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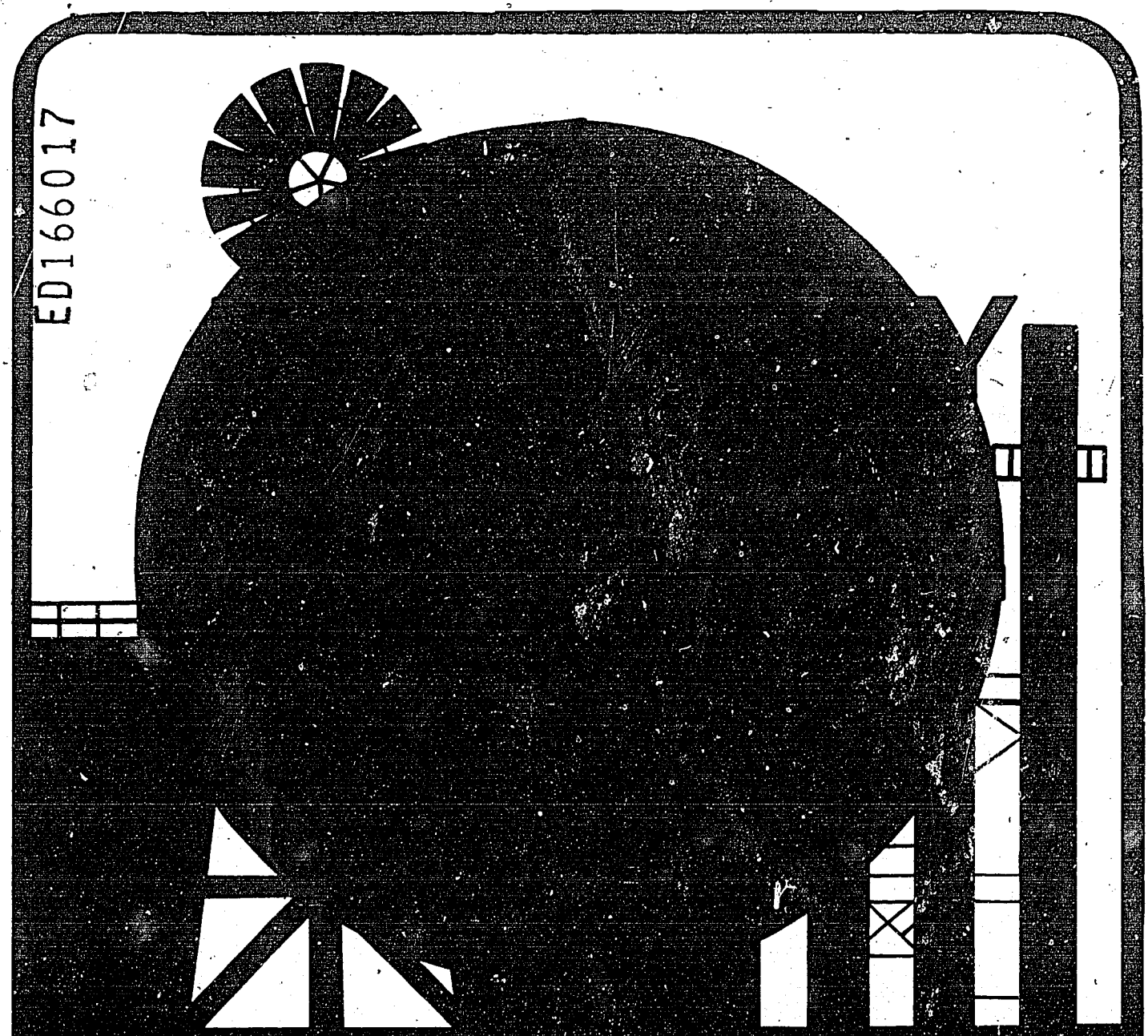
ABSTRACT

This is a national assessment of energy awareness among young adults. A national probability sample of young adults, ages 26 to 35, was drawn and stratified by region and community size. Approximately 1,300 persons responded to each of the 76 attitudinal and 70 knowledge questions administered by trained energy assessment interviewers. Besides the standard demographic information, each participant was asked to respond to the energy assessment items in the appropriate booklet. The discussion centers upon national results. Group results are also presented according to race, sex, total household income, family size, education, etc. The first two chapters present the results while the third chapter presents the analysis of these results. (MR)



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The cost figure cited above represents the total amount of money expended since late 1973 on assessments in art, career and occupational development, reading, writing, social studies/citizenship, science, basic life skills, mathematics and consumerism, resulting, to date, in numerous reports, papers, articles, presentations and assessment materials, many of which are used in state and local assessment programs. A complete list of all such materials is available upon request.

ENERGY

Knowledge and Attitudes

A NATIONAL ASSESSMENT OF ENERGY AWARENESS AMONG YOUNG ADULTS

Report No. 08-E-01

by the
National Assessment of Educational Progress

Education Commission of the States
Suite 700, 1860 Lincoln Street
Denver, Colorado 80295

December 1978

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Roy H. Forbes
Director

INTRODUCTION

Developmental History

Over the past nine years the National Assessment of Educational Progress (NAEP) has gathered and reported information, through yearly surveys, on the knowledge, skills and attitudes of American 9-year-olds, 13-year-olds, 17-year-olds and young adults, ages 26 to 35. Currently, 10 learning areas are assessed: art, career and occupational development, citizenship, literature, mathematics, music, reading, science, social studies and writing.

While the energy assessment was not one of the original assessment areas, its development is in line with NAEP's goal to provide the public with information about education concerns relevant to contemporary social issues. Problems with energy use and energy availability reached crisis proportions during the oil embargo of five years ago. Americans have been forced to consider energy issues because of increasing costs and the sudden recognition that certain vital resources in our country are being severely depleted. Energy problems have obvious implications for government, for business and commerce and for foreign policy — but they impinge on individuals and their current lifestyles as well. Since the solutions to these problems depend heavily on the knowledge and attitudes of an informed citizenry, the energy assessment seemed to be a most useful undertaking.

Prior to the administration of the survey, National Assessment staff and many individuals who have expertise in energy-related areas[1] identified some of the goals and objectives of energy education. After questions were developed, they were reviewed by scientists, science educators and energy experts around the country. The survey was then administered to a sample of American adults during the summer of 1977.

Seventy knowledge questions and 76 attitudinal questions were administered in the energy assessment.[2] The questions measuring knowledge were categorized in three major areas: (1) basic energy facts, (2) general energy issues and (3) energy conservation. The questions measuring attitudes were categorized in four major areas: (1) feelings about the seriousness of energy problems, (2) belief in the effectiveness of personal action, (3) feelings toward environmental hazards and (4) feelings toward energy trade offs.

The reader should keep in mind the limitations of attitudinal measurements. Such measures rely upon the reports of individuals, so they are *indirect* measures from which attitudes are inferred. National Assessment reports either the positive or negative direction of the majority of responses, but does not claim that either direction is necessarily "correct" or "incorrect." In addition, the reader is asked to remember that in the case of a current topic such as energy, attitudes are influenced by the events occurring at the time attitudinal data are gathered. Although data gathered from respondents may strongly indicate that they hold particular attitudes, their feelings may change rapidly. Consequently, the results of attitudinal measures presented in this report should be considered in the context of the events that occurred during the summer of 1977.

[1] See Appendix A for a list of the consultants who participated in various developmental phases of the energy assessment.

[2] See Appendix B for a complete index of the energy questions found in this report.

The Sample

National Assessment drew a national probability sample of young adults (ages 26 to 35) born between January 1941 and December 1950. This sample was stratified by region and community size. Approximately 1,300 adults responded to each question in the energy assessment. Characteristics of this sample are described in Appendix C.

Administration

The assessment was administered by trained interviewers. Each adult was given a test booklet and a background questionnaire related to education, income and sources used to gain information on energy. Each respondent read the questions and recorded his or her answers in the appropriate booklet. While the estimated completion time for the test booklet was set at 45 minutes, respondents were asked to work until they had completed all the questions. Those who completed the energy booklet were compensated for their time.

Reporting the Results

The emphasis throughout most of this report is on the national results for 127 individual questions. Group results are also presented, according to sex, race, total household income, community size, education and age. Differences between group and national results are discussed only when the results appear to be significantly higher or lower than the national percentages of correct responses. Only those differences that are statistically significant at the .05 level are discussed. This means, statistically, that we are 95% confident that these differences are real and not a chance artifact of the survey design or the sample. Group results on the knowledge questions are discussed in Chapter 1. Group results on the attitudinal questions are displayed in Tables D-1 through D-7 in Appendix D. Significant differences are indicated by an asterisk on these tables.

Chapters 1 and 2 of this report are organized generally around the thematic areas reflected in the knowledge and attitudinal questions. The data in Chapters 1 and 2 are estimates of the percentages of individuals in a given group who could answer specific questions correctly. For example, when we say that "85% of the adults gave a correct response," we mean that 85% is an estimate of the proportion of all adults ages 26 to 35 in the country who would have answered correctly, based upon the weighted performance of our sample group. (All the percentages in the text of this report have been rounded up or down to the nearest percent — e.g., 84.2% is shown as 84%; 84.7% as 85%.)

National Assessment does not make interpretive comments about the data it collects, relying instead upon the comments of outside experts in the field. Chapter 3, "What Does It All Mean?" contains the opinions of four experts in the energy field about the implications of these data for energy education.

Reporting Groups Defined

National Assessment, unlike most testing programs, does not report scores for individuals. Rather, NAEP reports how defined *groups* of people respond to certain questions. Definitions of the groups discussed in this report are presented below.

Sex

Results are presented for males and females.

M = Males
F = Females

Race

Respondents were classified as white, black or other on the basis of visual observation by the interviewer. Results are given separately for whites and blacks. The number of respon-

dents classified as "other" was too small to produce reliable results.

W = Whites
B = Blacks

Community Size

Size-of-community categories were based upon the populations of the communities in which the respondents being assessed were located.

BC-UF = Big cities and urban fringes, communities with a population greater than 200,000.
MC-SP = Medium cities and smaller places, communities with a population less than 200,000.

Age

The young adults ranged in age between 26 and 35 years.

26—30 = 26- to 30-year-old adults.
31—35 = 31- to 35-year-old adults.

Income

Young adults were asked their total household income in 1976 before taxes and deductions. Total household income was classified into three groups. Results are given separately for young adults who reported incomes of below $8,000, between $8,000 and $14,999, and $15,000 and above.

Below $8,000 = Young adults who reported a total household income below $8,000.
$8,000—14,999 = Young adults who reported a total household income between $8,000 and $14,999.
$15,000 and above = Young adults who reported a total household income of $15,000 and above.

Education

Young adults were asked their highest education levels attained. Respondents were classified into three groups. For purposes of definition, *high school* refers to grades 9 through 12.

NGHS = Young adults who reported they had not graduated from high school.
GHS = Young adults who reported they had graduated from high school, but had no formal education beyond high school.
PHS = Young adults who reported they had some formal education beyond high school that may have included business, professional or trade school training as well as college or university training.

CHAPTER 1

WHAT DO YOUNG ADULTS KNOW ABOUT ENERGY FACTS, ISSUES AND CONSERVATION?

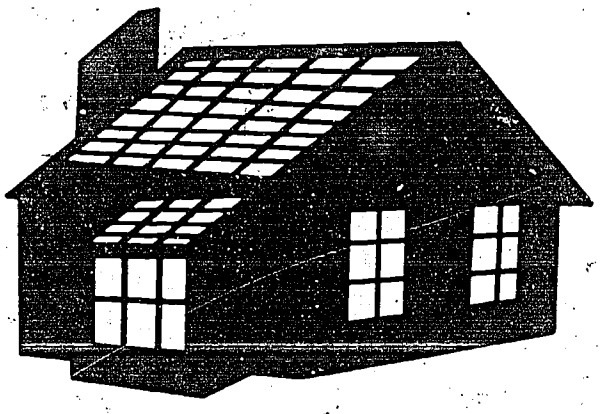
Highlights of the Results

- *Half of America's young adults mistakenly believed that improved technology will eventually make it possible to convert to useful work all of the energy released by burning a fuel.*
- *Less than half (49%) of the young adults knew that coal is the largest fossil fuel reserve in the United States.*
- *Only 14% of the young adults knew that coal is the primary energy source used to produce the largest portion of the nation's electrical energy.*
- *Only 16% of the young adults knew that coal, as well as petroleum, can be converted to gasoline.*
- *Less than half (46%) of America's young adults knew that petroleum (crude oil) provides the largest percentage of energy consumed in the United States.*
- *Half of the young adults knew that from 30 to 60% of the oil consumed by Americans is imported from foreign countries.*
- *Seventy percent of the young adults knew that the United States is likely to run out of petroleum before it runs out of coal.*

America, with 6% of the world's population, consumes about 30% of the world's available energy — more than West Germany, Japan, Great Britain and the Soviet Union combined. The average American citizen consumes, on the average, seven times the energy of other world citizens.[1]

What does this citizen know about the energy that he or she takes for granted? In order to explore the knowledge of young adults about various aspects of the energy problem, National Assessment's energy probe included questions about (1) energy facts, (2) issues confronting American citizens and (3) conservation techniques. Within these broad categories were such topics as energy demand and supply, energy use in various sectors of society, processes of energy conversion, major potential sources of energy, and social and environmental implications stemming from the current energy dilemma.

[1] *Energy Conservation in the Home*, U.S. Department of Energy (Knoxville, Tenn.: University of Tennessee, October 1977), p. 21.



What Do Young Adults Know About Basic Energy Facts?

Knowledge of some basic energy facts provides a context for understanding the scope and depth of America's energy problems. So National Assessment asked questions concerning potential sources of energy, energy reserves, and energy conversion and production. Results were mixed:

- Sixty-seven percent knew that solar energy is the largest potential source of energy.
- Seventy-nine percent knew that petroleum is the largest export from the Middle East.
- Seventy percent knew that the United States is likely to run out of petroleum before it runs out of coal.
- Only 16% knew that coal, as well as petroleum, can be converted to gasoline.

