AMERICA'S ENERGY FUTURES

Presented by Monte Canfield, Jr.[1]
Director, Office of Special Programs
U.S. General Accounting Office

Before

1975 Engineering Foundation Conference
Henniker, New Hampshire
August 4, 1975

I have taken the liberty of retitling my talk today. I would like to discuss "America's Energy Futures." In this I will indeed discuss "Growth of Energy and Related Needs," as shown in your program agenda, but I'm going to leave it to far more expert heads than mine to share with you descriptions and predictions about the "Projected Scope and Scale of Energy Complexes." Being neither an engineer nor a scientist, I doubt that I could do the topic justice.

So I would like to talk to you about something I do know. I hope that I can stimulate each of you to consider energy complexes as they relate to possible alternative energy futures. The energy complexes that would be required for a very high energy growth future are quite different from those one might expect to find in a low energy growth future--that should seem obvious to you after I finish, if it doesn't already.

Much of what I am discussing today is drawn from the work we did at the Ford Foundation's Energy Policy Project. If you find you are interested in more detail than I can describe here, I urge you to get a copy of the Project's final report--A Time to Choose.

---

[1] My thanks to John Davidson, OSP Consultant, who helped in the preparation of this paper.

With a few exceptions, energy was, at best, a third rate national concern before the OPEC oil embargo began in late 1973. Granted there were some Casandras crying out about such things as the skyrocketing growth in oil imports, the enviromental and social problems associated with the production and consumption of fossil fuels, the problems and risks associated with nuclear power plants, and the possibility of running out of low cost domestic oil and gas resources. But for most people, energy was relatively inexpensive, easily available, and taken for granted. In some respects, the same is still true today. Aside from griping about high fuel prices, most Americans are going back to sleep--many convinced that the energy crisis is nothing more than a big rip off of the consumer--by big business, big government, and foreign, meaning Arab, powers.

Yet, at least while the embargo lasted, most of us became quite aware of how essential energy is to the functioning of twentieth century America. During these few months, we saw the all too rapid development of events which most people found to be both troublesome and inconvenient: long lines formed at many gasoline stations; highway and aircraft speed limits were reduced; we were asked to turn down thermostats; some businesses were forced to close because of lack of fuel or petroleum products and prices for such items as gasoline, fuel oil, and electricity soared. Then quite suddendly, the embargo ended, and so did much of the national concern about energy.

Yet, I submit that the energy crisis has not gone away. We may be postponing the inevitable; but, sooner than we are now willing

to accept, we will have to come to grips with this issue. The fact that you are attending this conference tells me that you recognize the very long lead times necessary to soive our nation's energy problems.

I would like to briefly review with you some of the basic statistics of United States energy supply and demand. Chart 1 shows you what has happened to total United States energy consumption and domestic production over about the last 30 years.

