

Energy Policy in Arizona: a Plan for Sustainable Development

**Policy and
Recommendations**

**Advisory Committee on
Energy Policy and Planning
State of Arizona
December 1990**

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Energy Policy in Arizona: A Plan for Sustainable Development

Presented to the Joint Legislative Task Force
on Energy Policy and Planning
of the Arizona Legislature

By the Advisory Committee on Energy
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(See Appendix E for Committee Appointments)

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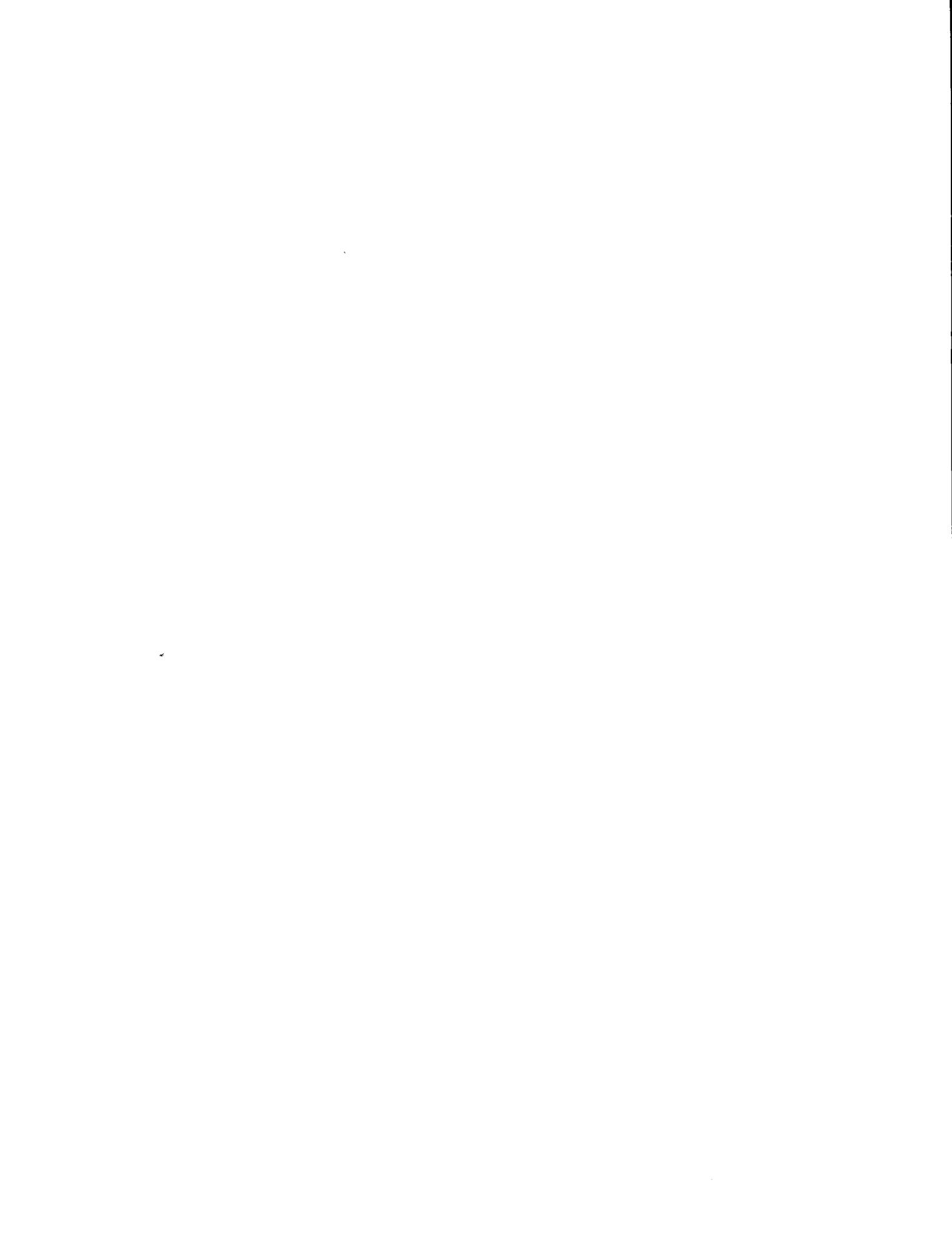
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As a benefit of the committee's broad area of expertise relative to the production, distribution, and consumption of energy, the committee could function largely as their own resource. Where the committee felt additional input was necessary, presentations by experts were arranged, including:

John R. Balfour, Assistant Marketing Manager, AEG Westinghouse Transportation Systems, International Magnetic Transit of America, Inc.

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The committee's editorial committee, consisting of Mark Ginsberg, Doug Brooks, and Dennis Beals for Marty Shultz, took time in the waning holiday hours of December to put the finishing touches upon the document.

William J. Murphy, Chairman
December, 1990

Recommended State Energy Policy

Whereas, the state of Arizona's population and energy use are projected to grow for the foreseeable future; and

Whereas, conservation and the efficient use of energy are expected to continue to be the preferred overall economic and environmental strategies; and

Whereas, energy is a key determinant of the way we live, environmental quality and the vitality of the economy of the state of Arizona; and

Whereas, energy supply, energy demand and the natural environment are at a point of conflict which will continue into the foreseeable future; and

Whereas, the effect of this conflict can be mitigated through the development of a state energy policy which balances supply, demand, environment and economic issues;

Therefore, be it resolved by the House of Representatives of the state of Arizona, the Senate concurring, that the energy policy of the state of Arizona shall be to:

1. Assure sustainability of Arizona's energy supply and environmental quality through efficient use and conservation of energy resources; utilization of a diversity of energy resources; promotion of energy research, development, and demonstration projects; adoption and implementation of mechanisms to assure energy-efficient communities, buildings, equipment and transportation systems; and promotion of the optimum utilization of renewable energy resources.
2. Assure the environmental quality of the state of Arizona through environmentally sound energy utilization.
3. Establish and utilize appropriate measures of the total cost and benefit to society while maintaining an adequate, affordable and environmentally sound supply of energy for all Arizonans.
4. Assure economic development and well-being that is sustainable through implementation of a balanced energy policy; efficient use of all energy resources; and with help from renewable energy and energy-efficient products and processes.
5. Establish a long-range comprehensive planning system incorporating integrated least cost energy planning, mitigation measures to avert supply disruptions and means to incorporate anticipated energy supply, demand and technological changes.
6. Encourage individual, local, and statewide action through the implementation of energy education programs to overcome institutional, structural, and individual obstacles to beneficial changes in the energy system



Introduction

Arizonans collectively spend in excess of \$5 billion per year on direct energy purchases from both in-state and out-of-state producers of natural gases, coal, electricity, and petroleum products. At the same time, they expend private and public dollars attempting to restore, protect, and enhance the quality of life and environment in Arizona. Energy and the environment have become part of the essential elements for all current and future Arizonans to maintain and improve their life quality. Having an adequate supply of clean energy resources to fuel the economy and quality of life in Arizona presents a significant challenge in an era of environmentalism and global interdependence. To do so at a reasonable cost, while simultaneously achieving our desires in the areas of health, safety, quality of life, and energy security will test our commitment to a hopeful future for subsequent generations of Arizonans. Yet, to rise above the short-term or special interests of those that benefit from an unbalanced energy marketplace may be the greatest challenge of all.