Any discussion of the energy problems besetting America sooner or later moves to the pros and cons of nuclear power. Nuclear power is a relatively new contributor to our society's total energy needs; the first commercial nuclear plant was operable in 1957, and there are now 68 such plants around the country. Together, they supply about 13% of the nation's electrical energy needs. However, proponents of nuclear power expect that conventional nuclear reactors can produce as much as 20% of our electrical energy by 1985.[2] Nevertheless, as Table 1 shows, the conversion process underlying the conventional nuclear reactor is little understood by young adults in this country.

Conversion is the act of changing energy from one form to another. Conventional nuclear reactors employ fission in the conversion process by splitting the nucleus of the

[2] John M. Fowler, "Conventional Reactors," Fact Sheet 12 (Washington, D.C.: National Science Teachers Association), p. 1.

TABLE 1. National Percentages of Responses: "Which Nuclear Process Matches Each Characteristic Listed?"

	Only Fusion	Only Fission	Both	Neither	I Don't Know
Used now as a means of generating power for useful purposes	9.2%	15.7%	10.5%	2.2%	62.3%†
Created by splitting atomic nuclei	9.5	28.9	6.1	1.9	53.3
Can create radioactive waste by-products	8.0	12.1	14.9	2.8	61.9

†Rows might not total 100% because of rounding and/or nonresponse.

isotope uranium 235 into two parts, releasing a large amount of energy. Technically, fission is a reaction that occurs when a heavy nucleus is *split* into two lighter nuclei. On the other hand, fusion is a reaction that occurs when two lighter nuclei are *combined* to release a large amount of energy. Although the fusion reaction has been demonstrated and studied for some 45 years, the only man-made, self-sustaining fusion reaction has been the explosion of the hydrogen bomb.[3] At present, there are no fusion reactors in operation anywhere.

The percentages of young adults who knew the correct answers to each question above were small. Furthermore, only 17% of the young adults correctly answered at least two parts of the question. These findings suggest that the typical American citizen has rather limited knowledge of nuclear power.

When young adults were queried about units of measuring energy, performance was generally high — except in the case of the acronym BTU. BTU (British Thermal Unit) is an engineering unit of heat energy used to designate the amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit. Some of the responses to energy measurement questions were:

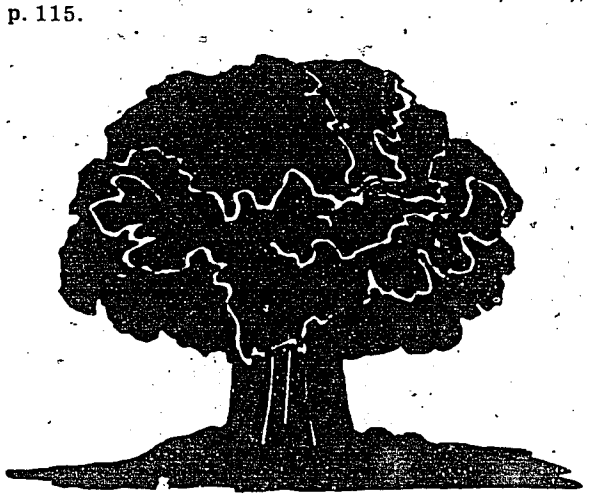
- Seventy-five percent of the young adults knew that electricity is measured in kilowatt hours.
- Eighty-four percent knew that the rate at which a light bulb uses electrical energy is expressed as watts.
- Ninety percent knew that the energy content of food is expressed as calories.
- Fifty percent knew that the heating value per pound of coal is expressed as a BTU or Calorie.

[3]John M. Fowler, "Nuclear Fusion," Fact Sheet 14 (Washington, D.C.: National Science Teachers Association), p. 1.

America's major energy sources are water, uranium and the fossil fuels coal, oil and natural gas. Economically recoverable reserves of the fossil fuels are limited, and reserves of oil and natural gas are already severely depleted. Our largest reserve fossil fuel is, of course, coal. Experts estimate that our known reserve of coal is about 400 billion tons.[4] Several National Assessment questions probed adults' knowledge about the fossil fuels. Results were among the following:

- Less than half (49%) knew that coal is the largest fossil fuel reserve in the United States.
- Selecting from a list of by-products that included glass, plastic, nylon, ammonia fertilizer and asphalt, only 29% of the young adults knew that glass does not use a fossil fuel as a raw material. Six percent responded that plastic was the correct choice; 9% responded nylon; 12% responded ammonia fertilizer; 4% responded asphalt; and 40% responded "I don't know" to the question. All of the by-products in this group, except glass, can be produced from petroleum.
- Only 14% knew that coal is the primary energy source used to produce the largest portion of our electrical energy.

[4]*Energy-Environment Source Book* (Washington, D.C.: National Science Teachers Association, 1975), p. 115.



Thirty percent of the young adults believed that falling water is the primary source of electricity, while 8% responded nuclear energy, 19% responded oil, 12% responded natural gas and 17% indicated that they did not know.

One challenge associated with the selection of energy sources is the loss of useful energy during a conversion. In order to clarify our conception of energy, scientists usually describe energy in terms of two forms: kinetic and potential. Energy in kinetic form is motion, heat or light; it is on the move, and we are able to use it. Potential energy is stored energy. John Fowler has discussed these two forms of energy in the following manner to illustrate the distinctions between them:

> When we have heat, or light (or the other forms of radiation: radio, x-rays, ultraviolet, etc.), or motion, we have energy in action. Whenever we have something, such as a lump of coal, a battery or a piece of uranium that can ultimately provide us with heat, light or motion, we know that energy is stored in that something.[5]

The most common challenge for scientists and engineers, therefore, is to convert the potential energy of a primary fuel — coal, oil, uranium, for example — to a kinetic form so that it can be used. But there are other primary energy sources that are already in kinetic forms; solar energy, tidal energy and geothermal energy are examples. They too, in most cases, must be converted to a more usable form. In all of these conversions, some energy becomes less useful and is thus *lost* for all intents and purposes.

This loss is particularly serious in heat-emitting engines, such as the gasoline-powered engine or the steam turbine in a power plant. No engine can ever be 100% efficient, and engines that generate considerable heat will always be limited to much lower efficiencies. This inefficiency is assured by laws of physics. Thus, the proposition "Improved technology will eventually make it possible to convert to useful work all of the energy released by burning a fuel" is false. Fifty percent of the young adults responded optimistically and incorrectly that it is true, 32% correctly labeled it false and 18% responded that they did not know.

When asked which of four sectors of our society — industrial, transportation, commercial or residential — consumes the largest portion of the nation's total energy, 52% of the young adults correctly chose industry. In fact, in 1973 the industrial sector of our society consumed 41% of all the energy consumed by the nation as a whole. Twenty percent was consumed in transportation, 24% in the residential sector and the remaining 10% in commercial enterprise.[6] In 1977, the corresponding percentages were: industrial, 37%; transportation, 26%; residential plus commercial, 37%.

Another question polled young adults' knowledge of the possible contribution by five energy sources — solar energy, the tides, Alaskan oil (still considered a future source at

[5] Ibid., p. 103.

[6] Ibid., p. 3.

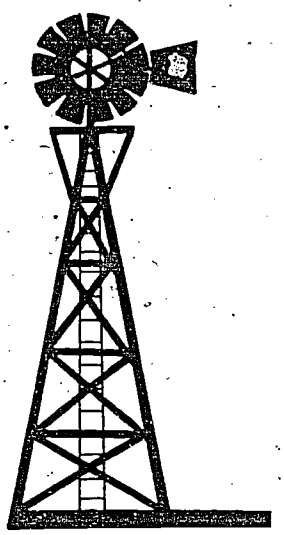


TABLE 2. National Percentages of Responses:
"Sources That May Contribute to Nation's Energy Needs by 1985"

	Less Than 1/3††	Between 1/3 and 2/3	More Than 2/3	I Don't Know
Solar energy	38.8%	31.9%	10.5%	18.7%†
Tides	43.2	8.2	3.0	44.9
Geothermal energy	32.0	13.0	3.8	50.9
Alaskan oil	34.2	32.1	13.9	19.2
Wind	53.5	9.6	2.9	33.7

†Rows might not total 100% because of rounding and/or nonresponse.
††Correct response.

the time of the NAEP assessment), geothermal energy and the wind — to the nation's energy needs that could be made by 1985 (Table 2).

Energy experts tend to agree that solar energy, tides, geothermal energy and wind require more comprehensive research and technology before they can make a significant contribution to the nation's energy needs. By 1985, any one of these sources might be capable of supplying, at most, less than one-third of the nation's energy needs. The percentage of people who did not know this was substantial.

The time required from start-up to production at various energy sites is another consideration in the energy sources area. Young adults were asked about the start-up time required for five energy sites: underground coal mines, oil refineries, oil fields, nuclear power plants and coal-fired power plants. Selecting from several time periods (6 months, 1 year, 5 years, 10 years or 20 years), few young adults responded correctly:

- Only 14% knew that underground coal mines require about five years from start-up to production.
- Only 28% knew that oil refineries require about five years from start-up to production.
- Only 15% knew that oil fields require about five years from start-up to production.
- Only 17% knew that nuclear power plants require about 10 years from start-up to production.
- Only 25% knew that coal-fired power plants require from 5 to 10 years from start-up to production.

In addition, only 14% of the young adults correctly responded to at least three parts of the question. Together, these findings suggest that public knowledge about the time required for making an energy site operable and productive is rather low.

What Do Young Adults Know About General Energy Issues?

America's demand for energy exceeds its long-term energy supply. Currently, much of our demand is met by oil, which accounts for 49% of our total energy consumption. Natural gas accounts for 26%, coal for 19% and hydropower and nuclear power for the remaining 6%.[7] Since 1970, the rate at which

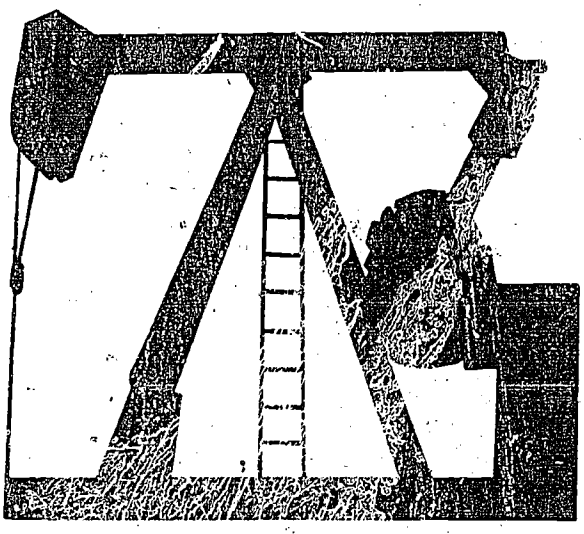
[7] *Monthly Energy Review*, Vol. II (July 1978). Energy Information Administration, Annual Report to Congress.

we have imported oil for domestic use has increased steadily. For instance, in 1972 the United States imported 19% of the total crude oil it consumed. In 1973, 26% was imported, and by 1977, 45% of all crude oil consumed in the United States was imported.[8]

Young adults responded to National Assessment's questions concerning America's supplies of and demands for oil with the following results:

- Less than half (46%) knew that crude oil provides the largest percentage of energy consumed in the United States.
- Exactly half knew that from 30 to 60% of the oil consumed by Americans is imported from foreign countries.

Young adults' understanding of the consequences of the rate of consumption in the lifetime of this country's oil resources was also probed. The lifetime, of course, depends on how much oil is eventually found. Since the United States in 1977 could count on about 60 billion barrels of reserves (oil that was already discovered),[9] the supplies will certainly last longer than 10 years. It is also apparent that discovered or undiscovered supplies will not last, at present rates of consumption, longer than 150 years. Thirty



percent of the young adults correctly responded that the United States has 50 to 150 years of oil supply remaining, but 28% mistakenly responded 10 years, 1% responded 300 years and 41% said that they did not know.

Although America has only 6% of the world's total population, Americans consume about 30% of the world's available energy. Only 34% of the young adults in the country appear to be aware of this, while nearly one-third (30%) indicated they did not know the relationship between our population and the amount of energy consumed in the United States. However, the majority of young adults do appear to realize that Americans' energy usage is growing faster than population size. Table 3 shows the national percentages of

[8] Ibid.

[9] Energy Information Administration, Annual Report to Congress, Vol. II (1978).

TABLE 3. National Percentages of Responses:
"Growth in Energy Use Compared With Rate of Population Growth"

Growth in Use Between 1960 and 1970	Greater Than Population††	Less Than Population	About the Same as Population	I Don't Know
Electrical energy	56.5%	9.3%	10.9%	23.1%†
Coal	12.1	53.8	10.7	23.2
Oil	65.5	5.6	10.3	18.4
Natural gas	58.8	8.9	12.7	19.5

†Rows might not total 100% because of rounding and/or nonresponse.
††Correct response.

responses to a question about the growth in use of certain types of energy compared with population growth in the United States between 1960 and 1970.

Very few people (12%) knew that the 1960—70 increase in the use of coal was greater than population growth for that period. Most people (54%) mistakenly thought that the use of coal grew less rapidly than population growth.

National Assessment's energy survey also included a group of questions designed to probe the knowledge of young adults about energy sources and environmental pollution. Results were:

- Some people (24%) realized that *waste heat* is emitted by nuclear power plants as well as by fossil fuel plants, but many (47%) did not know this fact.
- Some people (30%) were aware that the *sulfur* content of coal deposited in the Western United States is less than that of coal found in the Eastern United States; almost 50% did not know this fact.
- The majority (95%) knew that automobile emissions contribute heavily to *air pollution*, while 45% knew that solar collectors are not associated with air, water or heat pollution. More than three-quarters (76%) knew that oil tankers can contribute to *water pollution*.

On a series of National Assessment questions designed to explore general knowledge about federal monies used for research and development, ownership of power plants and terms associated with the energy problem, responses by young adults were varied. For example:

- Five out of 10 people knew that the federal government has allocated more funds to *nuclear* research and development than to coal, petroleum, solar, wind or hydroelectric research and development during the past 20 years.
- Seven out of 10 people knew that during the past 25 years the federal government has spent less to improve *rail transport* than air or highway transport.
- Seven out of 10 people knew that most electricity is produced in power plants owned by *utility corporations* rather than by major oil companies, the federal government or cities and towns.
- Almost 7 out of 10 people knew that the term *embargo* refers to a situation wherein one or more nations prevent another nation from obtaining certain materials.
- Five out of 10 people knew that the acronym *OPEC* (Organization of Petroleum Exporting Countries, comprised of 13 countries in the Middle East, North Africa, Asia and South America) refers to a group of countries currently controlling the sale of oil to many other countries.
- Five out of 10 people knew that the acronym *GNP* (gross national product) refers to a measure of the total output of services and products of a country.