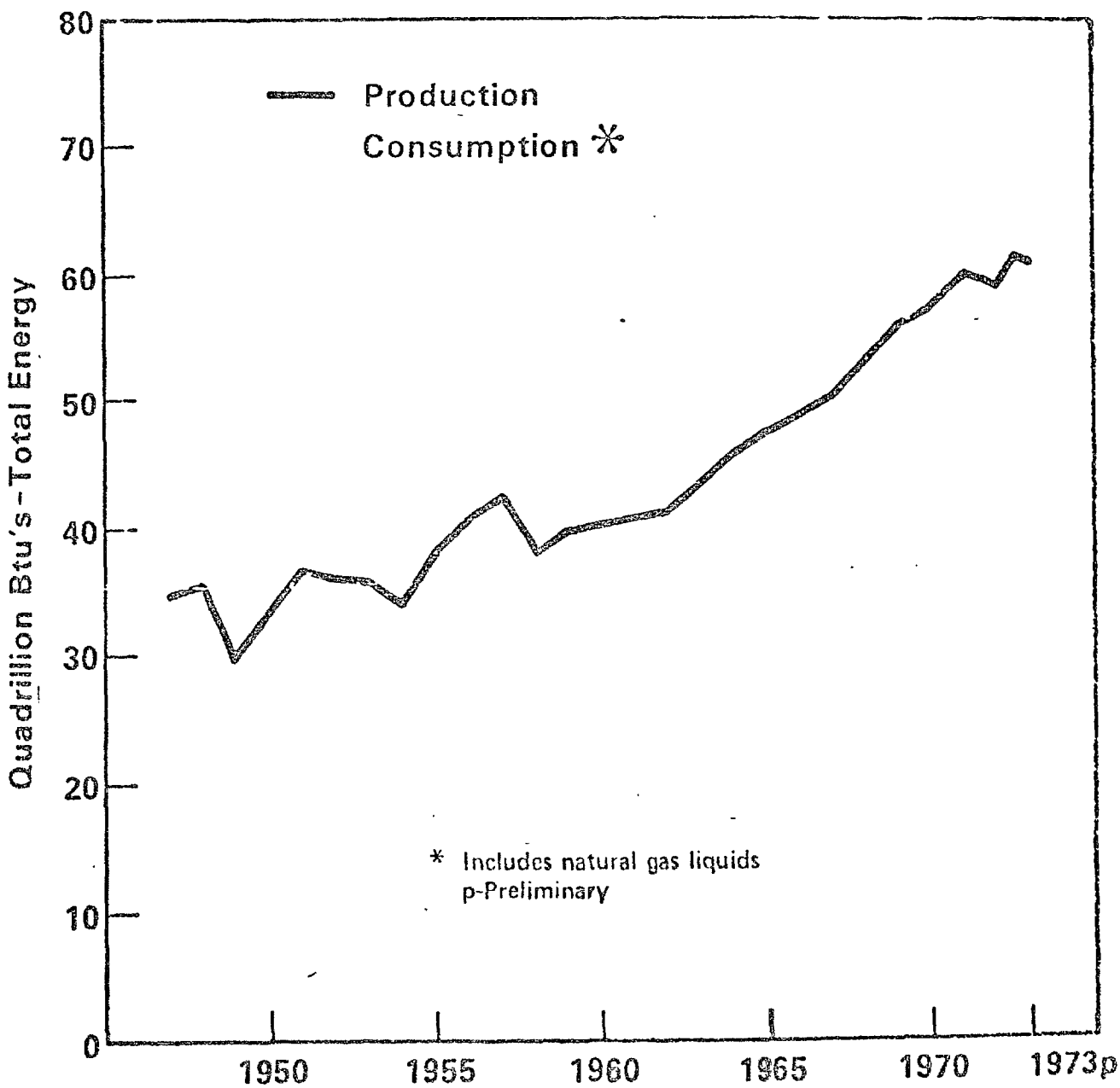
Total United States energy consumption grew at an average annual rate of about 3.5 percent from 1950 to 1965. From 1965 to 1973 energy consumption grew at an even higher annual rate of about 4.5 percent. As a result, total energy consumption has more than doubled in a period of about twenty years; per capita energy consumption increased by about 40 percent in the same time period.

On the other hand, as Chart 1 suggests, domestic energy production was growing more slowly. Its growth rate has been only about 3 percent per year. As shown on Chart 2, the growing gap between domestic comsumption and domestic production has been largely made up by the rapid increase in oil imports, particularly from the oil-rich Middle East Countries. The marginal barrel of oil is an Arab oil barrel.

