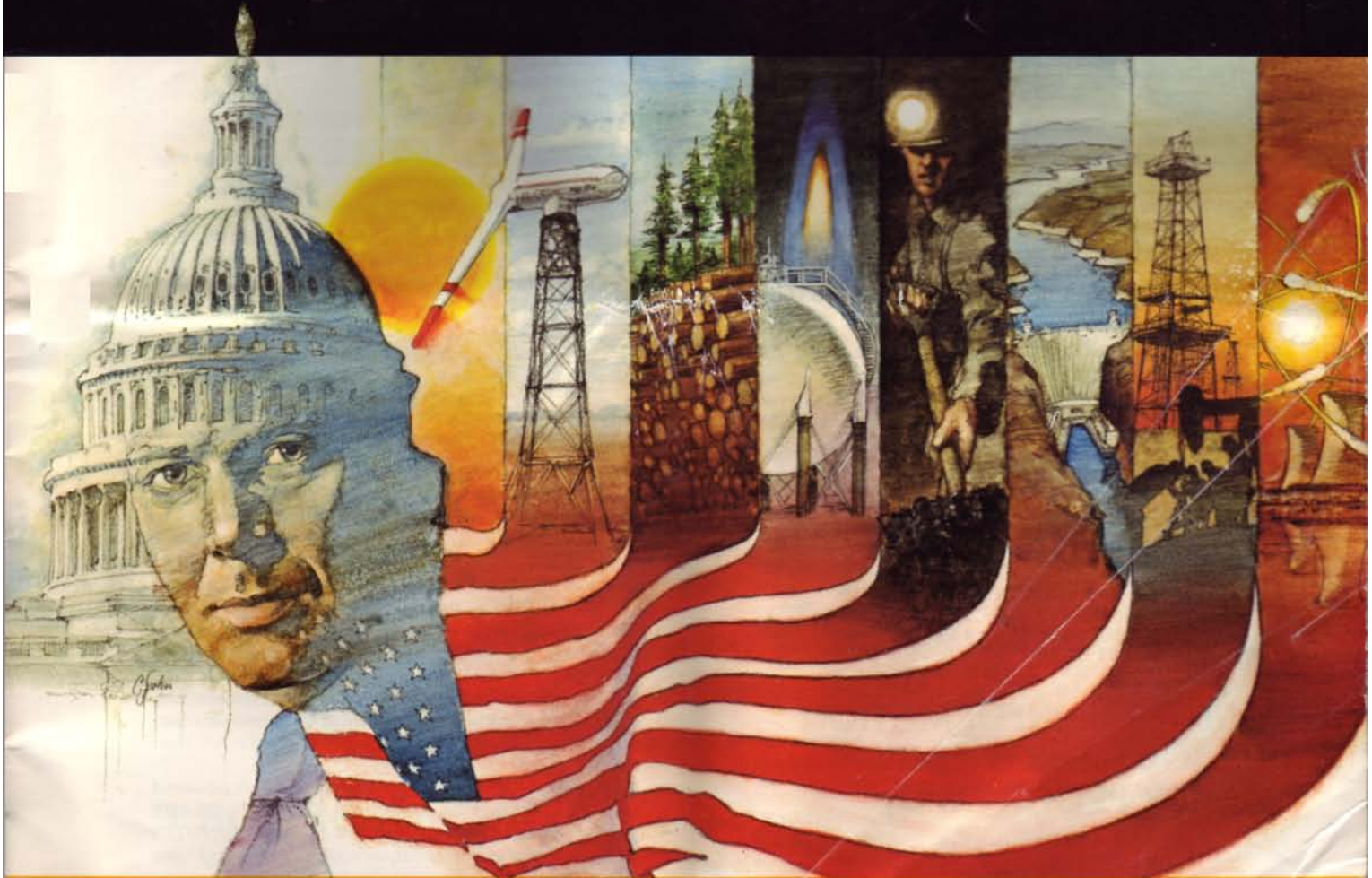ATARI®400*/800™

ENERGY CZAR

ATARI®

A Warner Communications Company

Model CX4121
Use with
ATARI® 400™ or ATARI 800™
PERSONAL COMPUTER SYSTEMS

*The ATARI® 400™ Personal Computer System must be upgraded to 16K of RAM at an ATARI Service Center

CONTENTS

1 GENERAL INFORMATION ABOUT THE ENERGY CZAR PROGRAM

AGE RANGE

Ages 12 to adult.

PURPOSE

ENERGY CZAR™ is a colorful and entertaining way of introducing users to the fundamental problems of the U.S. energy economy. It offers first-hand experience in formulating energy policy, explores energy policy bias, and leads users to discover for themselves the difficult trade-offs that must be made between energy needs, environmental considerations, economic factors, and political realities.

SKILLS

ENERGY CZAR develops the following skills:

- Logical thinking
- Creative problem-solving
- Effective decision-making
- Ability to see cause and effect relationships
- Recognition of patterns in complex systems.

CATEGORIES OF USE

- Education
- Recreation
- Personal Development

2 SETTING UP

ATARI® COMPONENTS REQUIRED

1. ATARI 800™ or upgraded ATARI 400™ Personal Computer System with:

   - 16K (minimum) Random Access Memory (RAM)
   - ATARI BASIC Computing Language cartridge

2. ATARI 410™ Program Recorder

3. ATARI ENERGY CZAR Program Cassette.

LOADING THE CASSETTE PROGRAM

1. Connect your **ATARI 800** or upgraded **ATARI 400 Personal Computer System** to your television set as instructed in your Operator's Manual.

2. Connect the data cord attached to your **ATARI 410 Program Recorder** to the **PERIPHERAL** connector on the right side of your ATARI Personal Computer System.

   NOTE: If you have "daisy chained" other ATARI units such as an ATARI Disk Drive and Printer to your computer, connect your ATARI 410 Program Recorder to the I/O Connector of the last unit in the chain.

3. Connect the power cord attached to the ATARI 410 Program Recorder to a wall outlet (110/115 VAC).

4. Make sure that at least **16K RAM** is installed in your ATARI Personal Computer System. See your Operator's Manual for Memory Module loading instructions.

5. Insert the ATARI BASIC Cartridge into the cartridge slot of your ATARI Personal Computer System. Use the LEFT CARTRIDGE slot on the ATARI 800 Personal Computer System.

6. Turn on your television set.

7. Turn on your ATARI Personal Computer System. The POWER switch is on the right side of the computer console.

8. If all equipment is properly connected and powered up, your television screen should display the **READY** prompt, with the white cursor just below. (See NOTES at the end of these installation instructions if you have loading problems.)

9. Press **STOP/EJECT** on your ATARI 410 Program Recorder to open the cassette door.

10. Hold the ATARI ENERGY CZAR Program Cassette so that the cassette label (Side 1) is up and the tape leader is facing you.

11. Slide the cassette into the cassette holder and close the door.

12. If necessary, press **REWIND** to rewind the tape to the beginning of the program. When the tape is rewound, press **STOP/EJECT**.

13. Type **CLOAD** on the computer keyboard and press **RETURN**. The computer will "beep" once to remind you to press **PLAY** on the Program Recorder.

14. Press **PLAY** and the **RETURN** key to start the tape. Through the window in the Program Recorder, note that the tape is turning. The "beeps" and other sounds you hear coming from the television speaker tell you that ENERGY CZAR is being loaded into computer RAM.

15. When the television screen displays the **READY** prompt, ENERGY CZAR has been loaded into the computer.

16. Type **RUN** and press **RETURN** to start the ENERGY CZAR simulation.
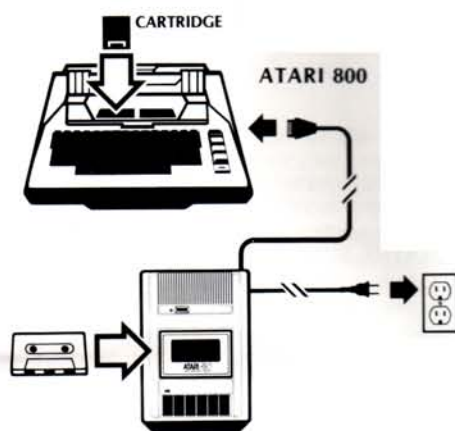

Figure 1. Installation of the ATARI 410 Program Recorder, BASIC Cartridge, and ENERGY CZAR Cassette

NOTES: If an ATARI Disk Drive is connected to the computer, the Disk Operating System (DOS) and system software use some of the available RAM, in addition to the RAM required to run your program. The amount of RAM required by DOS depends upon the version of DOS you are using. This overhead should be taken into account when calculating the amount of RAM required to run a program.