What Do Young Adults Know About Energy Conservation?

Current levels of energy supplies have set America on the course of conservation in order to reduce our society's demand for energy. Two approaches to conservation are (1) curtailment of energy supplies and (2) increased efficiency in the use of energy. Curtailment is a short-term strategy used to cope with acute shortages, such as those incurred during the oil embargo of 1973. Conservation involves long-term planning and requires cooperation throughout the society.

The National Assessment's energy probe included questions about two areas of conservation with implications for the average consumer: the home and personal transportation.

Although many citizens are aware of America's energy problem and are willing to practice conservation techniques in their personal use of energy, the purposes of conservation can be defeated if we do not know how and where to conserve energy.

Here is how young adults performed on questions about energy conservation in the home:

- Selecting from a list of electrical appliances commonly found in most American homes, 55% knew that an *electric clothes dryer* consumes more energy in 15 minutes of continuous operation than a color television, vacuum cleaner, dishwasher or washing machine.

- Selecting from a list of common activities in the home, very few (23%) of the young adults knew that *heating water* consumes more energy in the average American home in a year than refrigerating or cooking food, drying clothing or lighting the home.

Only 15% responded correctly to both of the two items above.

- Nearly three-quarters (71%) knew that a 40-watt fluorescent tube will produce more light than a 40-watt regular (incandescent) bulb for the same amount of electricity.

- Nearly two-thirds (65%) knew that installing six inches of insulation in an uninsulated attic saves more energy than weather stripping and caulking doors and windows, turning off lights when not needed or closing fireplace dampers.

- Only 29% of the young adults realized that home consumption accounts for just one-fifth of the total energy consumed each year in America. One-third of the young adults indicated that home consumption accounts for 55% of the total energy consumed each year, and 26% indicated that they did not know the answer to this question. The reader may recall from an earlier question that over 50% of the young adults realized that industry accounts for the largest portion of the total energy consumed each year.

Table 4 presents the national percentages of responses to a series of questions about whether several conservation techniques result in significant savings (more than 1% of the total bill), insignificant savings (less than 1% of the total bill) or waste energy.

Many young adults appear to know which of the energy conservation techniques are practical as a means of conserving both energy and money (see Table 4). But a considerable number did not know the techniques that can result in savings. For example, 32% incorrectly responded that setting the hot water heater thermostat at 140 degrees F instead of 150 degrees F results in insignificant savings. One-fourth of the young adults responded that turning off the air conditioner when the home is unoccupied for more than two hours results in insignificant savings, when the contrary is the case. Only 19% of the young adults knew all four conservation methods that can result in significant savings.

The responses of young adults to questions about energy conservation in personal transportation also reveal some gaps in knowledge. Table 5 displays the national percentages of responses to a series of questions about conservation techniques for automobile owners and drivers.

Although many people responded correctly to the items about conserving energy in personal transportation, a substantial number responded incorrectly. For instance, 1 out of 5 did not know that turning the engine off while an automobile is stopped for only five minutes saves gasoline. Some young adults (33%) mistakenly thought that keeping the tires slightly underinflated for better traction either saves gasoline or has no effect on the amount of gasoline consumed. Almost one-third thought that using radial tires has no

TABLE 4. National Percentages of Responses:
"Home Conservation and Savings"

	Significant Savings	Insignificant Savings	Wastes Energy	I Don't Know
In winter, turn thermostat to 68° during day and 60° at night	85.2%	7.6%	3.1%	4.1%
Turn air conditioner off when home is unoccupied for more than two hours	52.8	24.9	14.9	7.0†
Set air conditioner at 78° instead of 72°	55.5	15.1	21.4	7.8
Use portable electric heater for added heat in oil or gas heated home	8.8	21.3	58.3	11.5
Set hot water heater thermostat at 140° instead of 150°F	51.9	32.1	3.0	12.9

†Rows might not total 100% because of rounding and/or nonresponse.

TABLE 5. National Percentages of Responses:
"Transportation Conservation and Savings"

	Saves Gasoline	Wastes Gasoline	Has No Effect	I Don't Know
Turning off the engine when car is stopped only five minutes	61.3%	21.6%	11.6%	5.3%†
Keeping tires slightly underinflated for better traction	14.5	52.0	18.5	14.8
Using radial tires	46.4	3.2	32.1	18.1
Accelerating very quickly to the appropriate speed	4.5	87.1	3.8	4.4

†Rows might not total 100% because of rounding and/or nonresponse.

effect on the amount of gasoline consumed. The majority (87%), however, knew that accelerating very quickly to the appropriate speed wastes gasoline. Five out of 10 young adults correctly responded to at least three parts of this series, but only 23% correctly answered all parts.

On a series of general questions about conservation and transportation, young adults' performance was mixed. For instance:

- Eighty-one percent of the young adults knew that car pooling to and from work 50 miles every day with one other person saves more gasoline than buying a car that gets 20 miles per gallon rather than one that gets 15 miles per gallon, or driving 55 miles per hour rather than 65 miles per hour.

- Thirty percent of the young adults knew that the average automobile gets the most miles per gallon of gasoline at 40 miles per hour rather than at 15 miles, 55 miles or 75 miles per hour.

Only one-fourth of the young adults responded correctly to both of the items above.

- Fifty-five percent of the young adults knew that the weight of the car has a greater effect on the amount of gasoline a car uses than the amount of air pressure in the tires, the kind of gasoline one uses, how clean the oil filter is or how clean the spark plugs are.

- Fifty percent of the young adults knew that trains require less energy to move one ton of freight per mile than trucks, airplanes or helicopters.

Overall, young adults' performance was higher on conservation techniques in personal transportation (58%) than on conservation techniques in the home (54%).

Group Results

Each large bar on Exhibit 1 represents the estimated group mean percentage of correct responses on the set of questions about energy knowledge. The smaller, black bars represent ± two standard errors of that estimated mean percentage. The range designated by the smaller bars represents an approximate 95% confidence interval for the estimated mean percentage. Where the smaller bar does not cross the national mean percentage, there is a statistically significant difference between the estimated group and national mean percentages.

Exhibit 1 reveals that several groups performed differently than the nation as a whole:

- More males than females responded correctly.

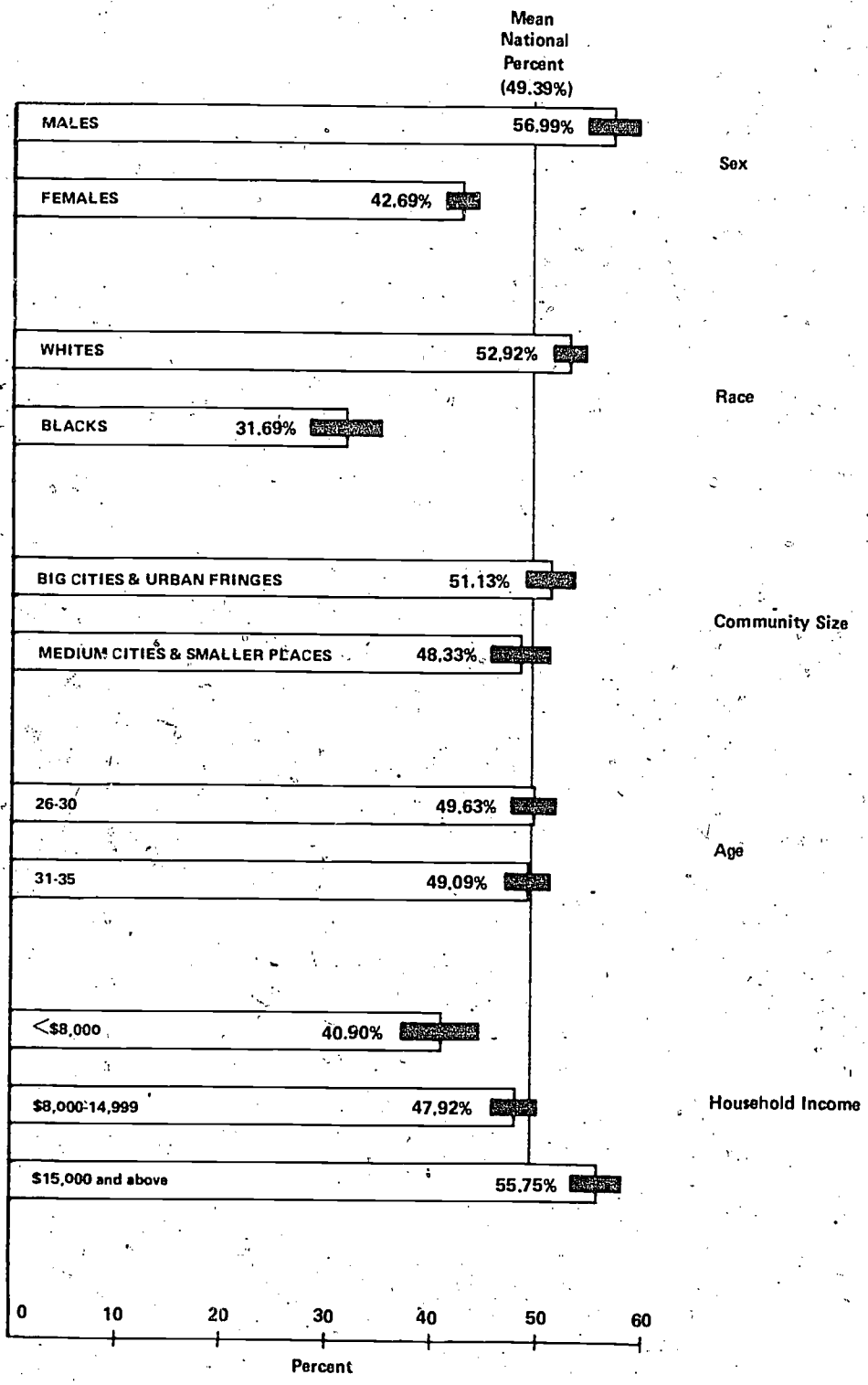
- More whites than blacks responded correctly.

- More people who reported an annual household income of $15,000 or above gave correct responses than those reporting $8,000—14,999 or $7,999 or less as annual household income.

Summary

Some instructive and interesting patterns are evidenced in the findings of National Assessment's energy probe. Generally, young adults were familiar with energy-related terminology and some practical conservation techniques that reduce energy consumption in transportation and in the home. But where knowledge of deeper issues, such as conversion processes, imbalances between supply and demand, and energy reserves, is concerned, we see that the level of knowledge was lower. Based on intervals of 19—20

EXHIBIT 1. Comparison of National and Group Percentages of Correct Responses to 50 Questions on Energy Knowledge



percentage points, the following is a summary of what young adults knew about energy-related matters:

Fewer than 19% of the young adults knew:

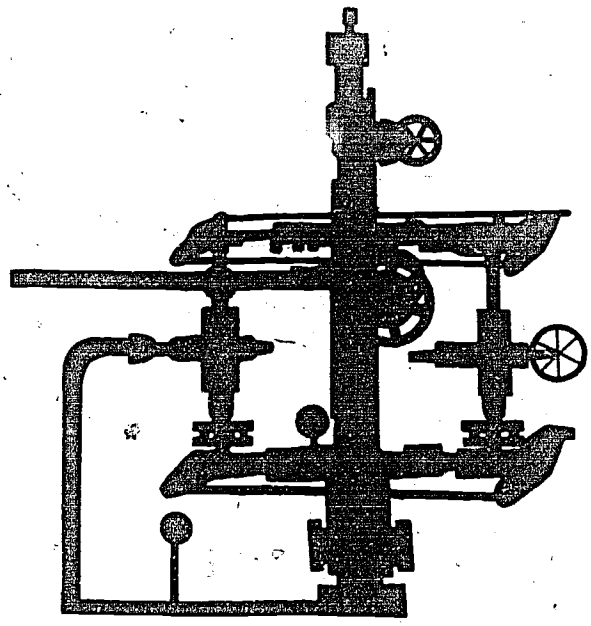
- That coal can be converted to gasoline.
- That the largest portion of our electrical energy is produced from coal.
- That 5 years are required to get oil fields and underground coal mines into production and 10 years are required to get nuclear power plants into production.
- That fission is the process currently used as a means of generating nuclear power for useful purposes.
- That fission and fusion create radioactive waste by-products.
- That during the decade 1960—70, growth in the use of coal was greater than the rate of population growth.

From 20 to 39% of the young adults knew:

- That residential consumption of energy accounts for only one-fifth of the total energy consumed in this country.
- That improved technology will not make it possible to convert to useful work *all* of the energy released by burning a fuel.
- That by the year 1985, less than one-third of our nation's energy needs will probably be provided by solar energy, geothermal energy or by Alaskan oil.
- That fission is created by splitting atomic nuclei.
- That 5 years are required to get oil refineries into production and 5 to 10 years are required to get coal-fired power plants into production.
- That fossil fuels and nuclear power plants pollute by way of waste heat.
- That the sulfur content of coal (a pollutant) varies between coal found in the Western and the Eastern United States.
- That glass production does not use a fossil fuel as a raw material.
- That heating water consumes more energy in the average American home in a year than refrigerating or cooking food, drying clothing or lighting the home.
- That the average car gets the most miles per gallon of gasoline at 40 miles per hour rather than at 15, 55 or 75 miles per hour.
- That the United States, with approximately 6% of the world's people, consumes 30% of the total energy consumed on earth in a year.
- That if the United States consumes 6.3 billion barrels of oil per year, 50—150 years of oil remain in the United States.

From 40 to 59% of the young adults knew:

- That the industrial sector of our society consumes the largest share of the total energy consumed in the United States.
- That crude oil now provides the largest percentage of energy used in the United States.
- That from 30 to 60% of all the oil consumed in the United States is imported.
- That during the decade 1960—70, the rate of growth in the use of electrical energy and natural gas was greater than the rate of population growth.
- That OPEC refers to a group of countries that sell oil to other countries.
- That the largest fossil fuel energy reserve in the United States is coal.
- That the heating value per pound of coal



is expressed in British Thermal Units or Calories.