The energy sector impacts the social, economic, and environmental quality of the entire state and will have a significant impact upon our future growth. Many have attributed the rapid population growth in Arizona since the end of World War II to the availability of abundant electrical energy to cool homes and businesses during the hot summer months of the desert metropolitan areas; and motor fuels to propel citizens from their suburban homes to central business districts. The availability of inexpensive fossil fuel energy helped create the miracle of the vast shining cities in the Sonoran Desert of Arizona.

The low transaction cost fossil fuel energy that partially provided the impetus for the development of Arizona into a state with a population exceeding three million is also directly responsible for the substantial environmental degradation of our air, water, and habitat quality. The air once world renowned for its purity is now heavy with pollutants of automobiles and power plants; the water once flowing pure from clear mountain streams contains residue from the mining of Arizona's vast coal and copper deposits; and the deserts once renowned for their majesty are vanishing due to the urban sprawl of metropolitan areas and their associated pollution.

The development of an energy policy for the state of Arizona and the United States is not a novel idea. In May of 1977, the Arizona Legislature passed a concurrent resolution prescribing an energy policy for the legislative body. This legislative policy (H.C.R. 2013 - Appendix A) was developed during a period of energy supply crisis at the mid-point of the Carter Administration. The legislative policy, although containing high ideals, was largely disregarded over the next decade as the energy crisis of the seventies faded from the memory of most Arizonans, as energy prices declined substantially, and because there was no mechanism for the sustained implementation of these ideals. The "crisis mentality" that has produced energy policy in the past has dealt largely with the mitigation of short-term jeopardy to the economy of the United States, leaving the problems that created the crisis to persist unresolved. Perhaps this mentality is being overcome as the United States

through the Department of Energy, like Arizona, is currently in the process of developing a "National Energy Strategy" at the direction of President George Bush.

In order to better understand the role of energy in the monumental conflict between economic development and environmental quality and to identify the legitimate public policy issues and role of government in resolving this conflict, the Legislature created a legislative Task Force on Energy Policy and Planning. To provide public input on this important public policy area, an Advisory Committee on Energy Policy and Planning was created and charged to explore and identify the various opportunities available to the Arizona State Legislature for assuring the future excellence of both the environment and the local economy as they relate to the production, distribution, and consumption of energy resources and services.

In Arizona, the current energy policy and strategy development process began with the passage of House Bill 2249 (Appendix B), authorizing the creation of a Joint Legislative Task Force and an Advisory Committee, signed by Governor Rose Mofford on 31 May 1988. During the calendar years of 1989 and 1990, the Advisory Committee met bi-weekly and was addressed by over 24 speakers. The Committee held 11 input workshops and four days of public hearings throughout the State. More than 20,000 person-hours were contributed by committee members and staff towards the goal of developing a sustainable energy policy and implementation plan for Arizona. Yet, this enormous effort still scarcely scratched the surface of measuring the total social cost and economic benefit of the energy sector upon Arizona. Further, more definitive studies and considerable action will be necessary before the conflict between our economy and our environment are fully resolved.

Unlike similar efforts in other states, this committee was composed of representatives of government, business, and individual citizens with staff support from the Arizona Energy Office of the Department of Commerce. The policy and plan involves all energy sectors and attempts to harness the resources of the marketplace and government by recognizing costs associated with energy production and consumption and assigning them to originators or users. The Legislature felt that starting this process by involving the public was not just sound policy, but essential. Ultimately, the public's acceptance and implementation of the recommendations will determine the committee's success.

One of the most important messages from the committee, staff, and testifiers was to immediately and dramatically increase energy efficiency and conservation through regulation, incentives, education, research, and demonstrations in all sectors. Energy efficiency and conservation was seen as the least-cost option, immediately available, that will have a positive impact on local economics, pollution, security, and the future we all share. The United States used virtually no more energy (and less oil) in 1987 than it did in 1973 — although the nation's population continued to expand, and products and services steadily increased.¹ This effort can be replicated between 1990 and 2005 in Arizona. In addition to the benefits to the environment and national security, our economy will flourish with greater profitability as a direct result of increased efficiency and productivity per unit of industrial output. Japan, which uses one-third the energy per unit of industrial output, and Germany, which uses one-half, are confirmations of this strategy.

Having an adequate supply of energy to fuel a robust and expanding local economy and to provide a high quality of life presents an increasingly difficult challenge in an era of economic sluggishness. To do so at a relatively reasonable cost, while simultaneously achieving our objectives in the areas of environmental restoration and protection tests our

1 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 189.

ability and resolve to invent and invest in solutions that balance these conflicting objectives (i.e., affordable energy and pristine environment).

Whether the source of energy is solar, natural gas, propane, oil, coal, or nuclear reaction, all Arizonans require energy for transportation from home to work, to light the dark desert nights, and to insulate themselves from the extremes of the environment we inhabit. The local development of commercial energy sources has supported the population growth of Arizona and plays an important role in our daily lives. Because energy plays such a fundamental role in the current and future economic development and environmental quality of the State, it is to our collective advantage to thoughtfully examine the total implications of energy production, distribution, and consumption in Arizona and proactively plan for an energy future that is sustainable economically and environmentally.

It is important to emphasize that in all instances the recommendations contained in this report reflect the collective philosophy of the Advisory Committee on Energy Planning and Policy and not the Editor. Nor should one infer that it represents the policies of the Governor's Office or the views of the Arizona Energy Office. The Advisory Committee process included conflict on many issues, some of which could not be resolved. Yet, the Committee was able to find enough common ground to issue this Energy Policy with its recommendations. This document is ultimately the result of a democratic effort to determine the future course of energy production, distribution, and consumption in Arizona. As former President Jimmy Carter explained to the Indian Parliament, "The experience of democracy is like the experience of life itself - always changing, infinite in its variety, sometimes turbulent and all the more valuable for having been tested by adversity."

Sustainable Development in Arizona

The worldwide "proven" reserves of fossil fuels (i.e., coal, crude oil, propane, and natural gas) are being consumed at rates greatly exceeding their usual replacement cycle. Fossil fuels are the remains of plants and animals that lived millions of years ago and require millions of years to be generated by natural processes. They contain the biologically-stored energy from sunshine that struck the Earth's surface in prehistoric times. Fossil fuel is simply ancient "solar energy" stored in chemical deposits. Its extraction and refinement, in recent times, into materials for consumption as a primary energy resource, drugs, and plastics has altered humankind's delicately balanced relationship with the planet.

The use of coal, oil, propane, and natural gas, as primary energy resources, has expedited the transformation of western society from an agrarian to an industrial economy. However, the current rates of discovery and recovery, refining, and consumption of these high caliber liquid "solar energy" deposits indicate that the entire resource base will have been depleted by the mid 21st century. Similarly, the complete depletion of the enormous worldwide coal reserves will take only a century or two longer.

Simultaneously, and more ominously, many of the vital urban areas of the United States, including Phoenix and Tucson, are experiencing profound environmental (e.g., water, habitat, and air) degradation from the massive consumption of these fossil fuels. Although it is of academic concern whether we will choke upon air-borne pollution or run out of the fossil fuels first, it is of immediate controversy and concern whether the current governmental and private sector energy policies of inefficient production and consumption of fossil fuels will have an enduring negative impact upon the environment and the health of all Arizonans.