Furthur, with a flattening or even gradual decline of domestic oil and natural gas production, imports can be expected to continue to increase, even if total United States energy consumption were to remain relatively constant. This poses some potentially serious international problems for the Nation. The issue, then, is not whether imports will continue to grow. They will. The appropriate questions are

CHART 1

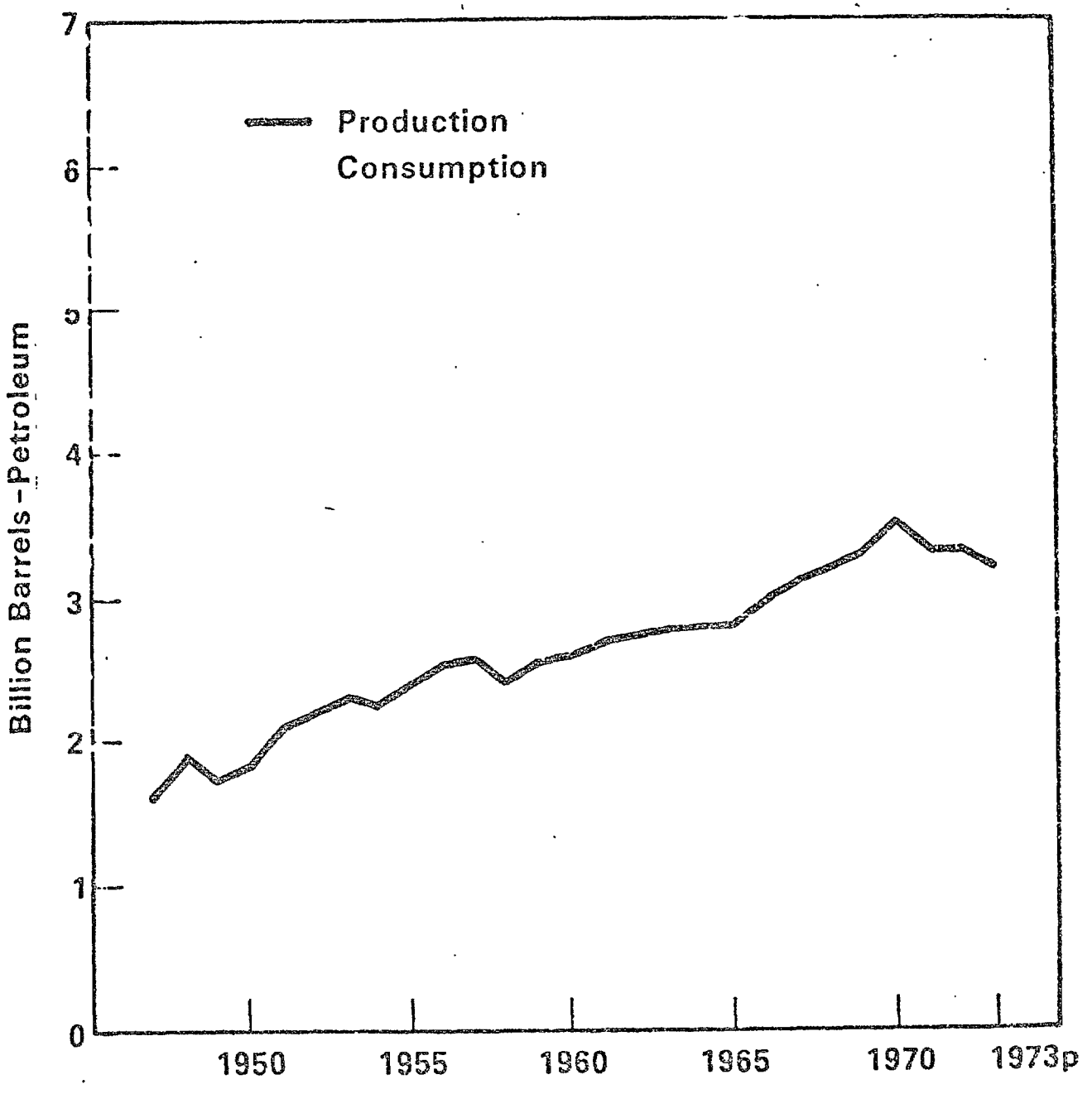
U. S. ENERGY PRODUCTION AND CONSUMPTION 1947-1973



Source: U.S. Bureau of Mines

CHART 2

U.S. ENERGY PRODUCTION AND CONSUMPTION 1947-1973



Source: U. S. Bureau of Mines

how much, how fast, and how much longer? There are many different answers. Interestingly, the answers to them largely hinge on the assumptions about demand levels, rather than on domestic supply alternatives.