If you have problems loading ENERGY CZAR and you have peripherals in addition to the Program Recorder attached to the computer console, try disconnecting the other peripherals and connecting the Program Recorder directly to the console to isolate the problem. If problems persist, consult the ATARI 410 Program Recorder Operator's Manual.

3 HOW TO PLAY ENERGY CZAR

WHAT IS ENERGY CZAR?

ENERGY CZAR is an educational simulation of the energy situation in the United States. A simulation is a simplified representation or working model of a real-world system, process, or problem. ENERGY CZAR lets you try to solve the problems of increasing demand, decreasing supplies, and rising costs of energy. As you attempt to solve these and other energy problems, you will learn a great deal about energy, economics, and politics.

THE SCENARIO

The year is 1980. The President of the United States has just appointed you Energy Czar and given you full power to guide the nation through the energy crisis. You have practically unlimited power to regulate eight energy resources: coal, oil, natural gas, uranium, hydroelectric power, solar power, wind power, and biomass. (Biomass includes synthetic fuels such as gasohol and byproducts such as methane gas from decomposition of organic matter.) You can promote or restrict supplies of these energy resources, ration them, raise or lower taxes on them, regulate prices, and tighten or loosen environmental controls. Whatever legislation you propose will be enacted.

WINNING AND LOSING

To stay in power, you must keep the people happy and maintain sufficient energy supplies to meet the demand for energy. If you fail to satisfy these requirements, you will be fired.

Every five years you face the **PUBLIC OPINION POLL**, which rates your overall performance and the effect your policies have had on three vital issues:

- Growth of the economy
- Inflation
- Deaths from accidents and pollution.

At least 20% of the people must think you are doing a good job on each of these issues or you lose your job. At least 30% of the people must approve of your overall performance or out you go!

You win and become a **NATIONAL HERO** if at least 75% of the people think you are doing a good overall job. You can then retire to the country and write your autobiography. Naturally, the goal is to become a NATIONAL HERO.

HOW TO BECOME A NATIONAL HERO

First, follow the simulation walk-through to learn what policy decisions you can make. Then read the next section, **Policy Options**, to find out what effect your policy decisions will have on the economy and your popularity. Also read **Hints on Winning**, the **Energy Primer**, and **Limitations of the Simulation**.

In the **Appendix**, sample forms are provided for your convenience in recording the information given on the graphs and the energy legislation you enact. While it is not essential to keep these records, they can help you understand the ratings in the Public Opinion Polls and can aid you in planning your strategy for becoming a NATIONAL HERO.

If you want more information about energy, there are some interesting books listed in the **Bibliography**. You might also like to debate some of the issues outlined in **Some Dilemmas to Think About**.

SIMULATION WALK-THROUGH

Running the Simulation

After you have loaded ENERGY CZAR, type **RUN** and press the **RETURN** key to start the simulation.

The first frame is the title frame with instructions to **PLEASE WAIT**. After a few moments, **CHOOSE A BIAS** is displayed (Figure 2).

Figure 2. CHOOSE A BIAS

Figure 3. MENU for 1980

Choosing a Bias

ENERGY CZAR has been designed to reflect three different energy biases:

A   PRO FOSSIL

B   PRO NUCLEAR

C   PRO SOLAR

Your bias selection tells the computer which set of numbers to use to determine prices, supplies, and safety factors for each of the eight energy resources. The set of numbers the computer uses affects many of the most important calculations. For example, the set will determine how abundant each energy resource is, how easy it is to develop and expand, and how safe it is.

The **PRO FOSSIL** set favors fossil fuels such as coal and oil. It is designed to reflect the following attitudes: fossil fuels are clean, cheap, and unlimited; nuclear energy is not as safe as fossil fuels and is rather expensive; solar, wind and biomass are impractical and very expensive.

The **PRO NUCLEAR** set reflects the attitude that nuclear energy is clean, cheap, and unlimited and solar, wind, and biomass are impractical and too expensive.

The **PRO SOLAR** set reflects the argument that solar, wind, and biomass are the cleanest, safest, and most abundant sources of energy, whereas coal, oil, and the waste products from nuclear energy pollute the environment and endanger all life forms.

The bias you select can affect the time it takes you to become a NATIONAL HERO. With the PRO FOSSIL bias you have a good chance of winning early in the simulation, within the first 20 years. After 20 years winning becomes more difficult with this bias and easier with the PRO NUCLEAR bias. With the PRO SOLAR bias, winning is more likely after 40 or 50 years.

For more information about the effects of the biases, see **DEATHS Graph** and **Public Opinion Polls**.

You will understand the energy crisis better if you will try each bias and work with it. If you select PRO FOSSIL, push fossil fuels. If you choose PRO NUCLEAR, promote uranium. If SOLAR is your bias, urge solar power, wind, and biomass. For this walk-through, select the **PRO FOSSIL** bias. Type **A**. The MENU for 1980 will appear (Figure 3).

The MENU

You begin every five-year term as Energy Czar with a **MENU**. The MENU reminds you what year it is and displays your choices. There are five graphs with policy options: **PRICES, TAXES, DEATHS, SUPPLY,** and **USAGE**. The **OVERALL VIEW** graph is a study graph that shows you the state of energy and the U.S. economy for the year given on the MENU. You do not have to select the graphs in the order shown on the MENU. You might want to start, for example, with the OVERALL VIEW graph and then go back to the other five graphs.

After you have studied the graphs and selected your policy options, you can **ENACT LEGISLATION**, unless you decide to **QUIT** being Energy Czar. More about this later.

To select a graph, type the first letter of its name. **ONLY TYPE THE LETTERS SHOWN ON THE LEFT SIDE OF THE DISPLAY. TYPING ANY OTHER LETTERS WILL SOUND THE BUZZER AND BRING UP THE "REMINDER" DISPLAY (Figure 4).**

Now let's look at the **PRICES** graph (Figure 5). Type **P**.

Figure 4. REMINDER Display

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Figure 5. PRICES Graph for 1980

Figure 6. TAXES Graph for 1980

PRICES Graph

This graph shows the current prices of the eight energy resources considered in the ENERGY CZAR simulation. Each price is in billions of dollars per quad of energy. For example, Figure 5 shows that the price of BIOMASS is $15 billion per quad. A **quad** is one quadrillion **British thermal units (Btu's)**. A Btu is a unit of energy. A typical home gas furnace releases approximately 60,000 Btu's per hour. If the furnace runs for 24 hours, it releases approximately 1,440,000 Btu's. Of course, when we talk about the nation's energy we do not talk about millions of Btu's, we talk about quadrillions of Btu's. The short term for quadrillions of Btu's is "quads" (sometimes abbreviated to **Q** in ENERGY CZAR).

As Energy Czar, you have the option to freeze or thaw prices. The **F** or **T** to the left of the graph bar tells you whether the price of a resource is frozen or thawed. In 1980 no prices have been frozen; therefore, you may choose to freeze prices or let them fluctuate with the market. Before you decide, you might want to review the next section, **Policy Options**, for some information about supply and demand, supply and price, and the effects of freezing prices.

To freeze a price, type **F** to move the blinking cursor up to the FREEZE row. Then enter the first letter of each resource whose price you want to freeze. For example, in Figure 5 the letters C, O and N have been entered for coal, oil, and natural gas. Enter each resource only once. Freezing a price more than once accomplishes nothing.

NOTE: In this program you do not press the RETURN key after entering the letters. If you press RETURN by mistake, the buzzer will sound to remind you to press **M** for **MENU** instead.

In your second term as Energy Czar, you might want to thaw prices. To do that, enter the first letter of each of the frozen resources in the THAW row. If the cursor is on the FREEZE row, type **T** to move it down to the **THAW** row.

If you make a mistake or change your mind and want to remove a letter, use the DELETE key. This key backspaces and deletes one letter at a time.

NOTE: If you should accidentally press the BREAK key and stop the simulation, type **GOTO 330** and then press RETURN. This should bring up the **MENU**. If it does not, restart ENERGY CZAR by typing **RUN**.

When you have finished with the PRICES graph, type **M** to return to the **MENU**. You always have to return to the MENU

before you can bring up a different display. Now type **T** to see the **TAXES** graph (Figure 6).