The production of electricity and combustion of fossil fuels results in many adverse environmental impacts. These include:

- degradation of the land such as strip-mining sites.
- water pollution, such as acid mine drainage.
- potential health impacts from radioactive materials.
- aesthetic impacts such as transmission lines marring the landscape.
- exacerbation of the greenhouse effect by burning fossil fuels and releasing carbon dioxide into the atmosphere.

These impacts are called externalities because they are external to the price of electricity or gasoline and thus are not considered by most users of electricity or gasoline when deciding how much to consume nor by producers in deciding what technologies to employ.²

Sustainable development is a contemporary concept meant to broadly define the government and private sector strategy of economic, social, and infrastructure development that attempts to meet the needs of the present generation of Arizonans, without compromising the ability of future generations to meet their own requirements. Its grand design is to achieve a balance in humankind's relationship with the environment, the future, and other forms of life upon the planet.

The concept of sustainability or sustainable development is without partisan political content and is substantially focused upon economic and social routines associated with the extraction and consumption of finite resources by the growing human population of the Earth. Like any fully developed system of convictions, however, it has an ideological core. This belief system includes support of:

1. long-term planning
2. environmentalism
3. balance of population and resources
4. biological diversity
5. protection of scarce resources
6. waste reduction and management
7. use of renewable fuels
8. global security

This act of balancing the needs of the present with the needs of the future and other forms of life may be the greatest challenge any society could face. The challenge of being responsible to unborn generations of citizens is uniquely difficult in a political context, where the economic dilemma of the current generations must be mediated.

The application of the philosophy of sustainable development in the field of energy production, distribution, and consumption is a conviction that modern society bears an obligation to maintain and improve the quality of the environment and resource base for future generations and other types of life, while providing for current energy service needs (i.e., air conditioning, transportation, light, etc.). It also recognizes, however, the need to utilize present resources and technologies while seeking to find the most environmentally benign solutions to our future energy requirements.

² Arizona Corporation Commission, *Staff Report Resource Planning Docket No. 0000-90-088*, September 1990, p. 58.

The current process of economic, social, and infrastructure development in Arizona and generally throughout the Southwest is not considered to be sustainable over the long term. We are depleting finite resources (e.g., minerals, air, water, and land) that we share with future generations of humans and other forms of life at an alarming rate. Already, the southern California region has begun to experience shortages of clean water, open land, and pure air due to an overburdening of natural systems. It is conceivable that if current governmental and private sector policies related to energy production and consumption are permitted to continue unaltered, future generations of Arizonans will be left a legacy of dirty air, ruined landscapes, and depleted natural and biological resources.

Energy is among the most essential resources of modern society. Without the cooling, heating, light, and food it provides, the metropolitan communities of the Sonoran Desert in Arizona could not exist in their current form. Since the end of World War II the population of Arizona has literally exploded, and with the advent of air conditioning in the mid-1950's, the need for energy to sustain these communities has grown equally. Yet, widespread use of fossil fuels to power automobiles and electric generation facilities threatens the air quality, vegetation, and climatic stability of several regions. In essence, the equilibrium in humankind's relationship with the environment is currently out of balance. We have discovered, that to a large extent, the long-term ability of the desert environment to support life will depend on the kind of energy consumption choices we make, and especially how effectively we use our energy supplies.

Until very recently, the traditional approach to government and private sector energy decision-making was simply to meet the increasing demands for energy through the construction of additional generation facilities or additional production at the well-head. However, during the past two decades, several factors have fused to challenge this approach to meeting energy needs. There has been a growing realization that fossil fuel resources are being depleted, energy prices are increasing steeply, prospects are diminishing for cost-effective nuclear generation technology, and environmental damage is growing from the production, distribution, and consumption of fossil fuel. This combination creates the existing economic and environmental predicament.

As a result, the traditional energy policy of merely increasing supply has been supplanted with approaches that emphasize a focus upon economic least-cost energy planning and attempts to stabilize or reduce the current demand for energy. This approach is considered feasible because the United States currently uses approximately twice the energy per capita as the West Germans or Japanese. It is hoped that by demand reduction through efficiency improvements, we may provide the same energy services (i.e., air conditioning, transportation, lighting, etc.) at a moderate economic cost. The challenge posed by the hypothesis of sustainable development is to integrate the least environmental cost into the same planning formula.

Because there are vast differences between nations and even regions of the United States in how much total energy is consumed, how much per capita is consumed, and how efficiently energy is consumed, energy efficiency improvements will take different forms in different regions. Many factors shape and affect a region's energy consumption and total peak demand, including population size, geography, climate, and urban spatial form.

Arizona, for example, uses larger amounts of energy per capita in summer months for space cooling, while much of the country tends to require greater energy per capita in winter months for space heating. For this reason, among others, the potential energy savings from efficiency improvements alters by region and nation. In the western industrialized countries, since the OPEC oil price increases in 1973, there have been significant improvements in energy efficiency. Industrial nations used about 1 percent less primary energy in 1985 than in 1980, in contrast to the 26 percent increase in the five years before

1973.³ And between 1973 and 1985, per capita energy consumption in Organization for Economic Cooperation and Development (OECD) nations dropped 6 percent while per capita gross domestic product rose 21 percent.⁴

Energy production, distribution, and consumption is believed by many to have a greater impact upon the environment (particularly climate stability) than any other human activity. The combustion of fossil fuels releases vast quantities of chemicals into the environment, including sulfur and nitrogen oxides, carbon monoxide, and hydrocarbons that threaten human health. Even carbon dioxide emissions, benign to human health, are now identified as the major cause of global climate changes that could significantly alter life on this planet. The cost of restoring the environment that has been damaged, where possible, will be enormous. Therefore, improvements in energy efficiency are considered to be the least expensive means to alleviate many energy and environmental concerns while partially assuring a sustainable environment and resource base for Arizona. Arizona's history demonstrates the consequences of policies which foster short-term economic development without adequate concern for long-term impacts.

Jerome, Arizona, was the third largest city in Arizona when open-pit mining began in early 1918. The town flourished as government and the private sector rushed to exploit the tremendous mineral resource beneath the substratum and launched the community headlong towards environmental destruction and near extinction. As the town grew to the largest in the State, atmospheric emissions and tailings from local mines and copper smelters killed many indigenous plants and wildlife. In both 1919 and 1928, lawsuits were brought which attempted to alter government and private sector policies that permitted the continued operation of smelters which were causing local crop damage. Although these early lawsuits failed in their attempt to stop the negative economic and environmental impacts of pollution, they demonstrate an early environmental concern of local residents.⁵ The pollution of the environment in and around Jerome associated with the economic development and inhabitation of the mountain-top community continued killing the plants that had stabilized the hillside soil until buildings literally began sliding off the mountain. Due to environmental problems and the declining profitability of an extraction-based economy, the community began to die—becoming a virtual ghost town with the decline of the local environment.

Although a drastic lesson, the story of Jerome is an excellent example of a community that permitted its short-term economic interests in resource extraction and consumption to outweigh a long-term governmental and private-sector objective of a system of sustainable development. The expensive municipal and private sector infrastructure of Jerome is only now (50 years later) beginning to be reclaimed by a new generation of Arizonans who expect a bright economic and environmental future provided by a distinctive tourist/service based economy.

