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Energy Education Begins with Teacher Education

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Introduction

Since 1973 the price of imported crude oil has escalated from $3.00 a barrel (42 gallons) to an average of over $35 a barrel in 1981. Our national bill for imported oil in 1970 was $3 billion, whereas our current expenditure for imported oil exceeds $81 billion. Within this same time period U.S. crude oil imports more than doubled, while import costs increased twenty-seven fold. This astronomic increase in crude oil prices has helped to reduce the value of American dollars abroad and has served to exacerbate recession and inflation at home.

Iowa's economy has been particularly hard hit as record crops result in lower market prices, which are in turn coupled with increased operating costs due to higher prices for fuel and electricity. At the national level, a vivid example of the effect of rising energy costs is reflected in the more than $1.7 billion electric bill which the U.S. Government incurred in 1980. It would take nearly all (95%) of Iowa's 1979 record corn crop cash receipts to pay this electric bill.

A positive aspect of soaring crude oil prices is that they have served to awaken the public to our overwhelming reliance on oil and to the fact that oil is a finite resource. In 1980 oil consumption actually declined. Oil imports were reduced by nearly 20% as a result of conservation efforts primarily enacted in response to rising costs. Many now agree that the quickest and most effective measure in combating dependence on foreign oil and to "buy" time in order to develop alternate energy resources is through conservation — using less.

Schools can and should play a major role in educating today's youth to the facts behind our energy situation, on how lifestyles and energy are interrelated and to the importance of developing and practicing an energy conservation ethic. In order to meet this challenge, teachers at all levels need to be cognizant of our energy situation, of basic energy concepts and technologies, and of methods and materials for incorporating energy topics into their classrooms. Toward this end a series of K-12 energy education workshops were held during June and July, 1981. Over fifty teachers throughout Iowa participated in four 3-day workshops in central and eastern Iowa. The workshops were co-sponsored by The University of Iowa, The Department of Public Instruction, area education agencies, and Energy and Man's Environment (a non-profit

organization). The workshops were designed to be interactive and informative, providing teachers with energy material ready for classroom use. As will be shown later in a summary of the workshops' evaluations, teacher participants viewed these workshops as being very beneficial.

Field trip experiences included visits to coal-fired power plants, homes, and businesses using passive solar heating, earth-sheltered homes, wind generator research facilities, and utility companies. These field experiences provided teachers with a first-hand look at how natural resources are converted to useful energy, a view of some practices currently employed to conserve energy in homes and businesses, and some current research designs and problems in developing energy alternatives. In addition, an awareness of energy-related careers was made possible through these field experiences.

A section of each workshop focused on the use of the *EME-Energy Simulator*.* The *Energy Simulator* is a programmed unit which allows the users to manipulate several variables relating to energy consumption while observing the consequent rate of resource depletion. Some of these variables include: rate of population growth, conservation measures, types of energy produced, amount of energy produced, amount of energy consumed for various purposes (i.e., transportation, research and development, domestic, industrial, agricultural, etc.), and environmental factors. The simulation begins and as time ticks on — population increases, finite resources dwindle, and environmental degradation may result as a consequence of heavy reliance on certain resources as others are depleted. The first few runs of the simulation generally do not extend very far into the future before finite resources run out. However, with some practice, the variables may be manipulated to successfully survive further into the future. The *Simulator* provides users with the opportunity to see graphically how physical variables affect the rate of energy consumption. The population growth rate as an overriding factor in the rate of consumption becomes very evident. It also becomes apparent that money and energy need to be placed into the arena of research and development of alternate energy technologies. In addition, it is apparent that we must incorporate conservation practices to allow time for the development and implementation of these technologies. Many questions are raised and discussions are generated which enhances not only concept formation but can facilitate values clarification.

Various energy alternatives were discussed during the workshops with a significant amount of time being spent on solar energy. Slide presentations illustrated passive and active technologies and demonstrated their applications in home use. Opportunities were provided for the construction of solar ovens and dryers. The use of the solar ovens

*The *Energy Simulator* is available for one week classroom use. For further information, contact Duane Toomsen, Curriculum Division, Iowa Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa, 50319, or call 515-281-3146.

and dryers was deliciously demonstrated by preparing a solar lunch (Fig. 1) in which a roast was cooked in a solar oven and fruits were dried in solar dryers. The participants were not only treated to a fantastic solar-cooked meal; they were also able to observe how the ovens and dryers are constructed and operate (Fig. 1). It was incredible to observe a 10-pound roast cook in a couple of hours with sunlight providing the sole source of heat. Temperatures within the oven reached over 350° Fahrenheit.

Fig. 1. Duane Toomsen warming buns in a solar oven.

Philosophy

The underlying supposition for the workshops was that if teachers are provided with basic energy information, are allowed to interact with and obtain energy curriculum materials, in addition to constructing activities and equipment for classroom use, they will feel confident and enthusiastic about infusing energy topics into their classrooms. By organizing the workshops around this supposition it was felt that the primary goal of increasing teachers' awareness and knowledge about energy, allowing them to contribute to the development of a more energy literate society, and to instill a conservation ethic in their students, could be met.

The methods of achieving this goal included:

a) providing up-to-date information regarding national and state energy problems;
b) providing a basic understanding of energy technologies;
c) providing participants with energy education curriculum materials;

d) sharing teaching strategies for energy education;
e) experiencing practical energy activities that could be used by students in the classroom;
f) experiencing field activities involving energy producers and actual technological applications; and
g) developing an awareness of career opportunities in energy-related industries.