TAXES Graph

You have the option to raise or lower taxes on the energy resources listed on this graph. Taxes are levied on production and are passed on to the consumer in the form of higher prices for finished goods. Every time you levy a tax you raise $1 billion per quad in revenues. However, the Energy Czar only gets one-tenth of this revenue. The rest is allocated to other government agencies and departments. The Energy Czar can spend tax revenues on subsidies for some energy resources and on legislation to restrict the exploitation or development of other resources. More about this when we review the **SUPPLY** graph.

The number to the left of the graph bar indicates the number of times a resource has been taxed. In Figure 6, the number 1 indicates that oil has been taxed once as of 1980. The zeros show that no other energy forms have been taxed to date. The number under the name of the resource shows the amount of the tax. Oil has been taxed $1 billion per quad of energy.

To raise a tax, type **R** to move the cursor to the **RAISE** row. Then enter the first letter of each of the resources to be taxed. You can enter a letter more than once if you want to levy a heavier tax on a particular resource. In Figure 6, coal has been taxed twice and natural gas once. You are limited to eight letters per row.

To lower or remove a tax, type **L** to move the cursor to the **LOWER** row. Then enter the first letter of each of the taxed resources. In 1980 you can remove the tax on oil or let it stand.

Before you decide what to do, you might benefit from reading **Tax Policies** in the next section, **Policy Options**.

When you have finished with the TAXES graph, type **M** to return to the **MENU**. Then type **D** and look at the **DEATHS** graph (Figure 7).

DEATHS Graph

The **DEATHS** graph displays the human cost of producing and using energy resources. It shows the number of people who died from accidents and diseases related to the production and use of energy resources over a five-year period. The DEATHS graph shown in Figure 7 tells you that between 1975 and 1980, 6000 people died from diseases and accidents related to the production and use of coal. According to this graph, oil took the largest toll (10,000 deaths), uranium was responsible for 15 deaths, solar energy for 20, and biomass for 60.
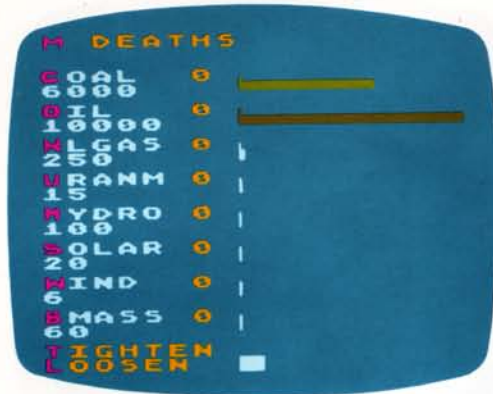
Figure 7. DEATHS Graph for 1980, PRO FOSSIL Bias

Figure 9. DEATHS Graph for 1980, PRO SOLAR Bias

In 1980 the statistics on energy-related deaths shown on the DEATHS graphs vary with the bias selected. This reflects the fact that in real life statistics on energy-related deaths actually do vary with the bias of the people who make the estimates. Figure 7 reflects the **PRO FOSSIL** bias. Compare it with the PRO NUCLEAR DEATHS graph (Figure 8) and the PRO SOLAR DEATHS graph (Figure 9).

According to the **PRO NUCLEAR** graph, 12,000 deaths were attributable to coal and 24,000 deaths to oil. Nuclear energy (uranium) was responsible for only 10 deaths.

The **PRO SOLAR** graph states that the production and use of nuclear energy caused 1000 deaths, coal caused 24,000 deaths, and oil was responsible for 30,000 deaths. Only one death was traced to solar energy and only two deaths to biomass forms of energy.

When we were researching energy-related deaths for ENERGY CZAR, we found that even reliable statistics varied, so we could not in good conscience settle on any one set of statistics. Since ENERGY CZAR is a simulation of the real energy situation, we decided to incorporate the statistical variations in ENERGY CZAR. Later on, when we talk about the **PUBLIC OPINION POLL**, you will see what effect the different death statistics have on the polls.

For the other graphs (**PRICES, TAXES, SUPPLY** and **USAGE**) there is only one set of values. Of course, the changes in these graphs after 1980 reflect the bias chosen as well as the legislation enacted, but at the outset you will get the same set of figures no matter which bias you choose.

In the DEATH graphs, the numbers to the left of the graph bars show how many times environmental controls were tightened in a five-year period. Figures 7, 8 and 9 show that no controls have been tightened as of 1980; therefore, you can tighten controls or leave them as they are. To tighten environmental controls, type **T** to move the cursor to the **TIGHTEN** row. Then enter the first letter of each of the resources on which you are placing tighter environmental controls. To put much stricter controls on a resource, type its letter more than once. You can enter up to eight letters per row.

Later on if you want to loosen controls, enter the appropriate letters in the **LOOSEN** row. Type **L** to move the cursor down to the **LOOSEN** row.

The ENERGY CZAR simulation assumes that tightening controls decreases deaths and loosening them increases deaths. However, there are other economic effects of tightening controls. We suggest that you read **Environmental Controls** in the next section, **Policy Options**, before you make a decision to tighten controls.

When you are finished studying the DEATHS graph, type **M** to return to the **MENU**. Then type **S** to see the **SUPPLY** graph (Figure 10).

Figure 8. DEATHS Graph for 1980, PRO NUCLEAR Bias

Figure 10. SUPPLY Graph for 1980

Figure 11. SUPPLY Graph for 1985

SUPPLY Graph

Your option is to promote or restrict production of the energy resources listed on the graph. It is assumed that promoting a resource means subsidizing it, and restricting a resource means passing legislation to restrict its exploitation or growth and development. Restrictive measures would include laws against mining, drilling, or building power plants in certain locations or under certain conditions.

The amount of energy supplied by a resource is shown under the name of the resource and is in quads. For example, Figure 10 shows that oil can supply 720 quads of energy; uranium, 40 quads; and solar, 2 quads. Oil supplies more energy than nuclear or solar because it has been exploited more and its reserves are much greater.

The number to the left of the graph bar indicates the degree of exploitation of the resource and also its potential for development or further supply. The higher the number, the greater its degree of exploitation and the lower its potential for further supply. In other words, the more you take, the less you can get. In Figure 10, hydroelectric power has a rating of 90; therefore its potential is very poor. Solar has a rating of 10; its potential is very good.

When you promote a resource, you increase the available energy from that resource, but you lower its potential for further supply. When you restrict a resource, you decrease the available energy from that resource and increase its potential for further supply.

Every time you promote or restrict a resource, you will increase or decrease the number to the left of the graph bar by one. If you promote or restrict a resource twice, you change the number by two. The increase or decrease shows on the next **SUPPLY** graph, after you have enacted legislation. Compare Figures 10 and 11.

In addition, every time you promote or restrict a resource, you spend $10 billion of tax revenues. You can only spend as much money as you have in tax revenues. No deficit spending is allowed. The **REVENUES** bar on the **OVERALL VIEW** graph tells you how much money you have in revenues.

You can enter as many as eight letters in each row on the SUPPLY graph, and you can enter a letter more than once. However, before you enter any letters, you should read **Policy Options** to find out what the overall effect of your decisions will be.

When you are finished with the SUPPLY graph, type **M** to return to the **MENU**. Then type **U** to bring up the **USAGE** graph (Figure 12).

Figure 12. USAGE Graph for 1980

USAGE Graph

The **USAGE** graph shows how many quads of each energy resource have been used over the past five years. For example, the graph for 1980 (Figure 12) shows that the U.S. used 80 quads of coal, 200 quads of oil, and 100 quads of natural gas between 1975 and 1980. More oil was used than any other energy resource listed.

Your option is to ration resources for the next 5 years or allow them to be used freely. The letter to the left of the graph bar shows whether the resource is **rationed (R)** or **free (F)**. Figure 12 shows that no resources have been rationed in 1980. If you ration any of them, you will restrict usage to the quad level shown on the graph. Usage may drop but it cannot increase above the level shown on the graph at the time you impose rationing.

Rationing is unpopular. You can expect to be less popular if you ration any energy resources. The effects of rationing are discussed under **Policy Options**. Read both **Rationing** and **Price Freezes**.

When you have finished with the USAGE graph, type **M** to return to the **MENU**. Then type **O** to review the **OVERALL VIEW** graph (Figure 13).