Jerome's early governmental and private sector policies failed to react to the critical conflicts between short-term profits and the long-term economic and environmental health of the community. Any community, including Tucson and Phoenix, could share a similar fate if short-term interests in immediate economic development are permitted to outweigh long-term interests in sustainable development. Attempts at energy policy development should balance the competing concerns of short-term wants with long-term needs.

3 Global Tomorrow Coalition, *A Citizens Guide to Sustainable Development*, 1989.

4 *Ibid.*, p. 201.

5 Morrison Institute for Public Policy, *Urban Growth in Arizona: A Policy Analysis*, 1988, p. 219.

An excellent example of state government's role in assuring sustainability of the environment and resource base is state held public lands. While it might be desirable to exploit these public lands for the benefit of the current generation (i.e., sell land to decrease current taxes), state government recognizes a fundamental responsibility to future generations of preservation of this strategic finite resource. For this reason, among others, the State attempts to balance short-term interests (i.e., reduction of the current tax burden) with long-term goals (i.e., maintaining uncontaminated lands for future generations). In this manner, the State discharges its obligations to both current and future generations, but only by relinquishing substantial economic benefit to current citizens.

In Arizona, with its distinctive resource base, an economic and environmental conflict currently exists between exploitation of the resource base for the production and consumption of energy at the lowest possible transaction cost and the needs of current and future generations of Arizonans for an unpolluted environment and superior resource base. Just as state government has an identifiable responsibility for the protection and management of state lands for future generations, many believe it bears an equal responsibility for the protection of the environment and resource base of the State.

Advocates of sustainable development believe that unlike fossil fuels, future use of renewable energy resources and energy efficiency improvements could provide an endless supply of energy for Arizonans at a moderate economic and low environmental cost. Most renewable forms of energy rely on the radiation from the sun, either directly through an abundant flow of heat and light (photovoltaic or solar-thermal) or indirectly from plants (biomass), wind (turbines), or falling water (hydroelectric). Other forms of renewable energy rely on the gravitational pull of the moon (tidal action) or from the Earth's internal furnace (geothermal). These energy resources are largely free; the challenge is to convert them to the energy services that Arizonans require at a moderate economic transaction cost.

The goal of a sustainable energy policy is to identify methods by which the State and private sector may meet their social responsibilities to insure an adequate energy supply for existing generations of Arizonans, while safeguarding the economy, environment, and resource base of the State. In some instances, this current conflict cannot be fully resolved at this time or at reasonable cost; in others, it is possible to correct existing deficiencies. However, in the long past and great future of Arizona, sustainability of the environment and resource base must be achieved or we will vanish from the desert sands like the Hohokam People. Without sustainable energy policies, the resource base that supports our current society could become too fouled for human inhabitation.

The Earth is approximately 4.5 billion years old. Human life has existed on the planet for only the past 2 to 3 million years. Only within the past two hundred years has humankind been able to significantly affect the global environment. And only since the 1950's has there been a measurable impact upon the global environment (e.g., carbon dioxide measurements from facilities located in Hawaii). It is the objective of this sustainable energy policy to assure that we reflect on the past and attempt to avoid its errors through establishing sustainable governmental and private sector policies.

Energy Situation Analysis

This recommended legislative policy and recommended strategy for implementation has been developed during the third phase of a fossil fuel crisis that began in the early 1970s and has lasted nearly twenty years. During the deliberations of the committee several major energy events occurred that substantially altered the energy marketplace. Saddam Hussein's invasion of Kuwait drove the price of oil to nearly \$40 per barrel; the State's largest electrical generating station experienced extended outages; the oxygenated fuel

program was implemented in Phoenix and Tucson; and the environmental impact of hydroelectric and coal-fired generating stations upon the Grand Canyon were questioned. Each of these events has had an impact upon this document.

The development of an energy policy and plan for the state of Arizona is predicated on the recognition that energy is essential for our desired lifestyle. While several problems/opportunities regarding the production, distribution, and consumption of energy have emerged since the last energy policy process was undertaken in the late 1970s, we are fortunate in the Southwest and particularly in Arizona to have a reliable energy system that has experienced few disruptions in service. With an adequate and safe energy supply we have been able to enjoy the benefits of unrestricted population growth. Certainly there are problems, but we must not overlook the positive benefits of our existing energy infrastructure. Although some of the items listed below are generic to the entire energy marketplace, they are listed here to provide a "frame of reference" regarding the specific energy situation in the State of Arizona. The degree to which these problems/opportunities are addressed by this document vary greatly and are addressed in much greater detail by publications of the Arizona Energy Office and by those listed in the bibliography of this document.

Petroleum

- domestic production capacity has declined over the past 20 years
- foreign supplies are subject to volatile politics
- consumption per capita is high contrasted with other regions
- virtually 100 percent of Arizona's gasoline is imported from other regions
- issues of air, water, and land pollution
- price is volatile
- no local emergency supply
- supply delivery is dependent on pipeline capacity
- foreign imports near 50% of United States consumption
- price is not regulated by any level of government
- no local refining capacity
- southern California refineries are facing pressure from air quality regulation
- carbon dioxide emissions
- decreasing number of independent retail outlets

Natural Gas

- finite resource
- carbon dioxide emissions
- virtually 100 percent of Arizona's supply is imported from other regions
- no local emergency supply
- supply delivery is dependent upon pipeline capacity
- access to all consumers is limited in some areas
- most environmentally sensitive and clean burning fossil fuel

Coal

- finite resource
- Arizona coal reserves are controlled by the Indian Nations
- issues of air and water pollution

- safety and health issues of production
- worst carbon dioxide emissions
- issues of acid rain deposits on trees and land
- bulk of supply is imported from other states
- current scrubber technology is expensive
- surface mine restoration
- may pose visibility problems
- impact of 1990 Clean Air Act

Nuclear

- total capacity exceeds 3600 megawatts
- generators have sustained prolonged outages
- three of the most modern generators in United States
- supported by substantial governmental subsidies
 - liability cap
 - enrichment
 - waste disposal
- permanent waste disposal is not established
- questions about decommissioning
- safety is of concern
- uncertain generator life-span
- waste may pose health risks
- high cost of infrastructure

Renewables

- tremendous unused potential
- fixed/capital cost intensive
- lack of federal government commitment and funding for research
- uncertain economics
- environmental impact on land and water flows
- diffuse and variable nature of resource
- industry is suffering growing pains
- technology is still under development
- many proven cost-beneficial applications
- important environmental benefits

Electricity

- rates are among highest in nation
- peak demand is difficult to serve economically
- type and amount of supply is out of balance with demand
- not efficient technology for all end uses
- fuel choice for next generation of plants is uncertain
- electromagnetic fields may pose health risks
- highly reliable source of energy

These issues are perceived by some as great problems and by others as tremendous opportunities. In some instances there are justifiable concerns, but in others they represent myths that have been perpetuated over time. Still, collectively they represent the varying views of the people of Arizona. These problems must be resolved and these opportunities exploited if we are to create a sustainable economy and environment in Arizona and the world.