Content

The specific content of each of the four workshops was somewhat different depending on the expertise of the staff, the area personnel utilized, available field trip sites, and the composition of the participants with regard to grade level. Some of the activities common to all of the workshops are presented below.

Curriculum programs introduced and provided for the teachers included: *Energy Conservation Activity Packets (ECAP'S), Iowa Developed Energy Activity Sampler (IDEAS), Energy and Man's Environment (EME),* and *Project for an Energy Enriched Curriculum (PEEC) – ECAP's* (K-6) and *IDEAS* (7-12) were developed in Iowa under the sponsorship of the Iowa Energy Policy Council in cooperation with the Iowa Department of Public Instruction. The underlying theme for all of the energy curriculum materials presented is that energy education is multidisciplinary and should be infused into the existing curriculum structure as opposed to being added as a separate discipline or subject. An overview of the development, major concepts, student skill, grade levels, and teaching strategies was presented for each curriculum. Teachers reviewed the materials and, in most cases, participated in representative activities from each. One of the few times in which participants were grouped by grade level was during the presentations of curriculum materials. Upon completion of the workshop, the curriculum materials were given to the teachers for use in their classrooms.

One of the most popular components of the workshops was the "Make'N'Take" sessions. These sessions provided teachers with hands-on experience in constructing energy learning centers and games. The finished product from these sessions consisted of one to several learning centers, activities, or games which were ready for classroom use.

Summary of Evaluations

The following (Table 1) is a composite summary of the workshop evaluations which were completed by the participants at the conclusion of each workshop. The following scale was used to rate both individual workshop sessions and the overall workshop: 1 = low and 5 = high.

Table 1. Workshop Evaluations

Workshops (N = 6)	Mean for all Participants N = 46
Presentation of Curriculum Materials	4.3
Field Experiences	4.3
EME-Energy Simulator	4.6
Make-N-Take	4.8
Solar Lunch	4.9
Workshop Facilities	4.8
Overall Workshop	4.6

All participants felt that their own objectives for the workshop had been fulfilled, while the majority of participants felt they had gained more knowledge concerning energy and had received many useful materials as well as ideas for use in their classrooms. Most participants indicated that at the end of the workshop they felt more confident in discussing energy topics, in using energy materials, and in infusing energy topics into their classes. Most of the teachers indicated that it was one of the best workshops they had ever attended. Participant suggestions for improvement included: (1) workshop should be longer; (2) need more Make-N-Take for secondary level; and (3) need more information on energy alternatives.

Conclusion

As shown in the above summary of workshop evaluations and by comments made by the participants, this type of energy workshop is desired by teachers and could be very successful. Perhaps foremost in importance is the fact that teachers perceived the workshops as being of practical use to them in their own teaching endeavors. It was very gratifying to witness an exchange of ideas among teachers from all grade levels and from various subject matter disciplines. Based on discussions and individual teacher projects, we are confident that the workshop participants will not only infuse energy curriculum materials into their classroom, but will also encourage their colleagues to do the same.

We are planning for a series of similar energy workshops to be held during the summer of 1982. The major change will be lengthening the workshops to four or five days in duration to accommodate time for more information on energy alternatives and Make-N-Take sessions.

References

Energy and Man's Environment (EME): Grimes, D. and Altig, D., Editors, Energy and Man's Environment, 1979.

Energy Conservation Activity Packets (ECAP's): Iowa Energy Policy Council and Iowa Department of Public Instruction, 1979.

Iowa Developed Energy Activity Sampler (IDEAS): Doris Simonis, Editor, Iowa Energy Policy Council and Iowa Department of Public Instruction, 1980.

National Geographic: "Energy — Facing Up to the Problem, Getting Down to Solutions," February, 1981.

Project for an Energy Enriched Curriculum (PEEC): Department of Energy/National Science Teachers Association, 1979.

NSTA Regional Conventions

The Knoxville, Texas convention will be held Oct. 21-23, 1982, and its theme is *Energy, Excellence, Education: Societal Issues.*

The Saskatoon, Saskatchewan convention will be held Nov. 11-13, 1982, and its theme is *Science for Society: What and Why.*

Consultation

The Iowa Academy of Science has set up a Panel of scientists charged with helping communities, parent groups, school boards, administrators, supervisors, and teachers deal with issues arising from science-related controversies, including creation-evolution. The Panel neither seeks nor enters into confrontations. Its aim is to defuse, on the basis of good science and with fairness and consideration to all, any controversies or confrontations that may arise.

Any one concerned with such potential problems is invited to consult the Panel. The contact person, whom you can reach by mail or phone, is: Stan Weinberg, Coordinator, IAS Panel on Controversial Issues, 156 East Alta Vista, Ottumwa IA 52501 (515) 682-7321.

The Panel will arrange for a team of its scientists to meet with you privately, and will seek to help resolve the problem. Neither DPI nor any other agency will be informed of the consultation, unless you wish this information made public. Should the need arise, we urge you to seek this confidential help.

A Fable for Everyone

This story is about four people: Everybody, Somebody, Anybody, and Nobody. There was an important job to be done and Everybody was asked to do it. Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that because it was Everybody's job. Everybody thought Anybody could do it, and Nobody realized that Everybody wouldn't do it. It ended up that Everybody blamed Somebody, when actually Nobody blamed Anybody. Does this sound familiar?

SPORE 15(1):5