- That the federal government has allocated more research and development funds during the past 20 years to *nuclear* sources of energy than to coal, petroleum, solar, wind, or hydroelectric research and development.
- That by the year 1985, the winds and the tides will probably supply less than one-third of our nation's energy needs.
- That trains require less energy to move one ton of freight per mile than do trucks, airplanes or helicopters.
- That solar collectors do not pollute.
- That the acronym GNP refers to a measure of the total output of services and products of a country.
- That turning off the air conditioner when the home is unoccupied for more than two hours results in significant savings.
- That setting the air conditioner at 78 degrees instead of 72 degrees results in significant savings.
- That setting the hot water heater thermostat at 140 degrees instead of 150 degrees results in significant savings.
- That the use of portable electric heaters for added heat in oil or gas heated homes wastes energy.
- That electric clothes dryers consume more energy in 15 minutes of continuous operation than do color televisions, vacuum cleaners, dishwashers or washing machines.
- That keeping the tires slightly underinflated for better traction wastes gasoline.
- That the weight of a car has more effect on the amount of gasoline a car uses than the amount of air pressure in the tires, the kind of gasoline used, or the cleanliness of the oil filter or spark plugs.
- That using radial tires saves gasoline.

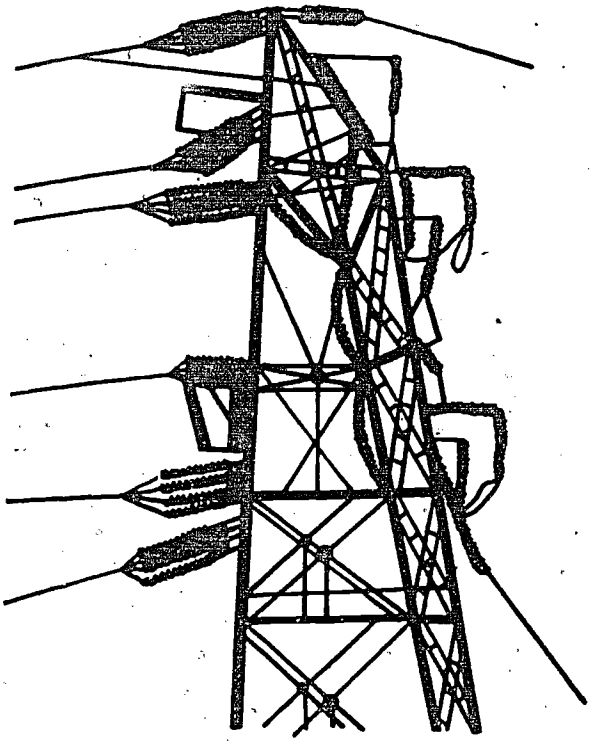
From 60 to 79% of the young adults knew:

- That petroleum, a primary source of energy, is likely to be depleted before other fossil fuels are.
- That petroleum, rather than coal, plutonium, uranium or solar energy, is the largest energy export from the Middle East.
- That during the decade 1960—70, the rate of growth in the use of oil was greater than the rate of population growth.
- That oil tankers can contribute to water pollution.
- That an embargo is a situation in which one or more nations prevent another nation from obtaining certain materials.

- That solar energy is our largest potential source of energy.
- That the federal government has spent less money for improvement of rail transport during the past 25 years than for improvement of air or highway transport.
- That most of our electricity is produced in power plants owned by utility corporations.
- That electricity is bought and sold by the kilowatt hour.
- That a 40-watt fluorescent tube will produce more light for the same amount of electricity than a 40-watt incandescent bulb will.
- That installing six inches of insulation in an uninsulated attic will save a substantial amount of energy.
- That turning off the engine when a car is stopped for only five minutes saves gasoline.

From 80 to 100% of the young adults knew:

- That turning down the thermostat to 68 degrees during the day and 60 degrees at night results in significant savings.
- That automobiles are commonly associated with air pollution rather than with water or heat pollution.



- That accelerating very quickly to the appropriate speed wastes gasoline.
- That car pooling to and from work with one other person for 50 miles saves gasoline.
- That the rate of electrical energy used by light bulbs is expressed in watts.
- That the content of food energy is expressed as calories.

CHAPTER 2

HOW DO YOUNG ADULTS FEEL ABOUT ENERGY PROBLEMS?

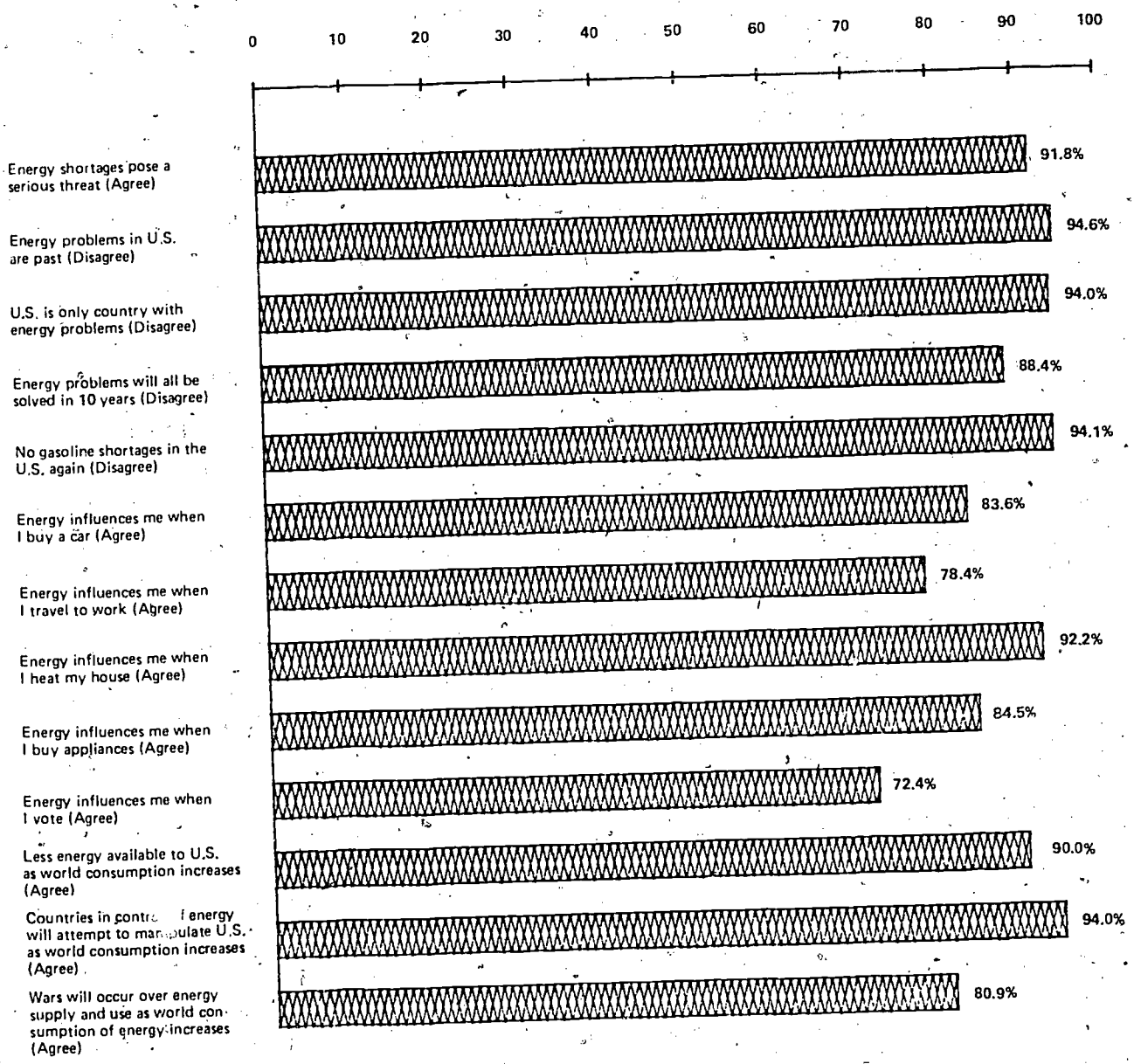
Highlights of the Results

- *Young adults apparently felt the energy problems confronting the nation are very serious.*
- *While most of the young adults desired more information on the energy problem (96%) and ways and means of conserving energy (94%), some doubted that they could influence government, manufacturers or oil companies with regard to energy problems.*
- *Over half (57%) of the young adults reported they would drive or ride in a car when traveling one-half mile or less.*
- *Most young adults (76%) apparently felt that disposal of radioactive waste is the most serious potential hazard associated with nuclear power, and 54% indicated they would not like to have a nuclear power plant within a radius of 25 miles of their residences.*
- *Of several energy-producing sources, coal mining and nuclear-powered generators are apparently thought by young adults to pose the most serious consequences for health and safety and for the environment and pollution.*
- *Young adults felt that importing foreign oil poses the most serious consequences for the social and economic well-being of the nation.*

The energy problems currently besetting America result from historical trends in the use of resources. Our country's energy needs were met first by wood. Wood remained our primary source of energy until the 1880s, when the use of coal became more viable because of improvements in mining technology and a plentiful coal supply. Since 1950, oil and natural gas have been our major sources of energy — not because of coal shortages, but because oil and natural gas are cleaner, cheaper and easier to extract, transport and burn. So, by 1977, oil and natural gas provided 74% of the total energy needs of this country, with coal providing about 19% and the remaining 7% coming from hydropower and nuclear sources.

From 1950 to 1970, the population of the United States grew by 34%, but per capita energy consumption grew by 46%. One effect of the combination of these two trends was that our 1970 energy use was nearly double that of 1950. If per capita energy consumption continues at the same or a greater rate than population growth, America's annual use of energy per capita will have doubled again by 1990. At this rate, we would have used in

EXHIBIT 2. National Percentages of Young Adults Agreeing and Disagreeing With Statements About the Seriousness of America's Energy Problems



the 20 years between 1970 and 1990 as much energy as we had used in all the years preceding 1970.[1]

The decline of energy production, increasing dependence on imported oil and increased costs of consumption have resulted in intense concern about energy. Citizens must begin to make choices for the future. Therefore, adults in the National Assessment sample were asked a series of questions designed to probe their attitudes about (1) the seriousness of the energy problem, (2) personal actions that relate to the energy situation in this country, (3) environmental hazards associated with the development of energy sources and (4) energy trade offs.

Do Young Adults Think the Energy Problem Is Serious?

National Assessment asked questions to explore whether or not young adults think the energy problem is a serious one. This group of questions included various propositions with which people could agree or disagree. For example, if people tended to *agree* that the energy problem in the United States is past, then the inference can be drawn that people do not think the energy problem is serious. On the other hand, if people tended to *disagree* with this proposition, then the inference can be drawn that people think the energy problem is serious. Exhibit 2 displays 13 questions (in a shortened form) and the national percentages of responses denoting the direction — agreement or disagreement — of attitudes toward the propositions contained within the questions.

[1] *Energy Dilemmas* (Washington, D.C.: League of Women Voters Education Fund, 1977), pp. 5—8.

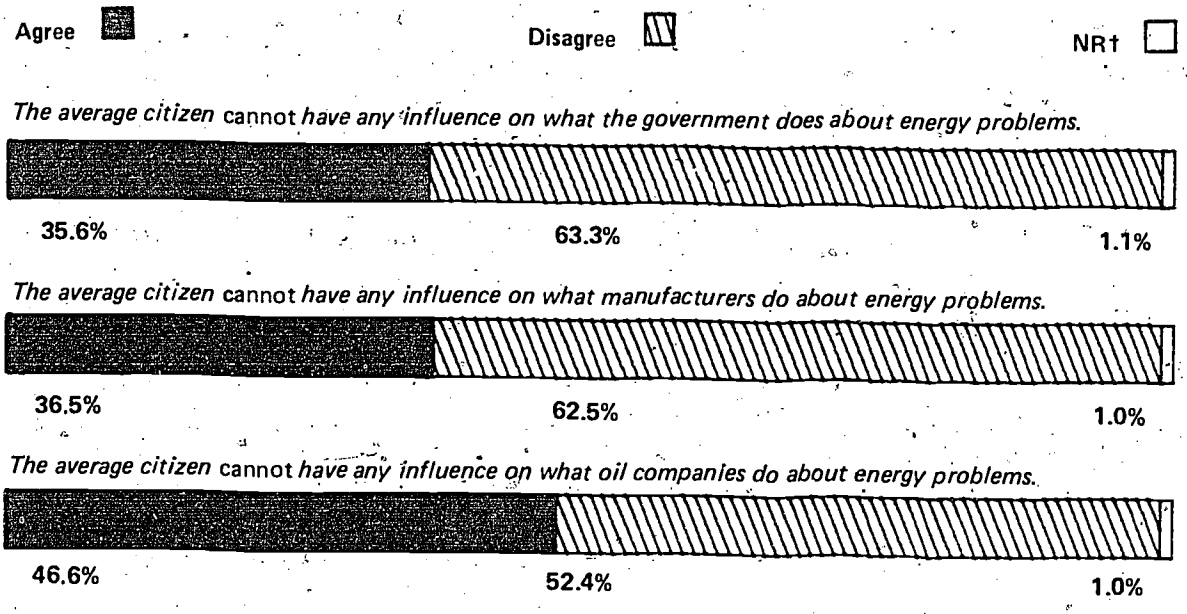
Note that young adults felt energy shortages do pose a serious threat to the future well-being of most Americans. Furthermore, most young adults realized that the United States is not the only country in the world with energy problems. They felt that energy problems are not past, that all energy problems will not be solved in 10 years and that there will be more gasoline shortages in the United States.

Most young adults also replied that energy considerations influence them when they purchase cars and appliances, in traveling to work, in heating their homes and in voting. Moreover, a high percentage of young adults appear to believe that as world consumption of energy increases there will be less energy available in the United States, and that there probably will be wars over energy supplies. In addition, when asked if America *should* develop energy independence even if it means energy will cost more, 36% of the young adults strongly agreed and 42% moderately agreed, while only 14% moderately disagreed and 6% strongly disagreed. From these responses, we can infer that most young adults think the energy problem is serious.

Do Young Adults Think They Can Influence Energy Decisions?