Figure 13. OVERALL VIEW Graph for 1980

OVERALL VIEW Graph

This graph displays the status of energy and the economy at the end of a five-year period. The **OVERALL VIEW** graph is for study only; there are no options to exercise. Study it carefully. It will help you decide what legislation to enact. After reviewing it, you may want to change some of your options before you enact legislation. Let's see what the state of energy and the economy is according to the **OVERALL VIEW graph for 1980** (Figure 13):

SUPPLY: The total supply of energy is 1426 quads.

DEMAND: The total demand for energy is 403 quads.

TAX: The average tax on energy resources is $0.15 billion per quad.

PRICE: The average price of energy is $14.88 billion per quad. The lower graph bar represents the current period. The upper bar represents the previous period. You can see that prices increased during the period of 1975-1980.

GNP: The Gross National Product (GNP) is the total market value of finished goods and services over a period of time. For the period 1975-1980 the GNP averaged $2000 billion per year.

GROWTH: The growth rate of the economy is based on the total increase in the output of consumer goods and services in a given period of time. For the period 1975-1980 the growth rate was estimated at 0.025 or 2.5% per year.

REVS: Tax revenues available to the Energy Czar total $50 billion.

DEATHS: The total number of deaths resulting from the production and use of all energy resources during the period 1975-1980 is 16,500.

When you have finished reviewing the OVERALL VIEW graph, type **M** to return to the **MENU**. Then you can type **Q** to **QUIT** playing Energy Czar, **E** to **ENACT LEGISLATION**, or any of the graph letters if you want to review your policy options before enacting legislation. You can call up the graphs in any order. Just remember to return to the **MENU** each time you have finished with a graph.

Enacting Legislation

When you are satisfied with your policy options, return to the **MENU**. Then type **E** to ENACT LEGISLATION. **PROCESSING PLEASE STAND BY** will appear and a countdown will begin. The countdown gives the computer time to evaluate your decisions and compute their effect on energy, the economy, and public opinion.

Public Opinion Polls

When the countdown reaches zero, the computer displays the **PUBLIC OPINION POLL** (Figure 14). The results of the poll will determine whether you are fired, can continue for the next five years, or become a **NATIONAL HERO**. To continue as Energy Czar, you must receive a rating of at least 20% on each of these vital issues:

- **GROWTH** rate of the economy
- **DEATHS** per quad of energy used
- **INFLATION** (energy prices).

Your **OVERALL** rating must be at least 30% or you lose your job. An OVERALL rating of 75% or more makes you a **NATIONAL HERO**. That means you win and can retire with honors. Any OVERALL rating between 30% and 75% allows you to continue as Energy Czar for another five years.
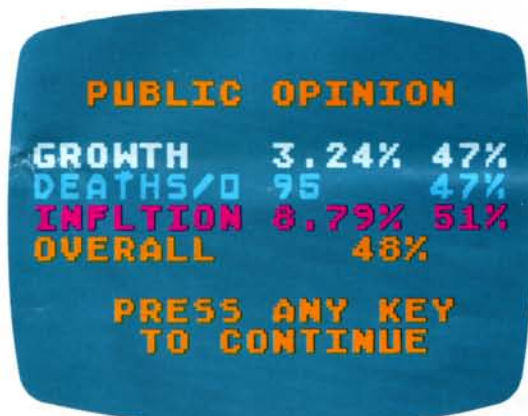

Figure 14. PUBLIC OPINION POLL for 1980
PRO FOSSIL Bias

Figure 15. PUBLIC OPINION POLL for 1980
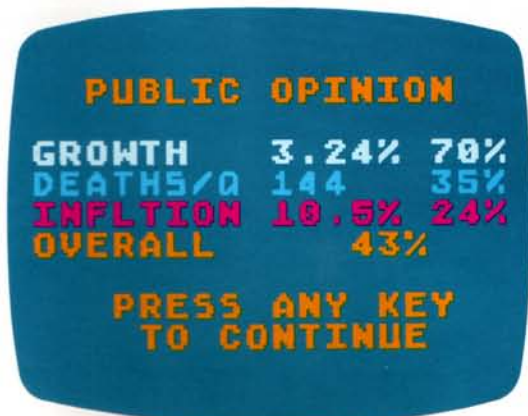PRO NUCLEAR Bias

Figure 16. PUBLIC OPINION POLL for 1980
PRO SOLAR Bias

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The **PUBLIC OPINION POLL** reflects the bias you chose at the start of ENERGY CZAR. Compare Figures 14, 15 and 16. These figures show the effect of doing nothing during your first term as Energy Czar except selecting the bias. (**NOTE:** This does not mean that we recommend you do nothing during your first term as Energy Czar. You cannot become a NATIONAL HERO by doing nothing!)

GROWTH: The growth rate of the economy is based on the change in the **GNP** from one period to another. A steady growth rate indicates a healthy economy, and that means jobs, availability of capital and goods, and opportunities for advancement. The 3.24% rate shown in Figures 14, 15 and 16 is based on the real growth rate of the U.S. economy over the past 80 years (3 to 4%). You can see that while the rate of growth given in the polls does not vary with the bias chosen, the public's acceptance of that rate does vary. People do not necessarily agree on what an acceptable rate of growth is. In Figures 14 and 15, 47% of the people polled said that 3.24% was an acceptable rate of growth. In Figure 16, 70% said it was acceptable.

DEATHS/Q: By comparing Figures 14, 15 and 16 you can see that the Deaths per Quad rate varies with the bias. The polls reflect the DEATHS graphs (Figures 7, 8 and 9). The PRO NUCLEAR and PRO SOLAR estimates of deaths due to the production and use of coal and oil are significantly higher than the PRO FOSSIL estimates. It is mainly these estimates that have influenced the DEATHS/Q rate given in the polls.

When the PRO NUCLEAR bias is selected, the DEATHS/Q rate goes down as the country turns toward nuclear power. When the PRO SOLAR bias is selected, the DEATHS/Q rate declines with the decline in fossil fuels and the trend toward solar energy and biomass fuels.

INFLATION: The inflation rate given in the polls is the inflation in energy prices, over and above the general inflation. The inflation rate is based on the bias selection, with the advantage going to the PRO FOSSIL bias. A comparison of Figures 14, 15 and 16 shows that the PRO NUCLEAR estimate of inflation is much higher than the PRO FOSSIL estimate, and that the PRO SOLAR estimate is nearly double the PRO FOSSIL estimate. The PRO FOSSIL bias has an edge on inflation because it assumes that expansion of fossil fuel supplies, which make up the largest part of our energy mix, can be done cheaply. The other two biases reflect more pessimistic views of the costs of expanding the fossil fuel economy.

The year 1980 is the worst year for inflation, regardless of bias. After 1980, inflation declines and is less affected by bias.

OVERALL: In the **PRO FOSSIL** poll, 65% of the people polled thought that the Energy Czar was doing a good overall job. Since we currently live in an economy dependent on fossil fuels, people are happy with the policies of a PRO FOSSIL Energy Czar. With this bias, the czar has an advantage for an early win.

The **PRO NUCLEAR** poll shows that in 1980 people are not very content with the state of energy and the economy. Only 48% of the people polled are happy with the Energy Czar. You will have to work harder to become a NATIONAL HERO when you select this bias. Be careful what you do in the first 20 to 25 years. After 25 years, nuclear power becomes more important.

The **PRO SOLAR** Energy Czar has the hardest time at the outset. Only 43% of the people polled are satisfied with the Energy Czar in 1980. Inflation is up to 10.5%, and the deaths per quad rate stands at 144. The PRO SOLAR Energy Czar will have a hard time changing energy habits and turning the economy around. The job becomes easier as time goes on. During the first 20 to 30 years, be careful what you do. Remember that rapid change is seldom popular.

1985 and Beyond

The graphs for 1985 and the following 5-year periods show two graph bars for each energy resource. The upper bar depicts the status at the end of the previous period. The lower bar depicts the current status. By comparing the bars you can see at once whether prices, taxes, deaths, supplies, and usage have increased, decreased, or remained constant.

All the graphs for 1985 and beyond will show changes in quantities. Unless they were frozen in the previous period, prices will have risen, and taxes, deaths, supplies, and usage will have altered. These changes reflect the legislation you enacted during your previous terms as Energy Czar as well as normal economic changes that we have projected.

To see what changes have been projected for 1985, look at the **OVERALL VIEW** graph for 1985, Figure 17. This graph does not reflect any legislation enacted in 1980, only normal economic changes.