In fact, after more than two years of study, the Energy Policy Project (which I will call EPP for short) concluded that the central energy problem in the next 25 years will not be the lack of energy resources per se, but rather the large potential for the rapid growth in energy consumption. The Nation has vast reserves of coal and lignite, and reasonable amounts of uranium, oil and natural gas.

However, I think it is important to emphasize that such resources are only "large" when compared to the consumption rates of the recent past. For example, if energy consumption were to increase at 4 percent per year, an energy resource which might last 500 years at todays consumption levels, would only last for about 76 years. At a 7 percent growth rate, the historic rate for electrical power, the same resource would last for only about 51 years. As you might imagine, the problems associated with continued energy growth at even historic rates are enormous.

* *

So the question is, "What is the Nation going to do about the gap between domestic production and domestic consumption?" We can increase supply, reduce demand or do some combination of both. What we do should depend on what we're after.

The EPP tried to figure out what people are after when they think about energy. Five values which people seek were identified as:

(1) Provide a reliable and flexible supply of energy allowing for no unexpected shortages;

(2) Provide energy at the lowest total cost to society. In the language of economics, we should "internalize the external costs", so that the selling prices include the expenditures required to control the environmental, health, and safety problems associated with energy;

(3) Avoid economic and regional inequities in such concerns as employment, income, and supply measures;

(4) Safeguard and improve the quality of the environment; and

(5) Minimize international problems.

Not everyone would agree on all of these goals. Some would add to them; some would emphasize one of them over the others. The point is, however, that any policy which is to have a prayer of succeeding in this country had better deal adequately with these goals--or it won't work.

* *

If those are to be the goals, what are the policy tools which we can use to achieve them? While there are many variations on the theme, there really are only two basic approaches:

(1) The market: that is, allow the market through its price system to attempt to allocate resources in such a way that these goals would be achieved.

(2) Government intervention. If the market is not competitive; if the selling price does not reflect the external costs; or if the market does not distinguish social preferences, then one can employ government intervention in the market to achieve the goals.

The Federal Government can intervene into the market through four major ways: (a) taxes and subsidies, (b) research and development, (c) regulation, (d) government ownership and management. In each way, government decision-makers can influence behavior, modifying it to meet the stated goals.

* *

I'd like to turn to a brief discussion of the options available to us. Too often we make the mistake of assuming that our options are much more narrow than they really are. To discuss this in some detail, I will divide the future into three segments--the short term which I define as the next two or three years, the mid-term which I define to be from 1978 to 1985, and the long-term, after 1985.

In the short-term, our options are very limited, since the lead times to do almost anything significant about energy policy are generally longer than two or three years. This means that in the next two or three years, there will be:

-- No new major source of energy

-- No major rebuilding

-- No major new transportation systems, etc.

However, we can begin to improve the efficiency of existing systems, and make some adjustments in our lifestyles so as to reduce

the growth in short-term demand for energy. And, most importantly, we can begin to make decisions that will shape growth patterns over the middle and long run. There is a major caution here. While doing these things, we should be very careful not to make adverse long term decisions in the midst of a short term panic. In the short-term it is especially crucial to keep our options open.

In the mid-term, we will be able to see some important results if we begin now. We can make significant improvements in the energy efficiency of our technologies and help encourage consumer changes which can slow the growth in demand for energy.

In the long term, after 1985, the Nation has a considerable number of options. We need not be in an energy straight jacket. As Lewis Mumford has said, "Trend is not destiny." However, trend can be a self-fulfilling prophecy if we let it become so.