Another dimension of attitudes is the extent to which people think their personal actions and behaviors have implications for others. In this instance, can personal actions influence agencies making energy decisions? Corollary issues are whether or not people want more information about the problem and what choices individuals will make in terms of their own actions. NAEP's energy assessment included a group of nine questions designed to probe attitudes along these lines.

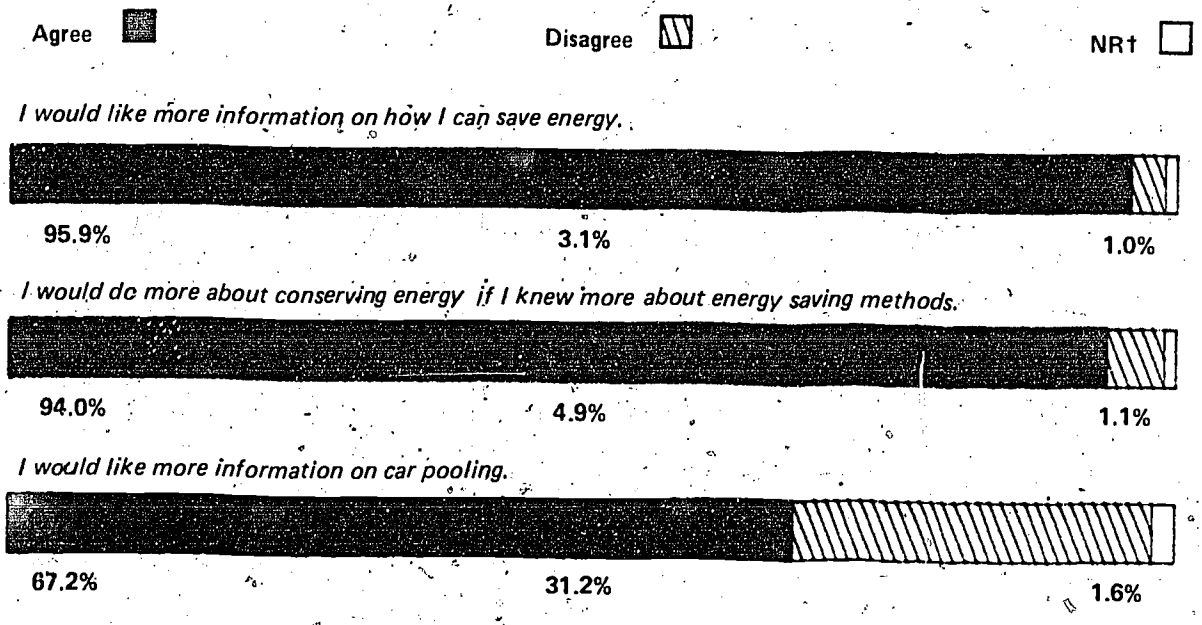
When queried about the average citizen's potential to influence various institutions, adults responded as follows:



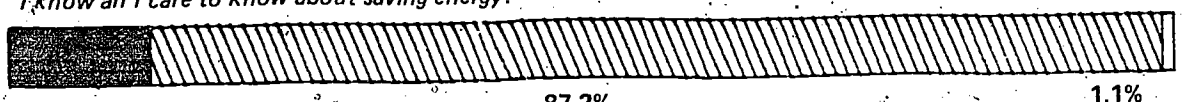
†No response.

Although the majority of respondents tended to disagree that citizens have no influence on government, manufacturing and oil companies, over one-third appear to doubt that citizens can influence such agents.

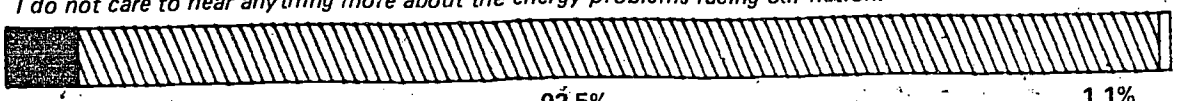
Responses to a series of questions probing whether or not people tended to desire more information about the energy problem and energy conservation indicate that the majority would like more information on both.



I know all I care to know about saving energy.



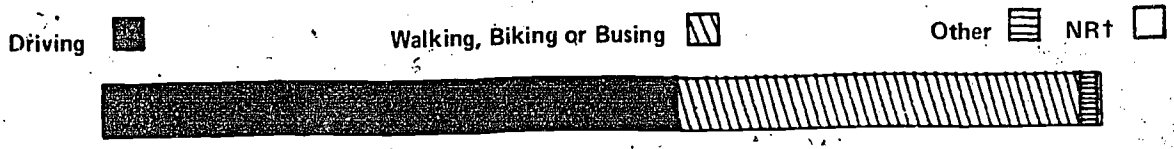
I do not care to hear anything more about the energy problems facing our nation.



†No response.

The responses to the question about car pooling may be interpreted in at least two ways. Although two-thirds of the young adults indicated that they wanted more information about this means of conserving energy, nearly one-third appear not to desire information. This might be true because many people are already car pooling and therefore do not need or desire more information. Or, it may indicate that some people may be indifferent to this particular means of energy conservation.[2]

When asked about their personal choices of means of traveling one-half mile, more than half of the respondents selected using a car, and a few more than one-third chose either walking, riding a bike or riding a bus.

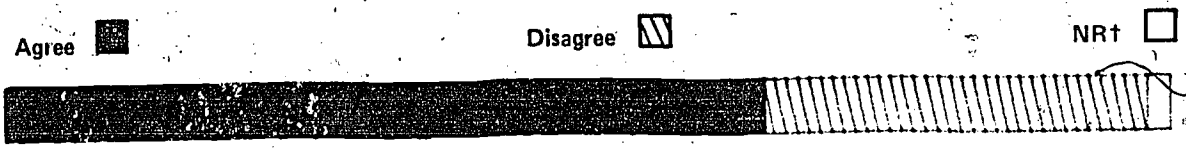


†No response.

If viewed as a whole, the responses to the questions in this group suggest that young adults are cognizant of their potential to influence major decisions about the energy problem, are concerned about the energy problem to the extent that they desire more information on the subject, and are perhaps moving in the direction of incorporating choices in their personal actions that may help ease the energy problem.

In connection with personal actions, young adults were asked if they would be willing to pay 10% more per year in electric bills if power plants would use this money to reduce their pollution. Responses are displayed in the bar graph below.

[2] *National Personal Transportation Study* (Washington, D.C.: Federal Highway Administration, The Ride-Sharing Branch, 1975). This study states, "For 1975, over 21% of the 74,000,000 people that commute to work by vehicle use some form of pooling (car, van or bus) as a principal way of commuting."



†No response.

What Do Young Adults Think About the Environmental Hazards Associated With Various Energy Sources?

As Americans become increasingly aware of the energy problems confronting the nation, environmental hazards associated with various alternative energy sources also become increasingly apparent. Attitudes of adults toward environmental hazards were probed in terms of whether or not people feel that declining environmental quality is a serious threat and whether they would tolerate certain energy sources near their homes.

As a prelude to the issue of environmental hazards, young adults were asked whether they agreed or disagreed that declining environmental quality poses a serious threat to the future well-being of most Americans. Nearly 90% agreed that this is the case. Young adults were also asked how serious they considered several potential hazards associated with nuclear power. Table 6 presents percentages of responses.

While each of the potential hazards was considered more serious than not, clearly, the disposal of radioactive waste was regarded as

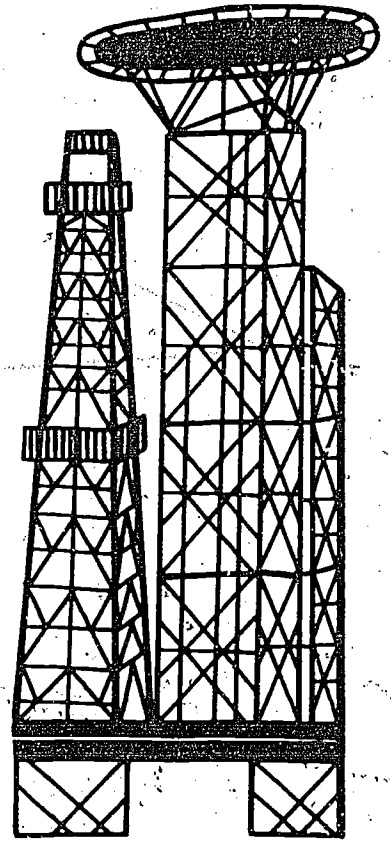


TABLE 6. National Percentages of Responses: "Potential Hazards Associated With Nuclear Power"

	Percent Very Serious	Percent Moderately Serious	Percent Not Serious
Disposal of radioactive waste	76.0%	18.7%	4.3%†
Explosion	56.6	26.1	16.2
Theft of plutonium	42.9	37.4	18.2
Radiation exposure from normal operation	42.2	35.6	21.1
Thermal pollution	33.8	47.5	17.3

†Rows might not total 100% because of rounding and/or nonresponse.

TABLE 7. National Percentages of Responses: "Energy Producers Built Within 25 Miles of Home"

	Percent Yes	Percent Maybe	Percent No
Large windmills	66.4%	23.5%	9.4%†
Large solar energy collectors	59.3	25.6	14.0
Dam with hydroelectric plant	33.8	31.6	33.4
Geothermal power plant	21.1	45.5	32.0
Nuclear power plant	19.8	25.2	54.1
Coal-burning power plant	14.2	36.5	48.4
Coal gasification plant	11.4	41.1	46.3
Oil shale processing plant	10.7	39.5	48.4

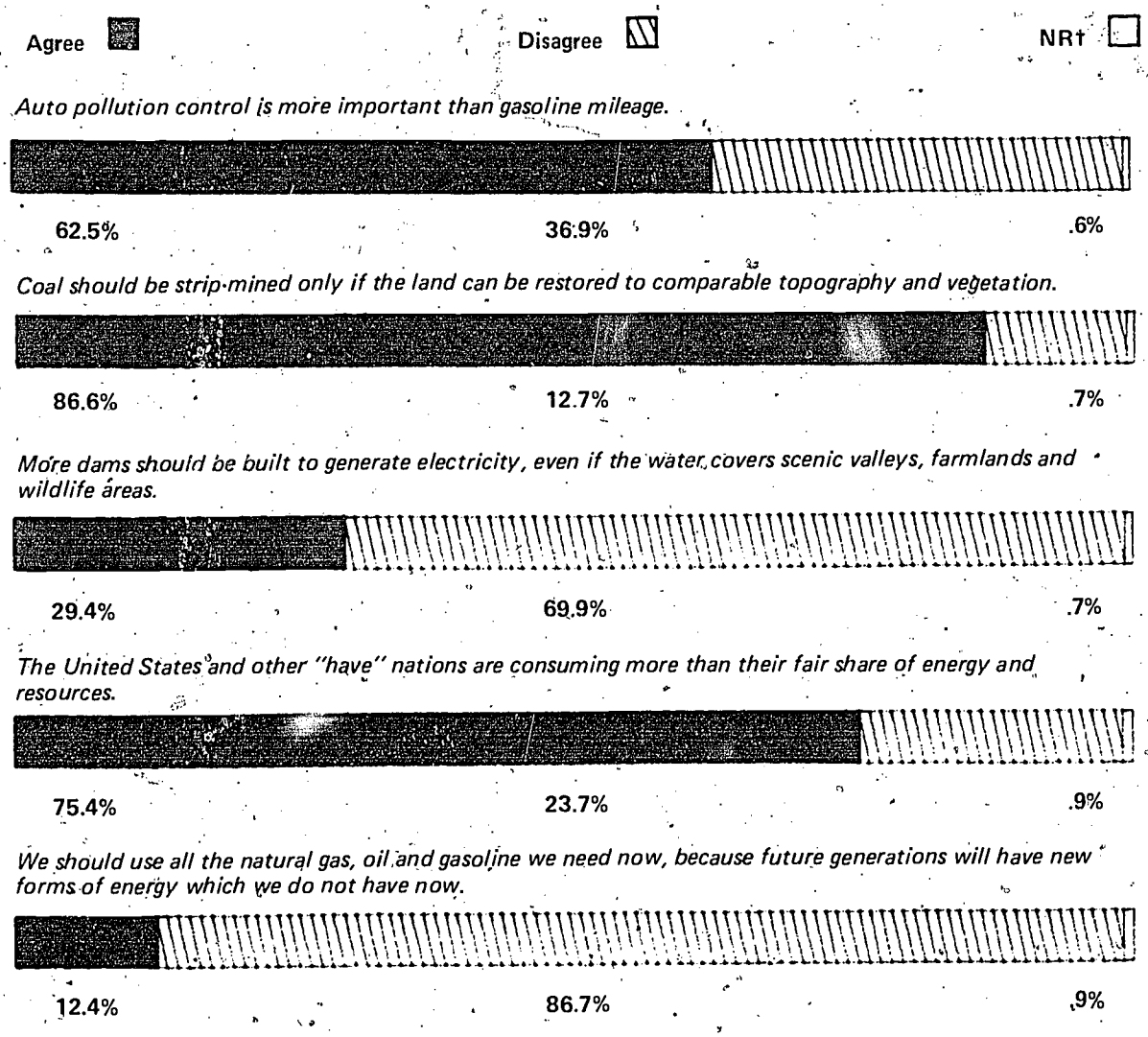
†Rows might not total 100% because of rounding and/or nonresponse.

the most serious hazard associated with nuclear power.

Finally, young adults were asked whether they would be willing to have various energy producers built within 25 miles of their homes. The ordered responses are shown in Table 7.

Viewed collectively, the responses to this group of questions suggest that only large windmills and large solar energy collectors are acceptable for location within 25 miles of one's residence. The remaining six energy producers elicited a high percentage of "no" and "maybe" responses, with nuclear power plants receiving more "no" responses than any other energy producer. Generally, it appears that young adults actually would prefer to have none of these energy producers near their own residences.

National Assessment included a series of questions designed to ascertain whether young adults lean toward an environmental perspective or an energy development perspective. The questions and responses are displayed in the bar graphs below.



†No response.