Figure 17. OVERALL VIEW Graph for 1985

The graph shows that while the supply of energy has decreased, the demand is also down, and supply remains almost four times the demand. With this ratio, shortages are not likely to occur. Taxes have doubled since 1980, and revenues have increased as a result. Compare Figure 17 with the OVERALL VIEW graph for 1980 (Figure 13). You can see that prices have risen moderately and the GNP has increased by $345 billion. Since 1980 the growth rate has increased reasonably, and the death rate has remained more or less constant.

Each new term in office, you repeat the process of studying the graphs and choosing options. It is always a good idea to look at the OVERALL VIEW graph before you review the other graphs and select options. When you are satisfied with your choices, enact legislation and see what the poll says.

4 POLICY OPTIONS

SUPPLY AND PRICE

The ENERGY CZAR simulation assumes that the amount of an energy resource available for use (supply) is proportional to the price we are willing to pay for it.

Take coal as an example. Some coal lies close to the surface in rich, thick deposits. It is easily mined and therefore relatively cheap. Other coal deposits are thinner and lie deeper. They are harder and more expensive to mine. The

coal mining companies naturally mine the cheap coal first. But as that supply is burned up, they have to mine deeper and deeper. Thus, the price of coal goes higher and higher as coal is used.

Renewable energy forms such as hydroelectric power, wind, solar, and biomass are not burned up like fossil fuels, but the supply/price relationship holds for them too. Take wind for example. Harnessing the wind's energy requires land for the erection of windmills, but good sites are limited. The good sites are very windy and give lots of energy for a small investment. Wind power produced at these sites will be relatively cheap. Less windy sites supply less wind power, but the cost of producing that power is the same. Therefore, wind power produced at these sites will be more expensive. When windmills have been erected at all the good sites, the less desirable sites will be used. Thus, the price of wind power will increase as more wind energy is used, even though wind is a renewable energy resource.

The economic difference between renewable and nonrenewable energy resources only becomes apparent when use of an energy resource remains constant. Then the price of a nonrenewable form of energy will increase while the price of a renewable form of energy will remain constant.

SUPPLY AND DEMAND

Gradual price increases should not worry you as long as you do not allow shortages of popular energy resources to occur and you keep the energy market competitive. Higher prices tend to stimulate supply, since producers work harder to expand and develop resources if the profits are attractive. In general, you should try to keep the supplies of energy resources at approximately three times the demand to keep prices stable. Remember that you can be fired for losing the supply of any vital energy resource.

Demand for energy is stimulated by the growth of the economy and discouraged by rapid price increases. Demand also shifts away from expensive energy forms and toward cheaper ones, assuming that cheaper ones are available.

Promoting competition among energy resources (see **Subsidies**) helps to conserve resources that are in short supply, keep prices in line, discourage inflation, and stimulate growth of the economy. However, there are some problems associated with promoting alternative resources. It takes time for the public to react to change and modify its habits, and it takes time to obtain the capital outlay that may be required for new or modified equipment. Do not expect immediate results from this approach.

PRICE FREEZES

Prices can be kept down by freezing. This will lower inflation, which will increase your popularity at the polls. However, there are trade-offs to consider. Price freezes dampen incentives to expand or develop resources. At the same time, they promote usage if the resulting prices are attractive. The result of reduced production and increased usage is shortages, and shortages can be very bad news for the Energy Czar.

What happens if you freeze a price and then thaw it? The price will rise rapidly, and the resulting inflation may defeat you at the polls if inflation is already critical.

Price freezes are tricky. If you freeze prices, always guard against increased usage and shortages. Promoting (subsidizing) the frozen resources will help keep production up and prevent shortages. Also, promoting cheaper resources will deflect usage from the frozen resources and help prevent shortages. Of course, the supplies of the alternative resources have to be sufficient to meet demand for energy or the subsidies will not prevent shortages.

If these tactics do not work, you may be forced to ration. Rationing is unpopular and will hurt you at the polls, but the loss in popularity is temporary and can be overcome (see **Rationing**).

Do not rule out price freezes. They immediately lower inflation and thus help you at the polls. The extra points you win will often be the only way to become a NATIONAL HERO, assuming that you have not done anything to hurt your ratings on deaths or growth. After you become a NATIONAL HERO, you can leave the problem of what to do about the price freeze to your unfortunate successor.

TAX POLICIES

Taxes raise revenues that the Energy Czar needs to promote (subsidize) or restrict supplies of energy resources. Revenues will be greater if you tax heavily used energy resources. In addition, a high tax on a heavily used energy resource can reduce use of the resource, if you feel that shortages are likely to occur and you want to shift usage to other resources. However, high taxes tend to increase inflation, since producers pass the tax on to the consumers. As a rule of thumb, it is safer to raise taxes in periods of low inflation than in periods of high inflation.

ENVIRONMENTAL CONTROLS

Tightening environmental controls reduces deaths; loosening them increases deaths. But there is more to environmental controls than that. On the one hand, a lower death rate will improve your rating at the polls. On the other hand, producers will pass the cost of tighter environmental controls on to consumers and prices will rise.

Tightening controls has a diminishing returns effect. The first 50 percent of pollution is easy to clean up and will not have a drastic effect on prices. After that, pollution control will be more expensive, will have a dampening effect on production, and will increase prices sharply. If sufficient supplies of cleaner, cheaper resources are available, people will use them. If not, they will be forced to pay the high prices and inflation will spiral. In general, it is better not to impose very strict environmental controls in times of high inflation.

SUBSIDIES

Promoting (subsidizing) an energy resource is very safe. The supply will increase, the price will rise more slowly, and inflation will be reduced. In general, the least developed energy forms with the highest potential (solar, biomass, and uranium) will give the largest percentage gain per dollar. However, it may take some time to realize sufficient benefits from the investment. A resource with a large supply will show a larger absolute increase in supply in a shorter time.

For example, compare a $10 billion subsidy of solar energy with a $10 billion subsidy of coal. The coal subsidy may produce only a 1-percent increase in the supply of coal, whereas the solar subsidy may produce a 10-percent increase in the supply of solar energy, but the solar subsidy is not necessarily the best short-term investment. If the total supply of coal is 400 quads and the total supply of solar energy is 2 quads, the coal subsidy will increase the coal supply by 4 quads, whereas the solar subsidy will increase the solar energy supply by only 0.2 quad.

Of course, the results of your investment are cumulative, and the long-term gain from investing in solar energy may justify the investment. It all depends upon your long-term expectations and your willingness to accept short-term penalties in exchange for long-term benefits.

RESTRICTIONS

Restricting growth of a resource has many disadvantages. It uses up revenues, encourages shortages, increases prices,

and contributes to inflation. Promoting the competition is a better means of curtailing use of a particular resource. Restrictive legislation, like high taxes and strict environmental controls, is not advisable in periods of high inflation.

RATIONING

Although you might feel that rationing is necessary in some instances, there is no denying that it is unpopular. If you ration any energy form, your overall rating will suffer. The amount by which your popularity will decrease will depend upon how much energy you ration. If you ration all energy resources, your rating will drop by about 50 percent, enough to guarantee your removal from office.

You can regain your lost popularity by freeing the energy resources you have rationed. Remember, however, that if you have also frozen prices, freeing the resources will probably increase usage, and you will have to guard against shortages.

5 HINTS ON WINNING

In the beginning, ENERGY CZAR can be frustrating. A new Czar often loses without understanding why. Here are some hints to cut your losses.

A SIMULATION IS NOT THE REAL WORLD

Like all simulations, ENERGY CZAR is not a perfect reproduction of the real world. For example, ENERGY CZAR has been designed to reflect long-term effects, whereas many analysts now believe that the energy economy is more vulnerable to short-term changes. In addition, some policies that might actually work in the real world will not work in this simulation. For a better understanding of this, read **Limitations of the Simulation**.

RESULTS TAKE TIME

Many policies will not show any effects for the first five years. Thus, you may pursue a wise policy for awhile and then abandon it when you fail to see any immediate benefits from it. After adopting an unwise policy, you may begin to realize gains. These gains will be the result of the good policy you abandoned, but you may think they are the result of your current policy. Thus, you may continue your unwise policy, heaping error upon error until suddenly the game is lost. How can you avoid this mistake?

MONITOR THE GRAPHS

Carefully monitor all the economic indicators given in the graphs. These indicators reveal the future. For example, if the supply of an energy resource falls relative to usage, you can be sure that the price of that energy resource will soon rise, unless it is frozen. Conversely, if supplies rise relative to usage, you can be sure that the price of the resource will soon fall. By carefully monitoring the behavior of supplies versus usage, you can forsee what prices will be like 5 or 10 years into the future.