The weather heavily influences the amount of energy, particularly electricity, that Arizonans consume. This in turn, affects energy sales and production. Arizona is characterized by a variety of climate types, ranging from alpine to low desert. The forces of nature impose differing requirements for energy systems on each of the various regions of the State. The variability of weather patterns from year to year, and over the seasons, results in changing demands for energy supply. A potentially severe summer or winter will drive up weather-sensitive electricity and natural gas consumption. Roughly 90 percent of the population resides in the deserts, which heavily influences the overall energy consumption patterns of the State - a significant summer peak electricity consumption due to air conditioning requirements. This may be exacerbated by global climate changes that are anticipated to increase average temperatures.

Table One demonstrates the changing pattern in the consumption of primary and end-use energy sources used by Arizona consumers between 1970 and 1988. In 1988, total end-use energy consumption reached 598.2 trillion Btus, rising 50 percent from 1970. In 1988, primary energy consumption was 898.1 trillion Btus, 75 percent greater than in 1970. Over the same time frame the population of Arizona nearly doubled from 1.8 to 3.5 million people. While gasoline was the dominant fuel source consumed by end users at 58.6 percent in 1988, its total market share as a primary energy source is declining as electrification of the Arizona economy continues, and as the choice for electric generating fuel shifts more to coal and nuclear.

Table One					
Primary and End-Use Energy Consumption by Source for Arizona					
Fuel Type	1970	1975	1980	1985	1988
Primary					
Petroleum	42.9%	47.6%	36.6%	33.3%	31.5%
Coal	1.7	14.5	29.8	35.8	27.7
Nuclear	0	0	0	1.2	22.0
Natural Gas	42.1	25.8	21.1	14.3	11.5
Hydroelectric	13.1	11.8	12.3	15.1	7.1
End-Use					
Petroleum	51.7%	53.8%	56.3%	56.3%	58.6%
Electricity	11.8	15.1	17.6	20.1	22.2
Natural Gas	35.7	30.5	23.4	16.6	17.1
Coal	0	0	2.5	6.9	2.0
Source: Arizona Energy Office					

The total primary energy consumption figures include electricity imports and exports, as well as losses from production, distribution, and transmission of electricity. From the table, it is possible to discern the slow transition from the use of liquid fossil fuel products to the use of nuclear and coal resources. This change in the primary fuel used by Arizonans will have long-term implications relative to the amount of pollution created and costs associated with energy production and consumption.

As local electric generating capacity has increased over the last decade, the trend of electricity importation to the region has reversed (TABLE TWO). Arizona is now an exporter of electric energy to other regions of the Southwest. The Palo Verde Nuclear Generating Station, for example, provides power to Texas, southern California and New Mexico. The exportation of energy can have positive economic as well as negative environmental impacts on the State.

Electricity consumption in buildings and manufacturing processes has grown substantially from 1970 to 1988. Residential and commercial consumption has more than tripled, significantly outpacing the doubling of the population. Industrial electric consumption almost doubled over the same period. Table Three illustrates this dramatic rise in electric use. Preliminary figures for 1989 show a continuation of this trend.

Table Two Net Interstate Flow of Electricity/Losses for Arizona	
1965	6.6 Trillion Btu
1970	25.9
1975	16.7
1980	-96.6*
1985	-129.6
1988	-217.6
*a negative value represents an export of electricity	
Source: U.S. Department of Energy	

Table Three Electricity Consumption by Sector					
Sector	1970	1975	1980	1985	1988
Residential	14.8	24.4	32.9	41.8	50.3
Commercial	16.0	24.3	31.1	41.9	50.9
Industrial	16.2	23.4	27.3	28.9	31.6
(reported in trillion Btus)					
Source: Arizona Energy Office					

The mix of fuel sources for electric generation has changed from 1960 to the present. Hydroelectric and oil-fired generation were the mainstays of electric production in the 1960's, and were supplemented by coal-fired units as the need for electricity grew with the population into the 1970's. The 1970's saw a shift away from oil, due to international considerations, to natural gas and more coal as fuel sources. The 1980's were marked by the completion of the Palo Verde Nuclear Generation Station, the largest in the United States. The late 1980's were characterized by variable output by Palo Verde, as these new units were being brought on line. Long term reliability and availability of this new resource has yet to be established, although Unit 3 has set national record electricity production figures for a one year period.

The transportation energy needs of Arizona are supplied virtually 100 percent by petroleum-based fuels—gasoline and diesel fuel. The 1989 consumption of off-road gasoline of over 1.8 billion gallons set an all-time high for the State, up 87 percent from 1970. Despite increasing efficiency of the vehicles on the road, the increasing number of vehicles continues to push consumption to higher levels. This reflects population increase, increases in vehicles per household due to improved living standards, as well as the pattern of suburbanization in the metropolitan areas.

The prices of electricity and natural gas are regulated either through the Arizona Corporation Commission or the boards associated with municipal utility systems. Motor fuel prices, however, are not regulated. This sets up a pattern of motor fuel prices that is characterized by higher prices in non-metropolitan areas of the State. In April 1989, Yuma's average price was 132.32 cents per gallon, a full 29.3 cents per gallon above Phoenix for the same period. There are many factors influencing this situation: local market conditions, source of supply, volume of product sold, overhead cost difference, and transportation costs. Gasoline prices in Phoenix have been among the highest and lowest in the nation at different times over the last decade.

Fundamental Suppositions

The development of this energy policy and implementation plan is based upon certain basic premises and values that have been identified by the Advisory Committee on Energy Policy and Planning, committee staff, and the public through the hearing process. These fundamental suppositions about the energy sector of the state and national economy run throughout the document and should be fully understood by the reader:

- **Energy Use is Directly Related to Environmental Quality.**

The production, distribution, and consumption of all energy in Arizona has a direct and largely measurable impact upon the environmental quality of the State. Each kilowatt of electricity, cubic foot of natural gas, and gallon of gasoline consumed by inhabitants of the State pollutes to varying degrees either our air, water, or land.

- **Energy Efficiency is Key to a Sustainable Future.**

The least-cost method of ensuring an adequate resource base for meeting the needs of all current and future generations of Arizonans is to use our finite resources in the most economically and environmentally efficient manner. The more efficient we become as individuals and as a society the fewer finite resources we will require to sustain and improve our quality of life and the less energy we require, the simpler will be the transition to the next generation of energy resources.

- **Government has a Role in the Efficient Operation of Energy Markets.**

The local, national, and world energy markets are not currently characterized as free markets. The existence of publicly-chartered monopolies and organizations of producing nations requires that appropriate levels of government have a role in the efficient operation of the energy market.

- **Energy Planning and Education are Essential.**

In order to ensure the efficient operation of energy markets, maintain consumer confidence in business and government, and protect environmental quality, the state government must maintain a proactive energy planning and education process to promote astute energy decision-making.

- **Low-Income Citizens Should have Access to Affordable Energy Services.**

Energy services (e.g., heating, cooling, lighting, transportation) are essential commodities in contemporary society. Denying low-income consumers access to affordable energy resources is equivalent to denying affordable access to shelter, food, or water.