Overall, the responses of young adults suggest a fairly strong preference for environmental concern as opposed to at-all-costs energy development. But a substantial number (37%) disagreed that auto pollution control is more important than gasoline mileage. Moreover, more than one-fourth (29%) of young adults agreed that more dams should be built to generate electricity at certain costs to the environment. Three-quarters of the young adults seem to realize that the United States and other "have" nations consume more than their fair share of energy resources. The majority of young adults disagreed that we should use all of the natural gas, oil and gasoline we need now, which suggests that they are concerned about future generations.

Do Young Adults Think Energy Trade Offs Are Serious?

As America seeks ways of alleviating the energy problem, it becomes apparent that certain energy solutions have implications beyond the present time and our immediate needs. The quest for energy alternatives forces us to consider the trade off between generating more energy on the one hand and, possibly, facing high risks to health, safety, the environment and the social and economic well-being of the nation on the other hand.

How do people feel about these issues? In the National Assessment's survey of attitudes toward energy, people were asked to evaluate the seriousness of problems associated with seven energy-producing sources[3] across three major trade-off areas: health and safety, the environment, and social and economic impact. The responses to the health and safety evaluation appear in Table 8 and are ordered from high to low percentages of "serious" responses.

Coal mining is apparently thought to offer the most serious energy trade off in terms of health and safety, while oil shale is viewed as the least serious. However, oil shale received a high percentage of "I have no idea" responses, which suggests that the public has limited information about the health and safety consequences of oil shale development.

When the energy-producing sources are viewed from the perspective of potentially serious environmental and pollution problems, the energy-producing sources received a slightly different evaluation than in the case of health and safety trade offs (Table 9).

Nuclear-powered generators are apparently

[3]Solar heat collectors were not included in the health and safety trade off.

TABLE 8. National Percentages of Responses: "How Serious Are Health and Safety Problems?"

	Percent Extremely Serious	Percent Moderately Serious	Percent Not Serious††	Percent I Have No Idea
Coal mining	47.8%	34.8%	6.9%	9.6%†
Nuclear-powered generators	34.0	31.4	17.6	16.2
Offshore drilling and the Alaskan oil pipeline	21.0	40.1	23.0	14.9
Importing or shipping foreign oil to the United States	20.6	39.0	27.1	12.4
Coal-powered generators	11.3	37.0	27.4	23.4
Oil shale	6.4	19.0	29.2	44.3

†Rows might not total 100% because of rounding and/or nonresponse.
††Includes "not serious" and "no potential problems."

TABLE 9. National Percentages of Responses:
"How Serious Are Environmental and Pollution Problems?"

	Percent Extremely Serious	Percent Moderately Serious	Percent Not Serious††	Percent I Have No Idea
Nuclear-powered generators	30.9%	26.8%	23.3%	18.1%†
Coal mining	29.3	41.2	20.4	8.0
Offshore drilling and the Alaskan oil pipeline	24.3	39.9	23.7	11.0
Importing or shipping foreign oil to the United States	22.5	36.5	28.7	11.2
Coal-powered generators	16.7	43.3	20.6	18.0
Oil shale	7.6	24.9	23.7	42.6
Solar heat collectors	4.9	8.5	65.9	19.6

†Rows might not total 100% because of rounding and/or nonresponse.
††Includes "not serious" and "no potential problems."

viewed as presenting the most serious energy trade off in terms of the environment and pollution problems, with coal mining a close second. However, if the extremely and moderately serious categories are combined, coal mining is considered the most serious. Solar heat collectors apparently are viewed as the least serious threat to the environment. Again, oil shale received a high percentage of "I have no idea" responses.

Finally, when viewed from the perspective of their potentially serious social and economic impacts, the energy producers were ranked in a still different order of seriousness than in the case of either health and safety or environmental and pollution trade offs (Table 10).

In this ranking, the importation of foreign oil is apparently viewed by young adults as

TABLE 10. National Percentages of Responses:
"How Serious Are Social and Economic Problems?"

	Percent Extremely Serious	Percent Moderately Serious	Percent Not Serious††	Percent I Have No Idea
Importing or shipping foreign oil to the United States	36.1%	34.1%	17.1%	11.7%†
Nuclear-powered generators	28.3	27.1	24.1	19.7
Coal mining	16.0	33.9	34.3	15.0
Offshore drilling and the Alaskan oil pipeline	15.3	35.3	33.5	15.0
Coal-powered generators	11.0	26.3	38.6	23.3
Solar heat collectors	10.1	15.2	54.5	19.3
Oil shale	7.1	22.7	27.5	41.8

†Rows might not total 100% because of rounding and/or nonresponse.
††Includes "not serious" and "no potential problems."

having more serious social and economic consequences than the others. Nuclear-powered generators, coal mining, offshore drilling and the Alaskan oil pipeline also appear to be regarded by some young adults as having a serious impact on the social and economic situation of the country. Again, solar heat collectors seem to be regarded as having the least serious impact on social and economic well-being, and oil shale has received the highest percentage of "I have no idea" responses.

The following exhibit (Exhibit 3) summarizes the results of young adults' evaluations of the energy-producing sources from the perspective of three areas where trade offs may be confronted as energy decisions are made.

The results of these three evaluations suggest that young adults do have a different perspective on the various energy producers, depending on whether they are viewed in terms of health and safety, the environment and pollution, or social and economic impact. However, young adults' ratings of the energy producers also suggest that these young adults may not have sufficient information about the relative seriousness of the energy producers.

Summary

This chapter has described the results obtained from a series of questions designed to probe the attitudes of young adults toward the current energy problems facing the nation. We can only infer, however, that the percentages of responses to questions are valid indicators of their actual attitudes toward the energy issues reflected in the questions.

The findings suggest that the majority of young Americans do believe the energy prob-

EXHIBIT 3. Energy-Producing Sources Ordered by Seriousness†

Health and Safety	Environment and Pollution	Social and Economic Impact
Coal mining	Coal mining	Importing or shipping foreign oil to the United States
Nuclear-powered generators	Offshore drilling and the Alaskan oil pipeline	Nuclear-powered generators
Offshore drilling and the Alaskan oil pipeline	Coal-powered generators	Offshore drilling and the Alaskan oil pipeline
Importing or shipping foreign oil to the United States	Importing or shipping foreign oil to the United States	Coal mining
Coal-powered generators	Nuclear-powered generators	Coal-powered generators
Oil shale	Oil shale	Oil shale
	Solar heat collectors††	Solar heat collectors††

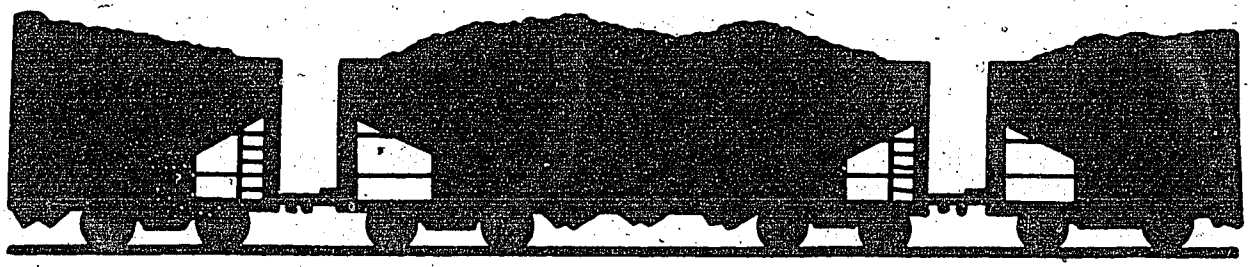
† "Extremely serious" and "moderately serious" have been combined.
†† "Solar heat collectors" was omitted from the health and safety evaluation.

lem is serious. For instance, the young adults did not indicate that they thought energy problems are past, that the United States is the only country with such problems or that all energy problems will be solved in 10 years. The majority indicated that energy concerns influence them when purchasing automobiles and appliances, in traveling to work and in voting. Most young adults seem to feel that as world consumption of energy increases, less energy will be available to the United States, countries in control of energy will attempt to manipulate the United States and wars probably will occur over energy supply and use.

While the majority indicated a desire for more information about energy problems and conservation, over one-third of the young adults also seemed to doubt that their personal actions can influence external agents such as government, manufacturers and oil companies.

While many young adults would not particularly like to have any of the energy producers built near their residences, the least desirable was a nuclear power plant. The high percentages of "maybe" responses to having energy producers near residences suggest a general ambivalence toward most of the energy producers.

Finally, young adults' responses to a series of questions about preferences for environmental protection v. energy development indicate that many people lean strongly toward environmental protection.



CHAPTER 3

WHAT DOES IT ALL MEAN? SOME REACTIONS TO THE ENERGY PROBE RESULTS

To provide a context for the findings contained in this report, National Assessment invited four persons interested and knowledgeable in the energy field to comment on the results. They are: Wilton Anderson, director, Energy and Education Action Center, U.S. Office of Education; Donald Duggan, chief, Academic Programs Branch, U.S. Department of Energy; John Fowler, director, Project for an Energy-Enriched Curriculum, National Science Teachers Association; and Isabelle Weber, coordinator, Energy Department, League of Women Voters Education Fund. These persons joined National Assessment staff members in discussions of the results of the energy assessment.

Following are some of the general observations made about these results. It should be noted that consultants' comments are their observations as individuals and do not represent the positions of any organization with which they are affiliated.

Consultants saw both positive and negative implications of the assessment results. The young adults gave evidence of deeper awareness and concern about the energy situation than was indicated in earlier polls.[1] They want more conservation strategies in particular and information about options and alternatives in general. But the survey results also show that this group did not really have the understanding of deeper issues and concepts that is necessary for making informed decisions.

The present results, consultants agreed, seem to indicate a high exposure to information about the energy problem and the issues related to it. Apparently, quite a bit of this information has been absorbed from the popular press since the oil embargo of 1973 and was not gained through schooling.

Fowler observed that although young adults in the National Assessment survey demonstrated quite a bit of concern and awareness, they did not demonstrate commensurate knowledge or deep understanding of the kinds of choices an informed citizenry must make. Fowler noted:

> *While sensitized to the realities of the energy problem, young adults show little understanding of the trade offs, time lags in energy production, conversion processes and the technologies associated with energy development.*

Concurring, Duggan pointed out that although there has been wide exposure to and some absorption of information, the prevailing lifestyle of the last 10 to 20 years has raised the expectations of this age population. They expect to be able to continue to depend on high energy use. It is one thing for people to know about an issue, he pointed out, and quite another thing for people to do something about it:

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[1] *The New York Times* and CBS News, "Survey Indicates President Faces Skepticism Over Energy Program," *The New York Times* (April 29, 1977), p. A16; Jeffrey S. Milstein, "Attitudes, Knowledge and Behavior of American Consumers Regarding Energy Conservation With Some Implications for Governmental Action" (Washington, D.C.: U.S. Department of Energy, October 1976), and "How Consumers Feel About Energy: Attitudes and Behavior During the Winter and Spring of 1976—77" (Washington, D.C.: U.S. Department of Energy, June 1977).

It may be safe to suggest from the results of this survey that the last area where young people are willing to conserve is in personal transportation. Yet this is one area where individual citizens can make a significant contribution to conservation.

Expanding on these opinions, Anderson noted:

The energy problem is a challenge to our present technology. Solutions to it depend upon our ability to make available an inexhaustible and widely accessible energy supply. It would appear that the relatively inexpensive costs of energy in the past, when compared with costs of other consumer goods, have lulled us into a sense of complacency. I am not quite sure that we are prepared for the inevitable increases in the costs of energy.

When discussion turned to perceptions about the seriousness of the problem, the consultants called attention to some contradictions. On the one hand, they pointed out, young Americans are pessimistic in their attitudes toward the seriousness of the energy problem. Ninety percent of them expect less energy to be available in the United States as world energy consumption increases. Over 93% expect that as world consumption of energy increases, countries in control of energy will attempt to manipulate the United States, and 81% expect that as world consumption increases, there might even be wars over energy resources. On the other hand, many young adults seem to have a naively optimistic attitude toward potential solutions to the energy problem — an attitude that might be translated as "through technology, scientists will solve everything." In this connection, Weber observed that apparently the less adults know about energy technology, the more optimistic they tend to be about it. Solar energy, for instance, is seen as a quick solution:

People tend to believe that solar energy will shortly make a significant contribution to the energy needs of the nation. They are not generally aware of the economic and technical problems or the time period needed before solar can make a significant contribution to our total energy needs.

Anderson cautioned:

Solar energy does not offer us total independence from the fossil sources at this time. But solar energy does offer us a very viable choice or alternative. This is what we must not forget as we begin to develop strategies for education.

Several consultants noted that young adults showed little evidence of making distinctions among alternate energy sources — particularly those sources requiring knowledge of science and engineering. Their concern about nuclear power, for example, did not seem to discriminate between major and minor problems associated with that technology.

Duggan and Fowler were troubled that young adults appear not to understand that most of our electricity comes from coal. Yet the whole direction for the near future is toward increased use and reliance upon electricity converted from coal because it is our most abundant fossil fuel — both in terms of reserves and economically recoverable supplies. There appear to be few who understand the relationship between coal and electricity as opposed to the relationship between petroleum and transportation. Not surprisingly, young people seem to know most about transportation and their cars and next most about petroleum, its by-products and uses.

Fowler suggested that one implication of the National Assessment findings is that young adults show little evidence of being prepared to select practical energy options for the future. There is no evidence to suggest that this age population has thought realistically about various energy technologies and conversions and the many problems associated with energy alternatives.

"People do not distinguish between rela-

tively benign technologies and those that are not," Fowler said. "They fear them all." Young adults are not aware of the time periods required to get various energy producers into operation, of the relative contribution that can be made by various energy sources, or that the farther away an energy producer is built, the more costly it is in terms of energy and money needed to get the usable energy to them. He noted, "They have little understanding of the consequences of exponential growth in the rate of energy use and the limits of energy sources — limits of technology and limits of available sources such as the fossil fuels."

