic supplies. The oil embargo highlighted the urgent need to stimulate domestic production of energy from other promising sources. A nation that could find the secret of splitting and harnessing the atom, of driving a car on the moon, could surely, through its science and technology, find unexploited energy materials and ways to recycle existing supplies. For man's survival over the years has not been wholly dependent on availability of raw materials or favorable climate, but rather on his ingenuity.

While a major effort and considerable lead time will be required to develop new, economically attractive, renewable, and environmentally acceptable sources of energy, there is reason for optimism. Alternatives in energy are available. Nuclear energy is here now. Energy from the sun and from geothermal heat are no longer considered pipe dreams. These promise clean, renewable sources of energy, as do the wind, the ocean temperature differentials, and the hydrogen in the sea.

. Coping with Time Lags

At this juncture, time is the all-important factor. It now takes seven to eight years from planning to completion of a nuclear plant in the United States. Underground coal mines take three to five years to open. Placing an offshore oil field in production can take five years or more from initial exploration. Large-scale recovery from oil-shale deposits in the western states is possibly a decade away, as is coal conversion to synthetic oil or gasification in quantity. Direct solar heating and cooling lack well-engineered, reasonably-priced systems before becoming generally accepted. In all of these developments, time is the crucial element.

Despite the time lags caused by environmental concerns, technical problems, late deliveries of specialized equipment and changes in regulatory procedures, progress is being made on most energy development fronts. Whatever the causes for delays in delivering new sources of energy, these should not include a shortage of skilled manpower. Our hope for reducing energy imports by stepping up production of our own rests largely upon American skilled manpower, our most valuable resource in time of need.

A recent study by the National Planning Association, Washington, D.C., points up the need to project future manpower demands in energy and energy-related industries so that the country's educational and training institutions can provide the mix of graduates to match future needs. While the study analyzes the demand for scientists and engineers in the area of energy supply, similar efforts should probe

the need for technicians and other skills required by the energy sector for all occupational categories.

The NPA study is based upon estimates by the National Petroleum Council of "maximum efforts" to develop domestic fuel sources by 1980 and 1985. The following table indicates the level of outputs for each of the energy sectors, and shows the projected imports for oil and gas for the same years.

Table 1

Energy Supply Trends Assuming Maximum Efforts to Develop Domestic Fuel Sources, 1970-1985

(Trillion BTUs /Year)

DOMESTIC SUPPLY	1970	1980	1985
Oil, all sources	21,048	28,229	34,656
Gas, all sources	22,388	27,464	35,214
Hydropower	2,677	3,240	3,320
Geothermal	7	782	1,395
Coal	13,062	21,200	27,100
Nuclear	240	11,349	29,810
Total domestic supply	59,422	92,264	131,495
IMPORTED SUPPLY	**1970**	**1980**	**1985**
Oil	7,455	12,258	7,547
Gas	950	3,900	5,900
Total imported supply	8,405	16,158	13,447

Source: National Petroleum Council, U.S. Energy Outlook, 1972.

According to Table 1, the demand for energy in America is quite likely to continue at or above the present rate for the foreseeable future. The present petroleum demand is between 15 and 16 million barrels per day, according to a report by the Federal Energy Administration.[1] The report also indicated that the U.S. Imports approximately four million barrels of crude oil per day, and two million barrels of finished products. Since the main objective is to "reduce our dependence on imported oil", Project Independence looks to the two options open for accomplishing such reduction: namely energy conservation and domestic resource development.

. Energy Conservation - Our First Hope

Reducing imports will call for cooperative participation at all levels of government and by people in all walks of life. What is called for is a blend of efforts. Conservation must become a way of life in America. Motorists and home owners, businesses and industries, schools and colleges -- all must be of one mind on the subject of energy conservation. How soon can more power plants be changed from oil to coal? Is public transportation or carpooling adequately encouraged for the community workforce? Is the auto industry shifting to gas economy cars fast enough?

In one of his earlier speeches President Ford said, "I ask each of you to apply our most abundant natural resource --American ingenuity-- toward including energy conservation in your life. The goal is not to change our

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[1]Federal Energy Administration Witness Statement before the Permanent Subcommittee on Investigations of the Government Operations Committee, October 16, 1974

standards of living, but to ensure that as we enjoy our American way of life, we are not wasteful and that we use our energy resources wisely. Each person has a part to play in this effort. I ask each of you to play your part."

According to the Federal Energy Administration, passenger automobiles consume about 31 percent of all the petroleum used in the United States. With an estimated one hundred million registered automobiles in the fifty states, each using approximately 700 gallons of gasoline per year, this appears to be a promising area on which to practice energy conservation. FEA's brochure, "30 Good Ways to Make Gas Go Further - DON'T BE FUELISH", points out that the difference between a careful driver and a poor one can be 50 percent better gas mileage. It also indicates that reducing fuel consumption of cars by only 15 percent would result in a saving of 28,000,000 gallons of petroleum per day.