Goals and Objectives

The rationale of this policy and implementation plan is to assure sustainable sources of affordable energy resources that will ensure the economic and physical health of the communities and citizens that constitute the state of Arizona, both contemporary and future generations. To resolve the existing conflict between economic realities and the environment will require cooperation among all levels of government, the private sector, and individual citizens. Yet, the social, environmental, and economic problems associated with the energy sector exist in a complex web of interdependence, in which the solutions to one problem may have unintended consequences upon another problem. Therefore, to reach this broad public policy goal, the Advisory Committee has identified four major objectives for state government and the private sector:

1. To use energy resources efficiently in Arizona through improvements in buildings, transportation, manufacturing, and delivery systems. Energy efficiency and conservation are seen as ways to reduce pollution, reduce imports of energy, and reduce expenditures for energy. Energy efficiency and conservation serve the economic interests of Arizona and the environmental interests of the entire planet.
2. To assist in the efficient operation of the energy markets of Arizona through improvements in planning and education about energy. Only through education of the public and effective planning will we be able to resolve the conflicts between energy production and consumption and the environment.
3. To assist in the economic development of Arizona through the use of indigenous resources and existing infrastructure. Arizona possesses unique renewable energy resources that can be promoted for the benefit of all citizens.
4. To assure the environmental quality of Arizona through safeguarding existing resources and rehabilitation of polluted resources. The economic and social value of a clean environment must be recognized in the energy decision-making process.

Priority Recommendations

The fundamental challenge of an energy policy is to find the appropriate mix of energy resources for a sustainable future. The proper strategy would produce economic vitality and a sound environment. The committee recognizes that it is the proper role of government to protect the energy future through appropriate incentives for the use of solar and renewable energy, energy efficiency and conservation; and disincentives for wasteful energy practices and use of non-renewable and fossil fuels. The following recommendations were deemed by the committee to be of the highest priority in facing this challenge.

During the two years of its existence, the Committee has focused on the role of state government, and in particular the role of the State Legislature, in effecting an energy policy. However, the Committee does see significant potential for private sector actions that would strive for the goals expressed in this document. Voluntary, cooperative efforts in the private sector can often produce the innovation and leadership that is required to establish new ideals in society. Additionally, the existing authority of state and local governments can be utilized to implement many of the recommendations expressed in this document, and to move our state toward a sustainable economy and a cleaner environment. In many cases, the power to implement these ideas already exists, and with education and public support that power could be brought to bear. The Committee believes that a cooperative effort among government, individual and corporate citizens can result in achieving the goals of this document.

For each Priority Action, the committee has considered multiple implementation strategies and provides a menu of these activities. Committee members recognize the need for further research to quantify goals as well as timelines for activities. An Energy Policy Implementation Advisory Council (Action 6) should be created to continue the effort to research and refine the necessary steps to create meaningful and effective public policy in the complicated field of energy.

Priority Action One—Solar and Renewable Energy

The State, in association with the federal government and private sector, should devote additional economic resources to further the State's solar and renewable energy research, demonstration, education, and technology transfer functions.

Possible Legislative Actions:

- establish a consumption-based fee through energy utilities to be used for solar and renewable projects.
- implement tax incentives for the installation and utilization of solar technologies.

Possible State and Local Government Actions:

- implement energy-efficient and conserving urban plans and building codes.
- Arizona Corporation Commission to begin use of long-run total avoided cost in calculating buy-back rates.
- Arizona Corporation Commission to facilitate use of mature solar technologies by energy utilities through implementing incentives for development/relocation of solar and renewable energy industries.

Possible Private Sector Initiatives:

- facilitate, endow, and invest in energy research and technology transfer.
- enhance industry standards and practices, encourage development of renewable energy trade organizations.
- encourage development of joint solar and renewable energy projects.

Priority Action Two—Transportation

The State, in concert with private and public transportation specialists, should develop a strategy to improve the utilization of our existing transportation infrastructure.

Possible Legislative Actions:

- alter current vehicle fuel, sales, and registration tax structure to acknowledge environmental impact.
- restrict source of revenue for all transportation infrastructure to vehicle fuel, sales, and registration taxes.
- require the use of “least-cost” strategy in all transportation decision-making.

Possible State and Local Actions:

- further expand regional and local mass transit opportunities.
- significantly raise parking fees at all state and local government facilities to encourage use of mass transit, ridesharing, etc.
- provide meaningful incentives for in-fill of metropolitan areas.
- require full infrastructure cost recovery from all new fringe development.

Possible Private Sector Initiatives:

- develop cooperative efforts such as transit management associations to help reduce single occupancy vehicle trips by employees.
- provide incentives to employees to utilize alternate work schedules.

Priority Action Three—Alternative Fuels

The Legislature, Governor, and other units of government should develop a long-term plan for the conversion of all government (ie., municipal, county, state, and school district) operated fleets and vehicles to cost-effective, environmentally benign alternative fuels (including but not limited to electric, CNG, reformulated gasoline, ethanol, methanol, propane, hydrogen, or solar).

Possible Legislative Actions:

- require that possibly 10% of all vehicles sold in Arizona be alternatively fueled by 2000.

- phased in conversion of all government fleets to economic alternative fuels by 2000.
- permit use of “diamond” lanes on freeways by vehicles fueled with alternatives to gasoline.

Possible State and Local Actions:

- open alternative fuel stations used by government fleets to the public.
- develop auto-free zones and streets for exclusive use of pedestrians and bike riders.
- permit utility cost recovery on the installation of alternative fuel stations.

Possible Private Sector Initiatives:

- demonstrate residential CNG fuel option by natural gas utilities.
- begin conversion of vehicle fleets to cost-effective alternative fuels.

Priority Action Four—Energy Environmental Protection

The Department of Environmental Quality should prepare for adoption stringent air quality protection measures associated with the stationary and mobile provision of energy, utilizing information gained from the South Coast Air Quality Management District, the California Air Resources Board, and local Arizona sources.

Possible Legislative Actions:

- authorize the development of stringent air quality standards by the Department of Environmental Quality for immediate implementation.
- authorize the development of chlorofluorocarbon controls by the Department of Environmental Quality for immediate implementation.

Possible State and Local Government Actions:

- convert all vehicle fleets to alternative fuels.

Possible Private Sector Initiatives:

- begin installation of best available scrubber technology.

Priority Action Five—Affordability

The State should fund a coordinated continuum of energy programs that include administrative costs to benefit low-income households through a dedicated funding source.

Possible Legislative Actions:

- identify and dedicate funding source for energy assistance programs.
- require the inclusion of energy conservation education in assistance programs

Possible State and Local Government Actions:

- implement recommendations of Energy Services Coordination study group.
- Arizona Corporation Commission to permit utility cost recovery for weatherization of low-income properties.

Possible Private Sector Initiatives:

- provide charitable contributions of funding, materials, and expertise for weatherization efforts for low-income housing.
- provide energy education for consumers.

Priority Action Six—Planning & Policy

The State should develop a comprehensive energy plan and process designed to help the State meet its needs for energy services. The plans should evaluate and address increased energy efficiency, the development of appropriate renewable energy resources including hydroelectric, greater energy independence, and preparedness for future energy emergencies.

Possible Legislative Actions:

- create an Energy Policy Implementation Advisory Council with specific goals and objectives to assist in the implementation of the state energy policy.

Possible State and Local Government Actions:

- Arizona Corporation Commission to expand breadth of Integrated Resource Plan by including municipal and wholesale energy providers.

Possible Private Sector Initiatives:

- conduct major energy audits and begin economical conservation programs.