The consultants felt that one serious question raised as a result of these findings is: How important is it that people understand some of the details (technology, conversion processes, supply and demand, etc.) associated with the energy problem and the selection of alternative energy sources? Duggan said:

> *Generally, it appears that people need two types of knowledge about energy: the practical (or application aspects) and the technical. Practical knowledge would help people adopt conservation methods in their personal activities. Some technical knowledge appears desirable so that people can intelligently participate in certain levels of the decision-making process about future selection and development of energy alternatives.*

Weber commented on this point:

> *It is perhaps time for technical information once considered apropos only to professionals and specialists to filter into the lives of the general citizenry. For instance, the concepts embodied in the first and second laws of thermodynamics are not mere bits of esoteric information. These concepts have serious implications for the selection and development of alternative energy sources.*

Fowler followed with this statement: "We must help citizens come to understand that the energy problem is global and that it will not be solved shortly." Anderson added:

> *Also, citizens must come to understand the interdependencies inherent in energy issues: (1) global interdependence — the influence of energy on the interaction between nations; (2) socioeconomic interdependence — the influence of energy on the economy, environmental controls, price regulations, taxes, etc.; (3) technical interdependence — the availability of raw materials (sources) and the limitations of technology. For instance, the production of food is an energy-intensive enterprise and is dependent upon many factors other than the actual growing of food.*

The consultants agreed that the greatest benefit of the National Assessment survey, administered four years after the oil embargo of 1973, is that it gives us a "baseline" picture of how much is known about energy by young adults (often considered the best-informed adult population). We can see some evidence of change in public attitudes toward the energy problem, and we are able to identify some serious gaps in public knowledge. These findings point to the need for education in the energy field.

Duggan and Weber concurred that on the one hand, there is a need for "how to" information that can be quickly and widely disseminated throughout the country for the benefit of all age populations. On the other hand, there is a need for an infusion of energy facts and information into existing curricula in the schools. Fowler pointed out that existing curricula need not be supplanted by the introduction of energy materials. Infusions of energy information can be accomplished by supplementing curricula to include examples based on energy issues. For example, information such as sources of energy, supplies of and demands for energy, and economic and environmental impact of energy production and use can be included in the usual curricula of many social studies courses such as geography, civics, economics or politi-

cal science, instead of being confined exclusively to science courses.

In conclusion, it was noted that 95% of the young adults apparently believed that topics like basic energy knowledge, energy problems, the future of energy, etc., should definitely be an important part of every school's curriculum. However, full-scale educational implementation of energy information in schools remains a somewhat distant goal. The consultants referred to a recent study, "The Status of State Energy Education Policy," which indicated that while some exemplary materials on energy are available for incorporation in the usual school curricula for grades K—12, there appears to be little widespread communication and cooperation within or between states to further energy education. Few state legislatures and/or governors' offices have provided input, financial or otherwise, into the K—12 energy education effort. Most states' K—12 energy education programs are funded by the federal government.[2]

Anderson suggested:

> *While a great deal was revealed from this limited assessment, other surveys should be undertaken to include both in-school and adult populations so that more efforts can be launched to increase knowledge and awareness of all citizens about the energy problems America faces. Such survey results would both guide the development of energy education efforts and measure, in rough form, such success as they might achieve.*

[2] "The Status of State Energy Education Policy," Preliminary Survey Report (Denver, Colo.: Education Commission of the States, 1978), pp. 46—7. The final report will be available in December 1978.

APPENDIX A

CONSULTANTS WHO PARTICIPATED IN THE DEVELOPMENT OF THE ENERGY ASSESSMENT

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APPENDIX B

INDEX OF ENERGY QUESTIONS FOUND IN THE REPORT

The list below provides a complete index of the questions discussed in this report. They are given in sequential order, by topic, beginning with Chapter 1. Each listing contains a short description of the content of the question and the NAEP item number.

DESCRIPTION OF QUESTIONS	NAEP NUMBER
Basic Energy Facts	
Largest potential source of energy	A12C01-B
Largest energy export from Middle East	A12C01-C
Energy source United States is likely to run out of first	A12C01-D
Energy source can be converted into gasoline	A12C01-F
Nuclear process used to generate power	A12C02-A
Nuclear process created by splitting atomic nuclei	A12C02-C
Nuclear process can create radioactive waste by-products	A12C02-B
In which unit is electricity bought and sold	A11C01-A
In which unit is the energy content of food expressed	A11C01-B
Which unit measures the rate of electrical energy used by light bulb	A11C01-D
In which unit is the heating value per pound of coal expressed	A11C01-C
Largest fossil fuel energy reserve in United States	A12C03-B
Does not use a fossil fuel as a raw material	A13C03
Energy source producing largest portion of electrical energy	A12C04
Improved technology will make possible conversion of all energy released by burning a fuel	A11C04
Sector of society using largest share of energy	A22C01
How much will solar energy contribute to energy needs by 1985	A21C02-A
How much will tides contribute to energy needs by 1985	A21C02-B
How much will geothermal energy contribute to energy needs by 1985	A21C02-C
How much will Alaskan oil contribute to energy needs by 1985	A21C02-D
How much will winds contribute to energy needs by 1985	A21C02-E
Time required to get underground coal mine into production	A21C03-A
Time required to get oil refinery into production	A21C03-B
Time required to get oil field into production	A21C03-C
Time required to get nuclear power plant into production	A21C03-D
Time required to get coal-fired power plant into production	A21C03-E

DESCRIPTION OF QUESTIONS	NAEP NUMBER
General Energy Issues	
Largest percentage of energy used in the United States	A12C03-A
What percentage of oil consumed by United States is imported	A21C01
Years of oil supply still in the United States	A13C02-A
Percentage of energy consumed by United States	A13C02-B
Between 1960—70, compare population growth with use of electrical energy	A22C02-A
Between 1960—70, compare population growth with use of coal	A22C02-B
Between 1960—70, compare population growth with use of oil	A22C02-C
Between 1960—70, compare population growth with use of natural gas	A22C02-D
Pollutant produced by fossil fuels and nuclear power plants	A24C01-A
Pollutant exists in coal	A24C01-B
Pollution associated with automobile	A24C02-A
Pollution associated with solar collector	A24C02-B
Pollution associated with oil tanker	A24C02-C
Federal government allocated the greatest amount of funds	A23C01-A
Federal government allocated the least amount of funds	A23C01-B
Electricity produced in plants owned by utility corporations	A23C03
Nations prevent other nations from obtaining certain materials	A23C02-A
A group of countries that sells oil to other countries	A23C02-B
A measure of output of services and products of a country	A23C02-C
Energy Conservation	
Electrical appliance consuming the greatest amount of energy	A31C03-A
Activity consuming the greatest amount of energy	A31C03-B
Produce most light for same amount of electricity	A31C04-A
Saves the most energy	A31C05
Percentage of energy consumed by homes	A31C01
Turn thermostat to 68 degrees in day and 60 degrees at night	A31C02-A
Turn off air conditioner	A31C02-B
Set air conditioner at 78 degrees	A31C02-C
Use portable electric heater	A31C02-D
Set hot water heat at 140 degrees	A31C02-E
Turn car engine off	A32C01-A
Tires slightly underinflated	A32C01-B
Use radial tires	A32C01-C
Accelerate quickly to appropriate speed	A32C01-D
Car pool with one other person	A32C02-A
Average automobile gets most mile per gallon of gasoline	A32C02-B
Car's weight has greatest effect on amount of gasoline	A32C03
Least energy to move one ton of freight per mile	A13C01
Energy Problem Is Serious	
Energy shortages pose a serious threat	A43A01-C
Energy problems are past	A41A01-B

DESCRIPTION OF QUESTIONS	NAEP NUMBER
United States is only country with energy problems	A41A01-C
Energy problems will be solved in 10 years	A41A01-E
No gasoline shortages again in United States	A41A01-F
Energy influence when buying a car	A44A02-A
Energy influence when traveling to work	A44A02-B
Energy influence when heating house	A44A02-C
Energy influence when buying appliances	A44A02-D
Energy influence when voting	A44A02-E
Less energy available to United States	A41A02-A
Countries in control of energy will manipulate United States	A41A02-B
Wars probably will occur over energy	A41A02-C
America should develop energy independence	A43A01-A
Influence Energy Decisions	
Citizen cannot influence government	A42A01-B
Citizen cannot influence manufacturers	A42A01-C
Citizen cannot influence oil companies	A42A01-D
More information on saving energy	A44A01-A
More about energy saving methods	A44A01-B
More information on car pooling	A44A01-C
Know all about saving energy	A44A01-D
Do not care to hear more about energy problem	A44A01-E
Travel one-half mile or less	A46A02
Willing to pay 10% more per year in electric bills	A43A01-B
Environmental Hazards	
Declining environmental quality poses a serious threat	A43A01-D
Potential hazards associated with nuclear power	A43A05-A-E
Energy producers built within 25 miles of residence	A45A02-A-H
Environmental v. energy development perspective	A43A06-A-E
Energy Trade Offs	
Potential health and safety problems	A43A02-A-G
Potential environmental and pollution problems	A43A03-A-G
Potential social and economic impact	A43A04-A-G
Energy Curriculum	
Basic energy topics should be in school's curriculum	A45A01-D

APPENDIX C

SELECTED CHARACTERISTICS OF YOUNG ADULTS

TABLE C-1. Percentages of Adults in Selected Groups

	Percentage of National Sample
Sex	
Male	46.6
Female	53.4
	100.0
Age	
26-30 years	54.8
31-35 years	45.2
	100.0
Race	
Black	13.1
White	81.2
Other	5.8
	100.1†
Community size	
Big cities and urban fringes	38.5
Medium cities and smaller places	61.5
	100.0
Education level	
Not graduated high school	18.5
Graduated high school	30.1
Post high school	51.3
Other responses	0.1
	100.0

†Column does not total 100% because of rounding and/or nonresponse.

TABLE C-1 *(continued)*. Percentages of Adults in Selected Groups

	Percentage of National Sample
Income	
Below $8,000	17.4
$8,000-14,999	34.4
$15,000 and above	42.1
Other responses	6.1
	100.0

TABLE C-2. Sources Used by Adults To Obtain Information About Selected Energy Issues During the Past Year

Issue	Source								
	Radio	TV	Books	Journals or Magazines	Newspapers	Family or Friends	Other	None	Total†
Pollution	5.4%	42.9%	2.3%	13.6%	22.5%	1.0%	4.8%	7.6%	100.1%
New developments in science and technology	1.5	28.0	7.6	28.2	15.4	1.5	4.9	12.9	100.0
Energy conservation	5.9	42.0	4.4	17.8	21.1	2.2	2.8	3.8	100.0
Alternative energy sources	3.6	35.3	4.6	22.0	20.0	2.1	5.0	7.5	100.1

†Some rows do not total 100% because of rounding and/or nonresponse.

APPENDIX D

ADULT ATTITUDES: RESULTS FOR SELECTED GROUPS

Tables D—1 through D—7 present national and group results on the attitudinal items in the energy assessment. The national percentage of responses is shown immediately after the item. The direction of the responses — agree, disagree, etc. — is usually placed above the items. The numbers shown for each group are the percentages of difference between the group's percentage of response and the national percentage of response. For example, on Table D—1, the national percentage of responses "disagreeing" with the item "Energy problems are past" is 94.5. The post-high-school group's response was 3.2 percentage points above the national, or 97.7%. The no-high-school group's response was -10.3 percentage points below the national, or 84.2%. A statistically significant difference between groups' percentage and the corresponding national percentage is designated by an asterisk. In other words, the differences are greater than two standard errors so we are 95% confident that they are real, rather than an artifact of the survey design or sample.

TABLE D-1. Comparison Between National and Group Percentages of Responses: "Statements About Seriousness of America's Energy Problem"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Disagree:															
Energy problems are past	94.5	0.2	-0.2	0.7	-0.8	1.5	-0.9	1.6*	-10.1*	-10.3*	0.9	3.2*	-5.7*	0.3	2.9*
U.S. only country with energy problem	94.0	0.5	-0.5	-0.5	0.6	1.0	-0.6	2.1*	-11.6*	-10.5*	0.6	3.5*	-4.6*	0.3	2.3*
Problems will be solved in 10 years	88.4	0.4	-0.4	-0.5	0.6	0.9	-0.6	3.0*	-14.0*	-6.0*	-2.8	3.8*	0.4	-2.6	1.8
No more gasoline shortages	94.0	-0.2	0.2	-0.4	0.5	2.3*	-1.4*	2.0*	-12.1*	-10.9*	0.9	3.6*	-4.3	-0.3	2.7*
Agree:															
Shortages pose threat to future	91.8	0.2	-0.2	-0.4	0.4	1.6	-1.0	1.8*	-10.9*	-6.7*	-1.4	3.3*	-5.7*	0.5	2.9*
Energy influences me when purchasing car.	83.6	-1.3	1.2	0.1	-0.2	1.7	-1.0	2.8*	-12.5*	-7.7*	-3.4*	5.0*	-0.5	3.0	1.0
Energy influences me when traveling to work	78.4	-2.5*	2.2*	-0.7	0.9	-0.9	0.5	0.1	0.3	0.4	-2.3	1.2	2.9	2.1	-0.8
Energy influences me when heating my house.	92.2	-0.6	0.5	-1.0	1.2	0.3	-0.2	2.8	-13.6*	-8.2*	-0.7	3.4*	-2.0	-0.1	2.8*
Energy influences me when purchasing appliances	84.5	-3.5*	3.1*	-2.4*	2.8*	2.7	-1.7*	2.0*	-8.2*	-8.6*	1.6	2.3*	-1.3	1.7	1.5
Energy influences me when voting	72.4	-0.5	0.4	-2.5	3.0	0.9*	-0.5	2.1*	-10.8*	-8.0*	-3.5	5.1*	-2.4	-3.5	5.2*
As world consumption increases:															
There will be less energy available to United States	90.0	-1.6	1.4	-0.3	0.3	-0.9	0.5	1.7*	-9.4*	-0.2	-1.2	0.7	-2.1	-0.5	1.2
Countries in control of energy will attempt manipulation	94.0	-0.8	0.7	0.9	-1.1	-0.2	0.1	1.6*	-10.9*	-4.0*	-1.7	2.5	-2.9	-1.7	3.5*
There will be wars over energy supply and use	80.9	1.2	-1.0	0.9	-1.0	-3.3	2.0*	0.4	-4.0	-1.0	0.8	-0.3	2.0	-0.2	-0.2

†"Strongly disagree" and "moderately disagree" have been combined, and "strongly agree" and "moderately agree" have been combined.
**Indicates mean percentages significantly different from the nation at the .05 level.*

M = Males
F = Females
BC-UF = Big cities and urban fringes
MC-SP = Medium cities and smaller places
W = Whites
B = Blacks