UNDERSTAND THE POLICY OPTIONS

It is also important to understand the policy options. For example, tightening pollution controls will bring down total deaths but may also decrease supplies and drive prices up. If you tighten environmental controls excessively, don't be surprised when inflation skyrockets 10 or 20 years later. We recommend that you study **Policy Options** and that you learn to think in terms of the effects your policies will have on the entire energy system.

GO EASY IN THE BEGINNING

In the early years of the simulation, the energy situation is dangerous. The simulation reflects the present off-balance posture of the U.S. energy economy and the high rate of inflation. A cautious approach is necessary until the economy has time to right itself. Then you can experiment.

LEARN ABOUT ENERGY

A good understanding of the energy technologies will increase your chances of success. You should read the **Energy Primer**, and you may also want to read one or more of the books listed in the **Bibliography**.

6 ENERGY PRIMER

This Energy Primer explains the capabilities, limitations, and problems associated with the eight energy resources considered in the simulation. Of these eight resources, hydroelectric power, solar, wind, and biomass are renewable; coal, oil, natural gas, and uranium are nonrenewable.

A renewable energy resource is constantly being renewed by nature. Sunlight is a good example. A nonrenewable energy resource is not being renewed by nature, at least not at a rate adequate for our needs. Oil is an example. Once we have used it, it is gone forever.

Clearly, our long-range goal must be to make the transition from nonrenewable resources to renewable ones. The main question is, how quickly must we make the transition? Should we abandon the nonrenewable energy resources for the renewable forms even while the nonrenewable resources are cheaper and more readily available?

COAL

Coal is a rock that comes from the decayed remains of plants that lived millions of years ago. Coal is thus a "fossil fuel" like oil and natural gas.

America has huge quantities of coal... at least several hundred billion tons, according to current estimates. The amount of energy this much coal can provide is staggering. It is enough to fuel the United States for at least the next hundred years. It is more energy than all the oil in all the Persian Gulf states can provide. Since this is true, you might ask, "Where's the energy crisis? We have plenty of energy!"

Coal may be more abundant than oil, but it is much more difficult to mine, transport, and use, and it pollutes worse than oil. It is easier to drill a well than dig a mine, and it is easier to pump oil through a pipeline than it is to load coal into a railroad car. Because coal is a rock, it does not burn as smoothly or as easily as oil or natural gas, and it cannot be treated as easily as oil. To make matters worse, coal is not a concentrated form of energy. You have to mine a ton of coal to get as much energy as you can from three barrels of oil.

But the most serious problem with coal is the pollution it causes. All coal has small amounts of sulfur in it. When we burn coal, the sulfur is released into the atmosphere as sulfur dioxide, which combines with water in the atmosphere to form sulfuric acid. The sulfuric acid returns to earth as "acid rain", which does much damage to lakes and crops.

Burning millions of tons of coal also releases hundreds of pounds of poisonous chemicals like arsenic, mercury, and lead and creates huge quantities of fly ash and slag. The slag is usually dumped into large fields, making the fields useless.

We can reduce many of these environmental problems by handling coal more carefully and by installing complex machinery that prevents much of the pollution from entering the atmosphere. There are techniques such as "coal liquefaction", which is the process of converting coal into a liquid fuel like gasoline. The coal liquefaction process is unfortunately very expensive, and the factory required for the conversion itself introduces some pollution.

Another technique under development is "fluidized bed combustion". This technique promises to burn solid coal more cleanly than conventional boilers. Unfortunately, fluidized bed combusters still will not provide a perfectly clean way to burn coal.

In summary, coal is a very abundant source of energy that can only be tapped if we are willing to accept serious environmental hazards or if we are willing to pay steep prices to prevent or clean up the pollution it causes. So far, it has been cheaper to buy oil from OPEC than to produce clean coal power.

OIL

Oil has been our primary source of energy for the last 30 years. It is cheap to obtain, simple to store and transport, safe to handle, easy to burn, and very concentrated. For these reasons we have used oil in huge quantities. We have used so much oil that the supply is dwindling. This problem is the core of the energy crisis today and for the next 30 years.

There is actually more oil in the earth than many people realize. Oil drillers used to walk away from oil fields because they thought they had pumped out all the oil. Today, thanks to more sophisticated recovery techniques, drillers are going back to the old fields to "squeeze" more oil out of them. They are also exploring for oil in new areas. Nevertheless, modern methods of recovery and exploration are expensive, and they will not change the fundamental fact that oil is nonrenewable and we are running out of it.

Although oil is cleaner than coal, it is not perfectly clean. In fact, the gasoline we burn in our automobiles is the greatest single source of air pollution in the country. Much progress has been made in reducing the amount of pollutants released by automobiles, but air pollution will never be totally eliminated as long as we use the gasoline engine to power automobiles.

There are other problems with oil: refinery fires, oil spills, tanker and pipeline accidents, and drilling rig disasters. These are spectacular events, but their threat to society is far less than the pollution caused by gasoline-powered automobiles.

NATURAL GAS

Natural gas is an excellent fuel. In many ways it is the opposite of coal. It is easy to get, easy to move, and very clean to burn. Unfortunately, it is also a rare fuel that we are rapidly depleting. Most studies indicate that by the end of this century natural gas will be on its way out. There is some hope that by vigorous exploration and by converting coal into gas (coal gasification) we can prolong the use of natural gas. But natural gas supplies will decline in any event, and prices will rise steeply.

URANIUM

Uranium is a natural resource that is used to produce nuclear energy. Nuclear energy can be produced by both fusion and fission techniques. Fission is the process of splitting an atomic nucleus to release large amounts of energy. Fusion is the process of uniting atomic nuclei to form heavier nuclei, a process that also releases large amounts of energy.

Although current light-water reactors can supply only a moderate amount of energy, breeder reactors and fusion reactors both promise to deliver huge supplies of energy, much more than coal can provide. For this reason, many people see nuclear energy as the answer to the energy problem.

Unfortunately, the development of nuclear energy is hampered by a combination of technological and political problems. Some of the political problems arise from the fear of radioactivity, although most experts say there is more danger from the burning of coal than from accidents in nuclear power plants.

The possibility that nations will use breeder reactors and nuclear energy processing techniques to manufacture and proliferate nuclear weapons is a much more serious threat to the world. New processing methods that would make it impossible to manufacture nuclear weapons are now being tested, but right now we do not know if they are 100 percent effective.

Centralizing the production and distribution of electricity, from any source, poses another serious problem. The utilities that build and operate electricity generating plants are government-regulated monopolies. Both monopolies and government regulation are considered unhealthy in our free-market system and are only tolerated as necessary evils. However, as we build more power plants, the utilities get bigger and the problem of regulating them fairly and efficiently grows more difficult.

Finally, there is the problem of capital intensity. Can we afford to build hundreds of nuclear power plants across the country when each plant costs a billion dollars?

HYDROELECTRIC POWER

Hydroelectric power is generated by moving water. We usually think of hydroelectric power in terms of dams on rivers, but it is also generated by harnessing the motion of water in tidal basins, bays, and estuaries.

Hydroelectric power is very clean and presents few safety problems, although dams fail more frequently and are more destructive than most people realize. Hydro poses only one significant environmental problem. Dams create lakes which destroy free-running rivers and threaten some species of aquatic life.

The principal problem with hydro is that we have dammed virtually every dammable site in the United States. Hence, hydro has very little capacity for expansion. The only real possibility is to set up a network of tiny dams on thousands of small sites scattered across the nation. Such a network would only make a small contribution to our nation's energy supplies. Thus, hydro, while useful, will not be a major source of energy in the future.

SOLAR POWER

Solar energy covers many kinds of technology, from simple solar water heaters to gigantic solar satellites beaming energy to earth. Solar heating, ocean thermal energy, solar cells, and solar power towers are all being developed. Only simple solar heating is economically practical at this time, and even that has not made much of a dent despite favorable tax incentives.

Many people have high hopes for the solar cell, which converts sunlight into electricity. As yet these devices are too expensive to be practical. However, if research is successful and prices decline sufficiently, we may some day see an economical solar cell.

There are fundamental limitations to solar energy which will certainly slow its growth as an industry. Solar energy is dif-

fuse. It requires large collectors operating for long periods of time to gather enough energy to be useful. In addition, the weather makes solar energy unreliable, so that energy storage or backup systems are required.