The Energy Policy Project did not project, predict or prophesy. Instead, we developed three energy scenarios, i.e., alternative energy futures which run through the year 2000. We named these scenarios: Historical Growth, Technical Fix, and Zero Growth, or ZEG. I believe that all three scenarios are feasible--they could happen. However, the real energy future will likely be a composit of each. If I had to guess about the long-term demand curve which we might actually achieve over the rest of this century, I would choose something slightly higher than the Technical Fix scenario depicts.

The scenarios are illustrtive; they say:

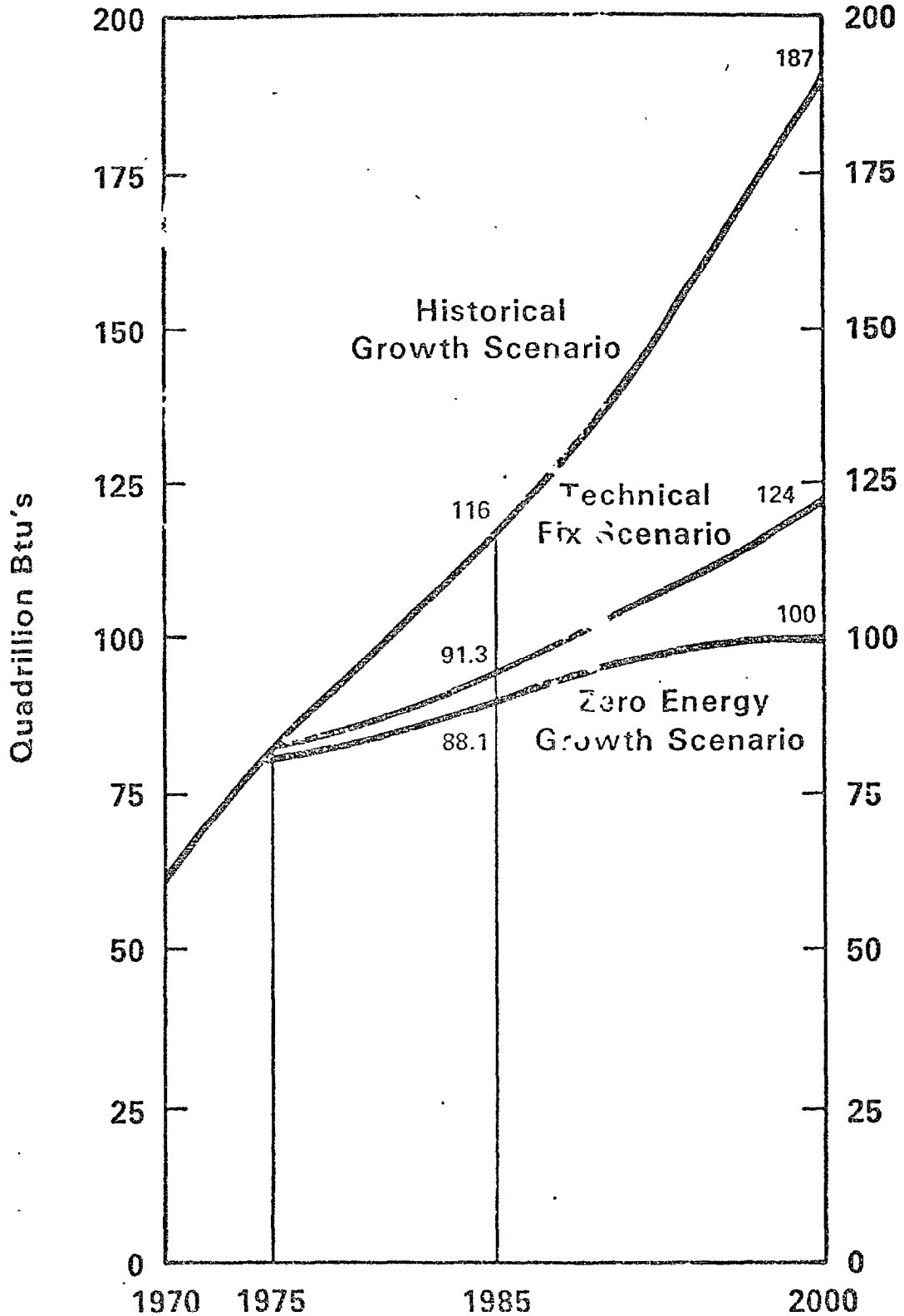
> If you want "A", here is what it will look like, here is what you have to do to get it; and here is what you pay. (You always pay--there is no free lunch!)