Section 1 - Energy-Related Environmental Quality

Clean air and water, productive and beautiful lands, abundant wildlife, and plentiful energy and natural resources, as well as a harsh desert climate and low rainfall are part of Arizona's heritage. The United States has by far the most comprehensive legislation of any nation on Earth aimed toward environmental protection and natural resource conservation. This legislative umbrella continues to undergo modification to refine and redirect the nation's and state's programs to best serve the people of Arizona. These efforts are having a positive effect. By all accounts, our state's air and water are getting cleaner.

Yet, we are becoming increasingly aware that many environmental problems do not stop at the State's borders and that regional and national problems will increasingly require coordinated attention and action. Statewide and regional environmental goals must be developed and pursued in the realization that the human environment is global in nature, and that regional and international cooperation must be a principal ingredient of effective environmental management.

Twenty years ago, the Congress of the United States initiated a major, nationwide effort to improve and protect the nation's environmental resources. *The National Environmental Policy Act*, which became effective January 1970, set general environmental policies, established the Environmental Protection Agency, and developed national goals for environmental quality. The *Clean Air Act of 1970* established the national goal of healthy air quality. And in 1972, a law was enacted at the federal level to restore and maintain the quality of water. Strict statutory controls on the disposition of hazardous wastes were established by legislation passed in 1976.

Upon their own initiative and in response to federal mandates, the state and local governments of Arizona have adopted a broad range of policy goals, statutory controls, and legislative mandates on the production, distribution, and consumption of energy for environmental protection, public health, and resource conservation. The creation of the Department of Environmental Quality, the enactment of laws regarding the oxygenation of motor fuels, and the regulation of underground storage tanks are just a few of the recent measures adopted to comply with federal regulation and improve the quality of Arizona's natural resource base.

These programs (national and local), while necessary to improve the State's environmental quality and public health, have been costly. A large share of these costs has been met by the State's energy industries and their customers. Total costs to meet air and water cleanup standards in Arizona have been estimated at more than \$5 billion over the last decade.⁶ Nationally, for example, energy-related costs to meet motor vehicle standards were more than \$200 billion and electric utilities paid more than \$120 billion to reduce flue gas emissions and water discharges.⁷ New clean air legislation, recently signed into law by President George Bush, is expected to add an additional \$20 - \$40 billion per year to the cost of environmental and public health protection.

⁶ National estimate (\$500 billion) x .01 (Arizona population percentage of U.S.) = \$5 billion.

⁷ Department of Energy, *United States Energy Policy 1980-1988*, October 1988.

Many questions have been raised about whether these federal statutes and state regulations have resulted in effective programs. Complaints of unneeded permitting and construction delays, inefficient regulatory choices, disincentives that constrain modernization, and overly stringent regulations have been common. The electric utility industry has had particularly high-cost statutory constraints on its choices for meeting standards for coal-fired generation plants. The current law forces new plants to use sulfur-dioxide scrubbers and new law proposes stringent visibility standards. This has been a major factor leading to the industry's aversion to modernize its technology by building new plants.

As early efforts to improve rural and urban environmental conditions were scientifically demonstrated as being generally effective, a new series of air-quality concerns has been identified as causing ecological damage and public health problems over large regions of the United States. Many of these pollutants are emitted from smoke stacks and vehicles, and are being carried hundreds and thousands of miles through the atmosphere before being deposited in relatively pristine areas. These new concerns—acid rain, regional haze, ground-level ozone and other pressing problems—require additional private and government sector action to avoid or mitigate environmental damage.

Acid rain has been the focus of international concern, while visibility at national parks and air quality in urban areas has been of major local interest. Electricity produced for Arizona use is responsible for over 100,000 metric tons of sulfur oxides and over 100,000 tons of nitrogen oxides annually.⁸ In the late 1970s, the United States and Canada agreed that sulfur dioxide emissions, which can travel long distances and often cross the U.S.-Canadian boundary, appeared to be damaging lakes in the northeastern United States and Canada. Similarly, the major pollution centers of southern California may have an impact on the environmental quality of Arizona and the many state and national parks within our borders (particularly the Grand Canyon).

In the early 1980s, the first concerns about global climatic stability emerged in academic and scientific literature. Since that time, numerous studies have been undertaken to identify and measure any changes in global climate. A recent report by the United Nations Intergovernmental Panel on Climate Change (UNIPCC) has indicated that unless the amount of carbon dioxide and other harmful gases released into the atmosphere was immediately reduced by more than 60 percent, global temperatures would rise sharply (5.4 degrees Fahrenheit by the year 2100). British Prime Minister Margaret Thatcher and West Germany's Environmental Minister Klaus Toepfer, breaking with Bush Administration skepticism over the need for immediate action, proposed prompt changes in each of their respective countries. Electricity produced for Arizona consumption adds 33 metric tons of carbon dioxide to the atmosphere each year.⁹ The Bush Administration has maintained that no scientific case for the greenhouse effect has been made and no action needs to be taken.

Dr. Houghton, UNIPCC panel chairman and Britain's top meteorologist, said only a handful of scientists disagreed with the finding, which he described as dramatic confirmation of how rapidly the "greenhouse effect" has and will alter the Earth's atmosphere. The United States (5 percent of world population) is identified as the source of 25 percent of the greenhouse gases. How this finding will impact the production and consumption of energy at the state level is yet to be determined. However, reducing carbon dioxide emissions (a major emission from electric generation by coal or gas) is one strategy that has been advocated by European leaders to slow the "greenhouse effect."

⁸ Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. iii.

⁹ *Ibid.*, p. iii.

Reducing pollution from stationary and mobile sources in Arizona may, however, put local industry at a competitive disadvantage with polluting states or countries. On the other hand, unilateral policies to promote cost-effective energy efficiency and pollution reduction could improve the competitiveness or health of the Arizona economy. Any economy with large sectors devoted to tourism, agriculture, and mineral production must take a proactive role in the development of state specific energy and environmental policies to protect these important local industries and the environment.

1 Energy-Related Environmental Quality

Human-induced global environmental damage has the potential to be the most economically costly and greatest public health dilemma that humankind has ever faced. There is growing international scientific consensus that human activity (primarily related to energy production and consumption) is altering the delicate chemical balance of the planet. The greenhouse effect, stratospheric ozone depletion, and urban air pollution; municipal and hazardous waste disposal; and protection of water quality are challenges that confront this generation as no other before. We who have soiled the planet are obliged to restore it, to the best of our abilities, for the protection of our own health and that of future generations.

For many years, humankind's relationship with the environment has been out of balance. Just as farmers must strive to manage their fields carefully to avoid overworking their acreage, the natural systems of the State, region, and globe must be carefully managed. Man has become a major geological force on the face of the planet.¹⁰ Today, we can literally move mountains or change the global climate.

Meeting the challenges posed by global warming, municipal waste, and acid rain/toxic chemical deposition in waterways will require action at all levels of government and within the private sector. Clearly, the federal government must be involved because several environmental problems cross international borders (e.g., global climate change, ozone depletion, and acid rain) and require cooperation among national governments. The federal government must also be involved in funding local and regional mitigation projects and by setting a regulatory ceiling for hazardous emissions.

It is at the state level where many of the most important efforts at environmental protection must be undertaken. States regulate the rates for the sale of energy, permits and siting for new plants, and which electricity production technologies are used. State and local governments also have regulatory authority over building codes, tax policy, waste disposal, agricultural practices, and over state lands.