Another area which draws heavily upon America's total energy is home heating. Estimates are that 13 percent of this country's total energy goes into home heating, "and much of the heat escapes through leaky windows and poorly insulated roofs," says TIME Magazine (November 18, 1974, p. 73).

Schools and Colleges Can Serve As Models

While serving as models for our children and youth by demonstrating good heating and cooling practices, classrooms, shops, and labs also are

ideally suited to carry on convincing experiments which illustrate the effectiveness of insulation and temperature control. Committed as they are to the concept of education for all children and youth, educators also share the awesome responsibility for an advocacy role to maintain the culture. Nor is this responsibility limited to elementary and secondary schools. In a recent address to the U.S. Office of Education staff on the occasion of American Education Week, Commissioner Terrel H. Bell predicted a "shift in the role, definition, and emphasis of our colleges and universities. They should have a better interface with the real world needs," he said.

The strain being placed upon American energy resources has grave implications for occupational education programs in schools and colleges, both public and private. "We could keep our institution busy if we only concentrated on training technicians for coping with the inefficiency of home heating systems," said Dick Pountney, Director of the West Side Institute of Technology (Cleveland) during the National Association of Trade and Technical Schools Public Relations Workshop in Washington on November 15, 1974. Modern technology calls for efficient, pollution-free home heating, but there is a shortage of technicians in this occupational area, according to Mr. Pountney. He made a study of the classified ads in a leading Cleveland newspaper for November 10, 1974 and found 1,760 job openings listed representing a broad range of jobs including some in home heating. Fourteen percent of them required some college, but 64 percent required a skill. Despite rising unemployment

in many parts of the nation, and particularly in the large cities, Pountney was of the opinion that demand exceeded the supply for home heating technicians "in every major city in America. Partly because of our close working relationship with the many industries of Greater Cleveland, and partly because of the focus on energy conservation, West Side Institute places 100 percent of its graduates on jobs," he reported.

Generalizing on the basis of the outputs of a single institution would of course be sheer folly. However, Mr. Andrew Korim of the American Association of Community and Junior Colleges, reinforces the Pountney report. "I have visited about two dozen community college campuses during the past several months," reported Mr. Korim, "and everywhere it's the same story. The trained auto mechanic, heating and air conditioning technicians, the power plant technicians and the many other technicians in occupational fields relating to energy production and maintenance seem to be in demand. And the busy occupational education programs on our campuses for training or upgrading technicians in the energy-type occupations reflect this demand."

Advocacy Roles of Schools and Colleges

What appears to be needed in schools and colleges at this moment in history is a bold, new approach for meeting the energy problem head-on. This calls for changing attitudes, where changes are indicated. Just as skiing enthusiasts of Idaho, Utah, Colorado and other skiing resort states suggest "think snow", educators must mount a "think energy" movement. Educators must assume the role of advocates by setting examples, by leading the way.

If the community colleges, technical institutes, trade and technical schools, and other two-year postsecondary institutions, both public and private, are to make their greatest contribution during this period of limited energy resources, they must not only help prepare the thousands of technicians and skilled persons for the energy fields, but they must assist in the process of changing attitudes. Faculty and students must somehow accept as "good" the idea of taking a bus or subway, or of forming carpools and doing more walking. Sticking to the 55-mile speed limit should be cheerfully accepted. At home they should turn off lights, T.V.'s and radios when not in use. Attics and windows should be insulated; doors kept closed. And health should be carefully guarded; sickness cuts productivity.

Machines and equipment must be maintained carefully -- "down times" for breakdowns and malfunctions are costly. In developing boilers and turbines that could withstand super-critical pressures as high as 4,500 pounds per square inch, or steam temperature at 1,150 degrees fahrenheit, NASA scientists recently reported a "screeching molecule" which sends warning signals at the point of stress just preceding the destruction point. At that precise moment a safety device removes the stress, thereby saving the unit and subsequent costly down time. Technology must search for other warning signals to prevent down times. Instrumentation courses in schools and colleges must continue to stress maximum safety and efficiency of industrial equipment.

Wharton County Junior College just outside of Houston reduced natural gas usage 77 percent, electricity 42 percent, and gasoline 87 percent "by simply being frugal," reported U.S. News and World Report, November 18, 1974. One area vocational school, technical institute or community college can't make much difference in terms of the nation's total energy consumption; 1,165 such institutions certainly can. How many educational institutions are trying "simply being frugal" with energy?