The essential difference between the three scenarios is the energy demand growth rate. Energy demand is the key variable. All too often we have been told that energy demand is automatically dictated to us by the market. EPP rejected this postulate. The Project concluded that over the long run energy demand growth rates can be substantially reduced without major adverse effects to national health and well being. Indeed, we concluded that reduced growth rates in demand for energy would be necessary to sustain national well being. I would like to take a few minutes to give you a brief overview of each of the energy scenarios. Chart 3 shows the energy demands for each.

Let us first look at the Historical Growth scenario. Under this scenario, total energy consumption is assumed to grow at 3.4 percent per year. This would imply that in the year 2000, annual U.S. energy consumption would be about 2.5 times what it is today. Such an energy future would require the aggressive development of all the major energy sources--coal, nuclear power, oil and natural gas (from Alaska, the Outer Continental Shelf, and the conterminous United States). Large amounts of coal would have to be gasified and/or liquified if imports of oil and natural gas are to be kept at or below today's levels.

CHART 3

FORD FOUNDATION
ENERGY POLICY PROJECT



Source: Energy Policy Project

EPP concluded that there are very serious problems associated with this scenario. In the first place, it will be difficult, if not impossible, to improve environmental quality so as to protect the health and welfare of the citizens. In fact, even to hold pollution to today's levels would require substantial improvements in control technology.

Furthur, by pushing very hard on all our major energy sources, we would not have the option of slowing the growth of any supply source until we can better understand the environmental and health implications. Energy growth at this rate would require tremendous investments of capital. Whether the society could maintain such huge capital expenditures for energy systems while meeting other economic needs is open to question. Finally, energy from new sources like coal gasification, and OCS oil and natural gas is going to be increasingly expensive.

As I have already mentioned, the EPP's second scenario is called Technical Fix. If I were doing it over I'd leave out the word "Fix" and substitute "Efficiency". "Fix" sounds like a gimmick, which the scenario is not. In this energy future, total United States energy would grow at about 1.8 percent per year. This means that in the year 2000, total annual US energy consumption would be about 1.6 times what it is today. This should be compared with the Historical Growth scenario which, you will remember, was about 2.5 times today's rate. In the year 2000, this would mean an energy savings eqivalent

to over 32 million barrel of oil per day when compared to the Historical Growth scenario.

Such a savings would be achieved by applying existing, economic technologies to our patterns of energy use. Its thrust would be to squeeze the fat out of our wasteful use of energy. No major lifestyle changes would be required to do this. We would travel as much as in the Historical Growth scenario. We would just do things more efficiently from an energy standpoint. Homes would be better insulated; cars would be somewhat smaller and more efficient; appliances would be designed to use less energy; recycling of metals and other materials would be emphasized; heat pumps would be used instead of the less efficient electric resistence heating, etc. The Nation's GNP could be very similar to the Historical Growth scenario. In fact, our research has found that GNP and energy consumption need not be directly proportional to each other.

In contrast to Historical Growth and Technical Fix, the Zero Energy Growth scenario would involve a few fairly substantial changes in how we live. In ZEG, the total energy consumption of the Nation would stabilize at about 1.3 times present consumption rates or possibly less.

ZEG would not mean that we would "go back to the caves". In fact, assuming US population continues to stablize, ZEG would provide for 10 percent more energy per capita than we use now. We would obtain more value out of each Btu by achieving what one could call a "Super Technical Fix".