It appears that solar energy will have little impact on the nation until at least the end of the century. It will take many years to develop a solar industry that will rival the oil industry.

WIND POWER

In many ways, wind power is similar to solar power. On the one hand, it is diffuse and unreliable and requires large collecting areas with backup systems. On the other hand, wind power presents few environmental problems. About the only environmental objection to wind is the possibility that thousands of windmills covering the hillsides would be unsightly.

The real problem with wind energy is that not much of it is available. While wind power can be a handy supplement to our energy supply, it certainly cannot carry a major share of the load.

BIOMASS

"Biomass" is an impressive name for a simple energy concept. Biomass is any recently produced biological substance that can be used as fuel. For example, firewood is biomass. Sawdust and tree bark are forms of biomass that may produce some useful energy. Manure from feedlots and our garbage are biomass materials that can be used to produce fuels, and so are certain agricultural waste products like rice hulls or corn stalks.

Biomass materials are usually converted into fuels in one of two ways: They are fermented into alcohol and mixed with gasoline to make gasohol, or they are allowed to rot without oxygen to produce methane or natural gas.

A completely different approach is cultivation of the joboba plant. The joboba is a desert shrub which produces berries containing energy-rich oil. By planting many joboba plants and harvesting the oil, we can "grow" our own gasoline.

Biomass technologies are very young and not quite ready for use. Some day they may prove valuable. Nobody knows just how important they might be.

7 SOME DILEMMAS TO THINK ABOUT

QUESTION: WHAT IS THE BEST TRADE-OFF BETWEEN HUMAN LIFE AND CHEAP ENERGY? HOW MUCH IS A HUMAN LIFE WORTH?

You might be interested to know that your government values a human life between $50,000 (traffic safety spending) and several million dollars (radiation safety spending). How much of your own money are you willing to spend to decrease your chance of accidental death by, say, one percent? Should the government spend more or less than you are willing to spend?

QUESTION: IS THE WAY TO PEACE THROUGH MORE NUCLEAR POWER OR LESS?

Some people say that the spread of nuclear power plants leads to the spread of nuclear weapons, and that we must stop the spread of nuclear power plants to keep nuclear weapons out of the hands of small unstable countries. Other people say that the lack of nuclear plants makes countries more dependent on foreign oil, and this dependency causes tensions that will inevitably lead to a third world war. Who is right?

QUESTION: SHOULD AN ELECTED OFFICIAL DO WHAT HE THINKS IS BEST FOR HIS PEOPLE OR WHAT HIS PEOPLE THINK IS BEST?

You are the governor of a small state. A new power plant must be built. The power company wants to build a nuclear plant, but the people are opposed to it. If you don't build the nuclear plant, you will have to build a coal plant. Experts convince you that the coal plant will kill more people and do more damage to the environment than the nuclear plant, but you are up for reelection. What do you do?

QUESTION: WHEN IT COMES TO CONSERVING OR RATIONING GASOLINE, WHO IS TO DECIDE WHICH ACTIVITIES ARE THE MOST IMPORTANT?

This country uses entirely too much gasoline. We all agree that we must cut waste, reduce consumption. Every weekend Tom drives his camper to the mountains to get away from it all. Tom works hard at the factory all week, and this is his only recreation.

Dick drives all over the state going to political rallies, teach-ins, and organizational meetings. Dick says that this is really important work, vital to America's future.

Harriet is a talented young athlete. Every weekend during the season she drives to a different competition. She believes that if she does well she may win a scholarship to college or become an Olympic contender.
Which of these people is wasting gas? Who is to decide whether Tom's recreation is more or less important than Dick's political activities or Harriet's career as an athlete?

QUESTION: IF IT COMES TO A CHOICE BETWEEN ENERGY EFFICIENCY AND FREEDOM, HOW SHOULD WE DECIDE? WHO SHOULD DECIDE?

One way to organize society is to pack people into high-rise apartment buildings, take away their automobiles, and give them efficient mass transportation. Another way is to let each family have a house with a yard and a private automobile. There is no question that the first way is more energy-efficient and that the second way provides more freedom. Thus, we have a trade-off between energy efficiency and freedom. Suppose we had to make a choice. Who should make it? How should it be decided?

QUESTION: DO ALL PEOPLE HAVE AN INALIENABLE RIGHT TO A BASIC SHARE OF ENERGY RESOURCES?

Is energy a fundamental need and right like food, housing, and medical care? Do people have equal rights to a minimum amount of energy to light their homes, cook their food, run their refrigerators? How about their television sets? How much energy is a minimum?

8 LIMITATIONS OF THE SIMULATION

ENERGY CZAR is not intended to be a perfectly accurate simulation of the U.S. energy situation. It is an entertaining introduction to the fundamental problems of the U.S. energy situation and is intended to acquaint users with energy

economics, energy policy bias, and some legislative possibilities. When users accept ENERGY CZAR's limitations and use the simulation for the purpose intended, they derive maximum pleasure and benefit from it.

Practical considerations, such as the size of the simulation and the amount of information we could fit on the television screen, made it necessary to compromise on realism. For instance, we make the assumption that there is a linear relationship between the price of an energy resource and the supplies of that resource. We imply that we can double the supplies of energy by doubling the price. The real situation is much more complex than that.

Some economic interactions have been oversimplified and others have been left out of the simulation. For example, aggregate price increases have been allowed to influence growth more than is realistic, and the effect of capital intensity (concentration of capital) on development of resources has not been included. The reaction of demand to price takes into account aggregate prices, relative prices, and price increases, but elasticity of demand in relation to price is a constant and is the same for all resources. The simulation does account for indirect influences on the economy, such as adaptation of the public to changing circumstances and consumer inertia, but it has no way to relate these influences to causes.

The market is assumed to be a perfect market. Cartels, price-fixing, black markets, and consumer stupidity do not exist, and everyone behaves as he should. The influence of foreign politics on our economy is ignored, since there is no way to predict what might happen. Foreign energy imports are included in total supplies, but no distinction is made between domestic supplies and foreign supplies.

Unfortunately, we have had to ignore short-term effects, which many analysts now believe are more significant than long-term developments. Some energy experts say, for instance, that we are in no real danger of running out of energy resources. The real danger is that our supplies may be so tight that some event such as a cold winter coupled with an Arab revolution could cause disastrous short-term supply problems. ENERGY CZAR has no way to predict or provide for such events.

Finally, none of the critical constants that govern the behavior of the simulation can be verified. Safety factors, supplies of energy resources, potential for development, and all the other crucial numbers that determine whether a policy will succeed or fail are all estimates. Much research was done to ensure that these estimates would be based on reliable information; however, they cannot be considered absolute truths.

9 BIBLIOGRAPHY

A Time to Choose, Report of the Ford Foundation Energy Policy Project; Ballinger, Cambridge MA (1974).
Somewhat dated but still very informative.

Energy Future, Report of the Energy Project at the Harvard School of Business, R. Stobaugh and D. Yergin, Editors; Random House, New York (1979).
Contains an excellent appendix on the inaccuracies of computer simulations.

Energy in Transition, Final Report of the Committee on Nuclear and Alternative Energy Systems, National Research Council, National Academy of Sciences; W.H. Freeman and Co., San Francisco (1980).
A careful, thorough, and excellent study by a much respected group; highly recommended.

Soft Energy Paths by Amory Lovins; Ballinger, Cambridge MA (1977).
Generally considered to be unreliable in places but thought-provoking nonetheless.

If you are interested in nuclear energy, here are three books to consider:

Health Hazards of Not Going Nuclear by Peter Beckmann; Golem Press, Box 1342, Boulder CO 80306 (1976).
The best pro-nuclear book. Polemical, with a vicious and hilarious sense of humor.

Non-Nuclear Futures by Amory Lovins and John Price; Ballinger, Cambridge MA (1977).
The best anti-nuclear book available; fairly reliable.

Nuclear Power Issues and Choices, Report of the Nuclear Energy Policy Study Group; Ballinger, Cambridge MA (1977).
The best all-around book on nuclear power; neither pro nor anti, very thoughtful and reliable.

APPENDIX: HOW TO USE THE ENERGY CZAR RECORD FORM

Enter the year shown on the MENU, the bias you choose, all the data given on the graphs, and the policy options you select. An example of how to fill out the ENERGY CZAR Record is shown in Figure 18. Some of the entries from the graphs have been rounded off to the next highest number. You don't have to be exact. The important thing is to record the changes and your policy choices.