. Keeping Pace with Job Changes

Colleges must tune in the shifting job opportunities evolving as a direct result of the changing focus in the energy fields. The need for "retreading" engineers and technicians makes good sense when surpluses and shortages show up simultaneously in job markets. If engineers, for example, are to maintain productive careers on the leading edge of appropriate technologies, there will be a gradual shift of surplus engineers from such areas as aerospace and civil engineering to coal gasification, solar power, nuclear fusion, hydrogen, and other energy fields. The need for a better interface with the real world as suggested by U.S. Commissioner of Education, Bell, implies expansion of courses and studies in such promising fields as solar energy, electricity from solar thermal energy, solar cells which can convert light directly into electricity without moving parts, wind generation electricity, synthetic fuels, geothermal power, and a host of others.

. Examples of Alternative Energy

Some promising prototypes for powering various forms of transportation include the steam-powered bus developed by Lear Motors of Reno. A steam car by the same firm is soon to be introduced, according to inventor Lear. Another steam-powered car which is creating considerable excitement is the "Carter Steam 1" which was invented by a father and son engineering team, Jay Carter, Sr., and Jr., from Burkburnett, Texas. The prototype engine was designed to fit a Volkswagen Squareback. During its May, 1974, Environmental Protection Agency emissions control test cycle in Ann Arbor, Michigan, "it met the 1976 air quality standards without pollution control 'add-ons' of any kind," reported the American Motorist Magazine, October 1974 (p. 6). One of the advantages of the Carter Steam 1 is its multi-fuel capability for building up steam. It has operated on gasoline, kerosene, diesel fuel, jet fuel -- it has even operated on coal tar. Engine life is estimated at 500,000 miles. These are but two of several steam-powered cars, buses and various vehicles which have been making the headlines in recent months because of their promise for reducing gasoline consumption.

Even more far-fetched is the invention of Russell R. Brown of Harrisburg, Pennsylvania -- an engine that runs on air! "There's no fuel pump, no plugs, no carburetor, and no exhaust system such as we know," reported Brown to The National Tattler (March 10, 1974, p.25). "Its capable of powering cars, trucks, ships, aircraft and myriad other uses not even thought of yet."

The engine was described as "simple"; an electric power source is switched on to run an air compressor. When pressure is sufficient, the compressed air pushes the pistons and the electrical power source is shut off.

The flywheel, long considered an energy storing device by engineers, has also been attracting attention in the news media as a "superflywheel" capable of powering everything from zero emission commuter autos to cordless hand tools. The 70-passenger Oerlikon Electrogyro bus produced in Switzerland in the early 1950's is an example of flywheel powered transportation. Several models of the Oerlikon remained in service in Switzerland and in South Africa for 17 years. What limited the bus was the inefficiency of its flywheel which took as much as two minutes to be brought up to its maximum speed of 3,000 rpm. This can be translated into 800 feet per second or about 550 mph -- for the flywheel, not the bus. The speed of the flywheel is important, for the faster it spins the more energy it stores. The superflywheel would be supersonic. Numerous other energy prototypes are being tested or are in various stages of development.

These and other energy sources may be here sooner than is widely recognized. For example, among the conclusions in the National Aeronautics and Space Administration-National Science Foundation 1974 Solar Energy Panel report, "Solar Energy as a National Energy Resource," is the following: "If solar development programs are successful, building heating could reach public use within five years, building cooling in six to ten years, synthetic fuels from organic materials in five to eight

years, and electricity production in ten to fifteen years." Several of the panel members felt that the new energy sources could be ready even earlier.

. Possible Impacts of Changing Energy Sources

Consider the impact on technician manpower of one of the above programs, that of home solar heating. If only 20 percent of all new home starts in five years installed solar heating, the home construction industry would be revolutionized. And if a national effort were mounted to convert 20 percent of all existing homes to solar heating and cooling by 1985, the need for solar heating and cooling technicians in this country would be staggering!

The American automobile, long considered a costly luxury with its long wheel base, super deluxe interior, and gas-guzzling hi-powered engine, has also been accused of polluting the nation's air. Visitors from England, Europe, and the Orient wonder aloud why American cars, frequently carrying only the driver, "have to be so bloody big." Bigness in autos equates with high fuel consumption. If the American economy cars can serve the same purpose on less "petrol", why not switch? And what effect would such a switch have on total gasoline imports?

About the time battle lines formed against the American car, along came the LaForce brothers from Vermont with an invention modification for the standard automobile engine which is purported to dramatically increase gas mileage. The inventors claim "we can get to a hundred miles a gallon real quick" with additional refinement. In addition, the LaForce engine reportedly gave off very little pollution, according