Through greater use of mass transit, export of growth in energy-intensive industries and a few other changes, ZEG could be achieved.

ZEG would not hold down the poor. In fact, there would be enough energy to raise the standards of the poor to the level of middle income Americans. The economy could still grow--zero energy growth does not mean zero economic growth. Instead of saying "more is better" the Nation would stress a different theme: "enough is best". Such a change in values would require us to reassess what we think is important in our lives.

Why should the Nation move toward Technical Fix or ZEG? There are many reasons: Historical Growth has serious problems in meeting any of the energy policy goals mentioned earlier--the more we must go all out to supply a rapidly increasing demand for energy, the less flexibility the Nation has. It is important to understand how little flexibility we have in a high growth situation. Policies which would be necessary to sustain high energy growth are:

(1) Governmental efforts to actually promote high demand;

(2) Subsidizing the energy industry in order to keep prices to consumers fairly low;

(3) Federal resources would have to be available for widespread development;

(4) Environmental quality standards would be lowered, in some instances sacrificed.

(5) Rapid GNP growth would be encourged. There would be no strong efforts to conserve energy;

(6) The capital necessary to finance building the systems required to supply the additional energy would have to be found.

(7) A major supply-oriented R&D program would have to be launched and sustained.

If the Nation cannot, or will not, do all of these things--and do them effectively--then the Historical Growth scenario won't work.

On the other hand, the Technical Fix scenario provides both more time and more flexibility, so that a mistake does not overload the whole system. The so called Technical Fixes would be in a few key areas:

(1) Space heating (insulation, design, retrofiting, and heat pumps);

(2) More use of "waste" heat from power plants and improved energy efficiency in general by industry;

(3) Improved auto fuel economy to 20 mpg or higher by 1985, and 25 mpg or higher by the year 2000;

(4) Use of solar energy for space conditioning and water heating where economic; and

(5) Increased recycling of metals and energy intensive products and use of energy from municipal wastes.

On the supply side, implementation of the Technical Fix scenario would permit us much greater flexibility. For example, it would be possible to both reduce or eliminate imports and drop or slow down committments to one major new energy source, e.g. nuclear power, Western coal, or OCS. Even so, the Nation would have to increase one domestic source significantly or continue to rely on imports.

What about ZEG (Zero Energy Growth)? Why should the Nation consider moving toward ZEG? There are several reasons:

(1) Technical Fix only buys time. If society's energy needs continue to grow, then we will run out of technical fixes and something approaching the historical rate of energy growth would resume--or we would suffer considerable hardship.

(2) The capacity of the earth is finite;

(3) Other nations and our decendants will need the resources;

(4) High technology, highly centralized societies may have serious problems in a resource short world; and

(5) Citizens may want a different kind of America.

ZEG would parallel Technical Fix until the mid-1980's. This is because of lead time problems. It takes about 10 years to begin to substantially replace a major portion of existing energy consuming technology. ZEG then would apply a "super" technical fix; particularly in the automobile sector, so that average fuel economy reaches 25 mpg or more by 1985 and 33 mpg or more in 2000. In addition, the Nation would emphasize such options as:

- Mass transit
- New communities having integrated utility systems (energy complexes)
- Industrial parks (energy complexes)
- Increased retrofiting of homes, commercial buildings and industries, so as to improve energy efficiency
- Encourage movement towards a service economy

- Encourage more rail and other ground travel, as compared to less air and truck transportation.

The basic lesson is simple--we can choose the energy future we want. The options are enormous.

Let us get about the business of choice by increasing the dialogue and implementing the policies.

Let us spend this week learning about not only how to design energy complexes but also about where they fit into our choices about our Nation's energy policy. Only in the context of a chosen energy policy can we understand the utility and importance of energy complexes. Energy complexes might come into being on a large scale. However, unless we view them in the context of how they will fit into a national energy policy, I doubt that they will ever be much more than fascinating engineering curiosities.