Let's look at the Energy Czar's record on legislation between 1980 and 1990. After taking office in 1980, the Energy Czar froze (F) prices on solar and biomass, raised (R) a tax on natural gas, imposed a double tax (RR) on coal, and tightened (T) controls on oil. After 1985, the czar lowered (L) the tax on coal and loosened (L) controls on oil. On subsidies or promotions the czar's policy was consistent. He promoted natural gas, uranium, solar, and biomass during both terms, as indicated by the P's opposite the entries under SUPPLY.

Note that there are two numbers for each resource listed under SUPPLY. The first number is the total supply in quads. The second is the exploitation/supply-potential factor. The second number increases by one each time a resource is promoted. This means that the exploitation of the resource has increased and the potential for further supply has decreased.

After 1985 supplies of coal, oil and natural gas declined, but USAGE of these resources also went down. No resources were rationed (R) during the czar's administration.

Now let's look at the Public Opinion Poll Record, Figure 19. The growth rate declined during the czar's second term in office. But since the death rate went down slightly and inflation decreased significantly, the czar's overall rating increased.

	1980	1985
Year	1980	1985
Bias	Fossil	Fossil
Prices (B$/Quad) F = Frozen Price; T = Thawed Price		
Coal	14	15
Oil	15	19
Nlgas	16	22
Uranm	14	14
Hydro	12	17
Solar	14F	14F
Wind	18	18
Bmass	15F	15F
Taxes (B$/Quad) R = Raised Tax; L = Lowered Tax		
Coal	0RR	2L
Oil	1	1
Nlgas	0R	1
Uranm	0	0
Hydro	0	0
Solar	0	0
Wind	0	0
Bmass	0	0
Deaths (Total in 5-Year Period) T = Tighten Controls; L = Loosen Controls		
Coal	6000	5479
Oil	10,000T	8578L
Nlgas	250	216.5
Uranm	15	52
Hydro	100	123
Solar	20	21
Wind	6	5
Bmass	60	58

Figure 18. ENERGY CZAR Record

15

| Year |
| Bias |
| Prices (B$/Quad) F = Frozen Price; T = Thawed Price |
| Coal |
| Oil |
| Nlgas |
| Uranm |
| Hydro |
| Solar |
| Wind |
| Bmass |
| Taxes (B$/Quad) R = Raised Tax; L = Lowered Tax |
| Coal |
| Oil |
| Nlgas |
| Uranm |
| Hydro |
| Solar |
| Wind |
| Bmass |
| Deaths (Total in 5-Year Period) T = Tighten Controls; L = Loosen Controls |
| Coal |
| Oil |
| Nlgas |
| Uranm |
| Hydro |
| Solar |
| Wind |
| Bmass |

Figure 18. ENERGY CZAR Record

15

	1980	1985
Year	1980	1985
Bias	Fossil	Fossil
Supply (Quads) P = Promote; R = Restrict		
Coal	320 50	200 50
Oil	720 50	597 50P
Nlgas	320 50P	232 51P
Uranm	40 20P	43 21P
Hydro	20 90	23 90
Solar	2 10P	2.5 11P
Wind	0.4 30	0.37 30
Bmass	4 15P	4.17 16P
Usage (Quads) F = Free; R = Rationed		
Coal	80	73
Oil	200	182.6
Nlgas	100	87
Uranm	10	10.4
Hydro	10	12.3
Solar	1	1
Wind	0.2	0.16
Bmass	2	1.94
Overall View (5-Year period)		
Supply (Q)	1426	1100
Demand (Q)	403	368
Tax (avg,B$/Q)	0.15	1.13
Price (B$/Q)	15	19
GNP (B$/Yr.)	2000	2345
Grwth (%/Yr.)	2.5	3.2
Revs (B$)	50	52
Deaths	16,500	16,451

Year							
Bias							
Supply (Quads) P = Promote; R = Restrict							
Coal							
Oil							
Nlgas							
Uranm							
Hydro							
Solar							
Wind							
Bmass							
Usage (Quads) F = Free; R = Rationed							
Coal							
Oil							
Nlgas							
Uranm							
Hydro							
Solar							
Wind							
Bmass							
Overall View (5-Year period)							
Supply (Q)							
Demand (Q)							
Tax (avg,B$/Q)							
Price (B$/Q)							
GNP (B$/Yr.)							
Grwth (%/Yr.)							
Revs (B$)							
Deaths							

Year								
Bias								
Prices (B$/Quad) F = Frozen Price; T = Thawed Price								
Coal								
Oil								
Nlgas								
Uranm								
Hydro								
Solar								
Wind								
Bmass								
Taxes (B$/Quad) R = Raised Tax; L = Lowered Tax								
Coal								
Oil								
Nlgas								
Uranm								
Hydro								
Solar								
Wind								
Bmass								
Deaths (Total in 5-Year Period) T = Tighten Controls; L = Loosen Controls								
Coal								
Oil								
Nlgas								
Uranm								
Hydro								
Solar								
Wind								
Bmass								

ENERGY CZAR RECORD

Year									
Bias									
Supply (Quads) P = Promote; R = Restrict									
Coal									
Oil									
Nlgas									
Uranm									
Hydro									
Solar									
Wind									
Bmass									
Usage (Quads) F = Free; R = Rationed									
Coal									
Oil									
Nlgas									
Uranm									
Hydro									
Solar									
Wind									
Bmass									
Overall View (5-Year period)									
Supply (Q)									
Demand (Q)									
Tax (avg,B$/Q)									
Price (B$/Q)									
GNP (B$/Yr.)									
Grwth (%/Yr.)									
Revs (B$)									
Deaths									

	1980	1985					
Year							
Bias	Fossil	Fossil					
Gwth Rate (%)	3.24	2.78					
% Approval	47	41					
Deaths/Quad	44	40					
% Approval	75	77					
Infltn Rate (%)	6.44	2.20					
% Approval	64	87					
Overall Rating (%)	62	68					

Year							
Bias							
Gwth Rate (%)							
% Approval							
Deaths/Quad							
% Approval							
Infltn Rate (%)							
% Approval							
Overall Rating (%)							

Figure 19. PUBLIC OPINION POLL Record

Year	Bias	Gwth Rate (%)	% Approval	Deaths/Quad	% Approval	Infltn Rate (%)	% Approval	Overall Rating (%)

Year	Bias	Gwth Rate (%)	% Approval	Deaths/Quad	% Approval	Infltn Rate (%)	% Approval	Overall Rating (%)

Figure 19. PUBLIC OPINION POLL Record

LIMITED 90-DAY WARRANTY
ON ATARI® PERSONAL COMPUTER PRODUCTS

ATARI, INC. ("ATARI") warrants to the original consumer purchaser that this ATARI Personal Computer Product (not including computer programs) shall be free from any defects in material or workmanship for a period of 90 days from the date of purchase. If any such defect is discovered within the warranty period, ATARI's sole obligation will be to repair or replace, at its election, the Computer Product free of charge on receipt of the unit (charges prepaid, if mailed or shipped) with proof of date of purchase satisfactory to ATARI at any authorized ATARI Service Center. For the location of an authorized ATARI Service Center nearest you, call toll-free:

In California (800) 672-1430   or write to: Atari, Inc.
Continental U.S. (800) 538-8547   Customer Service Department
                                                      1340 Bordeaux Drive
                                                      Sunnyvale, CA 94086

YOU MUST RETURN DEFECTIVE COMPUTER PRODUCTS TO AN AUTHORIZED ATARI SERVICE CENTER FOR IN-WARRANTY REPAIR.

This warranty shall not apply if the Computer Product: (i) has been misused or shows signs of excessive wear, (ii) has been damaged by being used with any products not supplied by ATARI, or (iii) has been damaged by being serviced or modified by anyone other than an authorized ATARI Service Center.

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DISCLAIMER OF WARRANTY
ON ATARI COMPUTER PROGRAMS

All ATARI computer programs are distributed on an "as is" basis without warranty of any kind. The entire risk as to the quality and performance of such programs is with the purchaser. Should the programs prove defective following their purchase, the purchaser and not the manufacturer, distributor, or retailer assumes the entire cost of all necessary servicing or repair.

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REPAIR SERVICE

If your ATARI Personal Computer Product requires repair other than under warranty, please contact your local authorized ATARI Service Center for repair information.

IMPORTANT: If you ship your ATARI Personal Computer Product, package it securely and ship it, charges prepaid and insured, by parcel post or United Parcel Service.

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