NGHS = Not graduated high school
GHS = Graduated high school
PHS = Post high school
<8 = $7,999 or less
8-15 = $8,000-14,999
>15 = $15,000 or more

TABLE D-2. Comparison Between National and Group Percentages of Responses: "Do Young Adults Think They Can Influence Energy Decisions Through Personal Actions?"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Disagree:															
Average citizen cannot influence government	63.3	1.3	-1.1	-0.1	0.1	0.1	-0.0	3.0	-19.4*	-16.3*	-4.3	9.2*	-6.8	0.9	3.0
Average citizen cannot influence manufacturers	62.5	2.9	-2.6	-0.4	0.5	0.7	-0.4	2.6*	-14.2*	-11.5*	-3.3	6.8*	-3.7	1.4	2.1
Average citizen cannot influence oil companies	52.4	1.8	-1.6	-0.9	1.1	0.2	-0.1	2.5	-12.5*	-14.5*	-1.5	6.7*	-3.6	0.6	1.0
I know all I care to know about saving energy	87.2	-2.6*	2.3*	0.7	-0.9	0.4	-0.3	1.7*	-7.5	-9.2*	2.6	1.7	-3.0	1.3	0.9
I do not care to hear more about energy problems	92.5	-0.7	0.6	-1.0	-1.2	0.4	-0.3	1.9*	-8.8*	-10.3*	1.3	3.2*	-2.1	-0.3	1.6
Agree:															
I would like more information on how I can save energy	95.9	-1.0	0.9	-0.9	1.0	0.0	-0.0	0.6	-4.0*	-2.7	1.8*	0.0	-1.7	2.0*	0.1
I would do more about conserving energy if I knew more about energy-saving methods	94.0	-1.9*	1.6	-0.5	0.6	0.4	-0.2	0.3	-3.1	-1.9	1.9	-0.5	-0.1	0.8	0.0
I would like more information on car pooling	67.2	-2.2	1.9	-1.0	1.2	-1.1	0.7	-1.4*	8.8*	6.0	0.5	-2.6	2.5	4.4*	-4.1*
I walk, bus or bike when traveling 1/2 mile or less	40.5	-2.7	2.4	3.1	-3.7	-0.5	0.3	1.1	-8.5	5.7	-3.7	-0.4	9.7*	0.4	-4.3

† "Strongly disagree" and "moderately disagree" have been combined, and "strongly agree" and "moderately agree" have been combined.

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TABLE D-3. Comparison Between National and Group Percentages of Responses: "Potential Hazards Associated With Nuclear Power"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Serious:															
Thermal pollution	81.3	-4.5*	4.0*	-2.4*	2.9*	-0.6	0.3	-0.4	1.9	-1.0	2.7	-1.4	3.4	-0.8	-0.6
Radiation exposure from normal operation	77.9	-10.9*	9.6*	-1.6	1.9	-3.2	1.9	-2.1*	10.8*	4.7	3.8	-4.2*	6.6*	2.5	-6.1*
Explosion	82.7	-9.1*	8.0*	-1.7	2.1*	-3.8	2.3	-2.0*	8.8*	6.1*	2.6	-4.0*	5.7*	1.6	-4.7*
Theft of plutonium	80.3	-2.5	2.2	-1.9	2.2	-4.4*	2.7*	-0.2	-0.1	-0.9	0.6	0.4	2.1	0.9	-2.3
Disposal of radioactive waste	94.8	0.2	-0.2	-1.9*	2.2*	-0.3	0.2	1.0	-5.3*	-6.5*	-1.4	3.2*	-4.7*	-0.2	2.5*
Agree:															
Declining environmental quality poses threat	89.3	-0.6	0.6	1.3	-1.5	1.1	-0.6	2.4*	-11.3*	-12.7*	-2.5*	6.2*	-5.7*	0.8	4.1*

†"Extremely serious" and "moderately serious" have been combined, and "strongly agree" and "moderately agree" have been combined.

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TABLE D-4. Comparison Between National and Group Percentages of Responses: "Energy Producers Built Within 25 Miles of Home"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Coal-burning power plant	50.8	9.0*	-7.9*	-0.6	0.7	-1.2	0.7	2.3*	-9.2*	6.5*	0.9	-2.6	7.5*	4.9*	-0.9
Nuclear power plant	45.0	12.7*	-11.2*	-0.1	0.1	-0.4	0.3	1.9*	-8.0*	2.9	-1.1	-0.1	6.3*	3.3	3.1
Coal gasification plant	52.5	10.2*	-9.0*	-1.3	1.6	1.5	-0.9	2.8*	-14.6*	1.1	-2.6	1.6	9.0*	3.8	0.3
Large solar collectors	84.9	4.4*	-3.9*	0.2	-0.3	-0.1	0.1	4.6*	-25.5*	-10.5*	-4.6*	6.8*	-4.2	-2.0	5.6*
Large windmills	89.9	3.0*	-2.6*	-0.1	0.1	-1.7	1.0	3.8*	-20.1*	-7.3*	-3.3*	5.3*	-4.6	-1.4	3.9*
Dam with hydroelectric plant	65.3	4.5*	-3.9*	-0.2	0.3	-0.8	0.5	4.4*	-20.2*	-12.9*	-0.7	5.7*	-5.4	2.2	2.8
Oil shale processing plant	50.2	8.8*	-7.8*	-1.1	1.3	-0.9	0.5	2.5*	-6.5	-6.3	1.1	2.1	-10.5*	2.1	3.2
Geothermal power plant	66.6	10.1*	-8.9*	-0.7	0.8	1.3	-0.8	5.0*	-21.2*	-11.2*	-5.4*	8.0*	-9.7*	-1.0	5.9*

†"Yes" and "maybe" categories have been combined.

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TABLE D-5. Comparison Between National and Group Percentages of Responses: "How Serious Are Health and Safety Problems?"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	≥15
Coal mining															
Serious	82.6	-1.1	0.9	-0.3	0.4	2.1	-1.3	3.3*	-13.0*	-14.8*	-3.2	7.3*	6.5*	-4.8*	6.7*
I have no idea	9.6	-2.8*	2.5*	0.7	-0.8	-1.3	0.8	-3.1*	12.2*	15.6*	1.9	-6.9*	7.5*	3.6	-6.4*
Offshore drilling															
Serious	61.1	2.0	-1.7	-1.1	1.4	3.0	-1.8	1.6	-5.8	-14.6*	-5.2	8.3*	-3.8	-0.2	2.0
I have no idea	14.9	-5.9*	5.2*	-0.8	0.9	-1.4	0.9	-2.8*	15.3*	14.3*	2.8	-6.9*	8.8*	-1.1	-5.3
Coal-powered generator															
Serious	48.3	4.1*	-3.6*	-0.5	0.6	5.0*	-3.0*	0.7	-4.2	-4.9	7.2*	-5.9*	0.7	-1.2	1.1
I have no idea	23.4	-10.9*	9.6*	-1.4	1.6	-3.4*	2.1	-2.7*	13.1*	12.7*	4.0	-7.0*	8.9*	-2.4	-4.2*
Import oil															
Serious	55.7	5.4*	-4.7*	2.6*	-3.1	2.3	-1.4	0.2	-4.1	-5.1	-1.7	2.8	-0.5	-0.1	-0.6
I have no idea	12.4	-7.8*	6.9*	-2.2*	2.6*	-2.5	1.5	-1.5*	10.2*	10.6*	1.7	-4.9*	7.1*	1.9	-5.4*
Oil shale															
Serious	25.4	2.5	-2.2	-0.4	0.5	1.5	-0.9	-0.7	4.2	-1.3	-3.5	2.0	2.5	-0.3	-0.6
I have no idea	44.3	-18.7*	16.4*	0.3	-0.4	-0.1	0.1	-1.9*	8.6*	12.5*	3.5	-6.4*	5.9	0.9	-5.0*
Nuclear-powered generators															
Serious	65.4	1.5	-1.3	1.8	-2.1	2.0	-1.2	2.8*	-11.8*	-17.5*	-4.8*	9.2*	3.8	-5.9*	4.6
I have no idea	16.2	-7.1*	6.3*	-2.6*	3.1*	-1.9	1.2	2.8*	14.4*	20.7*	1.7	-8.7*	4.4	3.0	-6.7*

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TABLE D-6. Comparison Between National and Group Percentages of Responses: "How Serious Are Environmental and Pollution Problems?"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Coal mining															
Serious	70.5	0.4	0.3	0.6	0.8	0.4	0.3	1.9*	7.9	-10.0*	-5.7*	6.9*	-0.7	0.7	-0.1
I have no idea	8.0	-3.3*	2.9*	0.3	-0.4	-0.1	0.1	2.7*	12.3*	13.6*	-0.0	-5.0*	5.4*	0.2	-3.0
Offshore drilling															
Serious	64.2	3.7*	-3.2*	0.3	0.3	0.0	-0.0	2.9*	-11.6*	-16.9*	-6.7*	10.1*	-3.6	-3.2	4.0*
I have no idea	11.0	5.6*	5.8*	-1.8*	2.2*	0.5	0.3	-2.7	14.9*	14.6*	0.4	-5.6*	7.8*	-0.4	-4.3*
Coal-powered generators															
Serious	60.0	6.3*	-5.5*	1.7	-2.0	4.9*	-3.0*	2.3*	-11.5*	-10.2*	-6.1*	7.4*	-5.7	0.9	2.7
I have no idea	18.0	-9.3*	8.2*	-1.3	1.5	-1.0	0.6	-2.4*	15.2*	-9.7*	3.8*	-5.8*	8.7*	-0.4	-4.1*
Import oil															
Serious	59.0	4.8*	-4.3*	-0.7	0.8	1.1	-0.7	1.1	-2.6	-10.7*	1.8	2.6	2.9	-2.6	1.3
I have no idea	11.2	7.0*	6.1*	0.6	0.8*	-1.5	0.9	-1.9*	9.5*	16.0*	-0.4	-5.7*	5.4*	0.4	-5.3
Solar heat collectors															
Serious	13.4	-2.0	1.7	0.2	0.3	0.4	0.2	-2.9*	15.6*	11.2*	2.2	-6.1*	8.4*	1.5	-5.8*
I have no idea	19.6	-7.0*	6.1*	0.1	-0.1	-3.4*	2.0*	-3.0*	11.6*	18.6*	3.3	-8.8*	5.8*	0.6	-5.7*
Oil shale															
Serious	32.5	7.3*	-6.5*	-0.1	0.1	-1.2	0.7	-0.6	3.7	-2.7	-4.3*	3.1*	-1.6	1.4	0.2
I have no idea	42.6	-18.8*	16.6*	-0.0	0.0	1.3	-0.8	-1.6	7.8	10.1*	5.0*	-6.5*	6.0	-0.6	-3.6
Nuclear-powered generators															
Serious	57.7	4.0*	-3.5*	-0.3	0.4	2.5	-1.5	2.2*	-6.2	-19.8*	-3.6	9.4	0.1	-4.6	5.0*
I have no idea	18.1	8.3*	7.3*	-0.8	1.0	-1.8	1.1	-2.8*	14.5*	22.0*	2.7	-9.7*	6.3*	2.2	-7.1*

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TABLE D-7. Comparison Between National and Group Percentages of Responses: "How Serious Are Social and Economic Problems?"

	National†	Sex		Age		Community Size		Race		Own Education			Income		
		M	F	26-30	31-35	BC-UF	MC-SP	W	B	NGHS	GHS	PHS	<8	8-15	>15
Coal mining															
Serious	49.9	1.5	-1.3	0.7	-0.8	1.9	-1.1	0.2	-0.3	-8.8*	-2.6	4.4*	-1.2	-1.1	2.1
I have no idea	15.0	-6.5*	5.8*	0.0	-0.0	-2.7	1.6	-2.2*	14.3*	18.0*	-0.6	-6.2*	10.7*	-0.3	-7.1*
Offshore drilling															
Serious	50.6	5.3*	-4.7*	3.2	-3.9	1.3	-0.8	0.8	-0.5	-11.6*	-6.4*	7.8	-1.3	-0.1	1.3
I have no idea	15.0	-9.0*	7.9*	-1.9	2.2	-0.3	0.2	-2.2*	11.9*	16.9*	1.8	-7.3*	7.2*	-0.7	-4.9*
Coal-powered generators															
Serious	37.3	4.5*	-4.0*	0.7	-0.9	2.6	-1.6	-0.9	5.9	-1.5	-3.3	2.3	-0.6	0.6	1.0-
I have no idea	23.3	-10.6*	9.3*	-1.6	1.9	0.1	-0.1	-1.7*	9.2*	10.5*	2.9	-5.8*	8.4*	-2.8	-4.9*
Import oil															
Serious	70.3	3.0	-2.6	2.5	-3.0	0.4	-0.2	3.2*	-13.5*	-18.6*	-2.9	8.5*	-3.3	-1.4	3.6*
I have no idea	11.7	-6.4*	5.6*	-0.9	1.1	-1.8	1.1	-1.8*	12.3*	11.7*	1.7	-5.3*	8.0*	-1.9	-4.0*
Solar heat collectors															
Serious	25.3	-0.6	0.6	0.5	-0.6	-0.2	0.1	-2.2*	10.6*	4.5	-0.8	-1.8	0.7	1.7	-1.8
I have no idea	19.3	-5.8*	5.1*	-1.3	1.6	-2.4	1.4	-2.5*	13.0*	16.0*	3.4	-7.9*	6.9*	0.6	-5.8*
Oil shale															
Serious	29.9	7.7*	-6.8*	-0.3	0.3	1.0	-0.6	-1.0	5.3*	-1.8	-4.5	2.9	0.1	-1.4	0.9
I have no idea	41.8	-17.6*	15.5*	0.6	-0.7	0.3	-0.2	-1.5*	7.0*	10.7*	2.9	-5.4*	5.7	0.3	-4.4*
Nuclear-powered generators															
Serious	55.5	2.7	-2.3	1.4	-1.7	3.8	-2.3	1.8	16.6*	-18.3*	-4.6*	9.2*	-3.3	-0.9	4.5*
I have no idea	19.7	-7.6*	6.7	-2.0	2.4	-2.1	1.3	-2.9*	17.8*	19.9*	2.4	-8.7*	9.6*	-0.1	-7.4*

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