With the broad grant of authority vested in state governments by their constitutions, the federal government, and the people, it will fall to this level of government to control many of these regional problems. Only state and local government can deal with the intricacies of the economic and social fabric of local communities. For this reason, as the drive to restore and protect the environment grows in the next decade, it will benefit government, citizens, and business to invest a lead agency with authority over environmental issues related to energy production, distribution, and consumption.

¹⁰ Dr. William Clark, Harvard University, quoted in *The Arizona Republic*, November 8, 1987.

Recommendation 1. The Legislature, Governor, and other units of government should develop a long-term plan for the conversion of all government (ie., municipal, county, state, and school district) operated fleets and vehicles to cost-effective, environmentally benign alternative fuels (including but not limited to electric, CNG, reformulated gasoline, ethanol, methanol, propane, hydrogen, or solar).

Even though the oxygenated fuel program implemented in the winter of 1989 in Maricopa County has proven a short-term success, many still resist the development of alternative fuels for motor vehicles. Fear that oxygenated fuels would damage cars and tales of expensive gasoline initially created much opposition to the oxygenated fuels program. But after one season of driving with oxygenated fuels in Maricopa County, resistance to the program seems to have subsided. However, an equally deafening resistance has developed in the Congress of the United States and among automobile manufacturers to the development and implementation of alternative fuels and vehicles.

A chicken and egg dilemma has evolved in the process of implementing alternative fuel programs. The auto industry refuses to manufacture alternative fuel vehicles, because there are few refueling sites. The alternative fuel producing industries refuse to introduce the fuels on a large scale until new alternative fueled vehicles are "on the road." There remains a lack of consistent and reliable technical information on the total environmental effects of each fuel type, the ability of existing technologies to improve efficiencies, technology benefits, and consumer acceptance. Therefore, because of the need for accurate field experience and the need for infrastructure to distribute and store these alternative fuels, the State should take an active role in assisting in their full penetration of the market.

The development and use of alternative fuels and reformulated fossil fuels can be effective in the reduction of polluting emissions from the transportation sector. Compressed natural gas, hydrogen, solar, methanol, ethanol, and electricity are options for transportation. Reformulated or oxygenated fossil fuels have already been used successfully in Maricopa County. Additional advancements in the area of reformulated and alternative fuels are occurring constantly in the transportation field.

Alternative fuels for transportation can have environmental, economic and energy security benefits and are currently available in commercial quantities throughout the United States. Some of these fuels have been developed to improve fuel efficiency, while others have primarily environmental benefits. Because of concerns about the long-term reliability of particular sources of crude oil and environmental impacts of the combustion of current grades of vehicle fossil fuel, alternatives ought to be considered. These alternatives include: compressed natural gas, methanol, ethanol, electric, solar, and hydrogen (Table Four).

Diversification of the type and source of energy used to move people and freight should be examined. Currently, more than 95 percent of the on-road gasoline consumed in Arizona is refined in either southern California or west Texas. The fuel is delivered to Arizona through a pipeline system stretching from the Los Angeles region of California through Phoenix to Tucson and from the El Paso region through Tucson to Phoenix. Supply disruptions are a constant threat to the economic health and security of the State and people. Supply shortages have occurred on several occasions in the past due to problems associated with these two pipelines.

Increased private and public sector focus on the development and distribution of alternative fuels and sources of supply could have a positive effect on the energy efficiency and security of supply for the transportation sector. Currently, dependence on fossil fuels is almost complete (Table Five), with few alternatives available to the transportation

consumer. Recent federal and California state legislation will positively impact the availability of alternative fuels and alternatively fueled vehicles.

Under a new piece of legislation passed by the State Senate of Louisiana, all state-owned autos will be required to run on alternative fuels. This measure requires that beginning September 1, 1991, state government must purchase vehicles that operate on compressed natural gas or other alternative fuels. Additionally, the Louisiana State Motor Pool must convert 30 percent of vehicles to natural gas by September 1994, 50 percent by September 1996, and 80 percent by September 1998. Following the example of Louisiana, the state of Arizona should develop a plan to implement the use of alternative fuels in all government fleets.

**Table Four
Sources and Applications of Alternative Fuels**

Alternative Fuel	Derived From	Internal Combustion Engine	Diesel	Gas Turbine	Electric Motor	Fuel Cell
Reformulated Gasoline	Petroleum	•				
	Natural Gas	•				
Methanol	Biomass	•	•	•		•
	Natural Gas	•	•	•		•
	Coal	•	•	•		•
Ethanol	Biomass	•	•	•		
Compressed Natural Gas	Natural Gas	•	•	•		
Electricity	Solar				•	
	Hydro				•	
	Nuclear				•	
	Natural Gas				•	
	Biomass				•	
	Coal				•	
Hydrogen	Solar	•		•		
	Nuclear	•		•		
	Coal	•		•		
Synthetic Gasoline	Biomass	•				
	Nuclear	•				
	Oil Shale	•				
Synthetic Diesel	Biomass		•	•		
	Coal		•	•		
	Oil Shale		•	•		

Source: U.S. Department of Energy, Office of Renewable Technologies

Table Five Transportation Energy Consumption by Fuel Type		
Fuel type	1978	1988
Petroleum	97.3%	97.3%
Natural Gas	2.6	2.6
Coal	0	0
Electricity	0.1	0.2
Hydroelectric	0	0
Nuclear	0	0
Source: U.S. Department of Transportation, <i>Automotive Fuel Economy Program, 11th Annual Report to Congress</i> , Washington, DC, January 1987.		

Recommendation 2. The Department of Environmental Quality should prepare for adoption stringent air quality protection measures associated with the stationary and mobile provision of energy, utilizing information gained from the South Coast Air Quality Management District, the California Air Resources Board, and local Arizona sources.

The South Coast Air Quality Management District (Los Angeles Metropolitan Area) has the most serious air pollution problem in the United States. Ozone and carbon monoxide reach levels nearly three times the national standard to protect public health. This basin is the only region in the United States still exceeding the nitrogen dioxide standards of the Environmental Protection Agency.

The pollution of the Los Angeles basin has resulted in billions of dollars in damage to residents' health, materials, agriculture, and visibility. A recent study has concluded that children raised in the Los Angeles region have 15 percent diminished lung capacity by age 20.¹¹ Because of these persistent problems, and in light of tough control strategies that have brought the region into compliance for lead and sulfur dioxide, all regional governmental units adopted a policy for attainment of all federal and state health standards.

The 1989 Air Quality Management Plan is a comprehensive regional plan for attaining federal air quality standards in the basin. The plan required five years to develop and consists of over 5,500 pages. The plan has been approved by the South Coast Air Quality Management District, Southern California Association of Governments, California Air Resources Board, and the Governor of the State of California. It has been presented to the Environmental Protection Agency as part of the State Implementation Plan. The plan is considered the current "model" for dealing with urban air quality issues.

¹¹ James M. Lents, Ph.D., Executive Officer of the South Coast Air Quality Management District, interview with Michael Walters, June 15, 1990.

The 1989 Air Quality Management Plan presents a three-tier strategy to reduce harmful emissions to the point where all federal and state standards are met by the year 2007:

- **Tier I - Full scale implementation of known technology.**

Tier I includes 120 control measures that can be adopted within the next five years using currently available technological applications and management practices.

- **Tier II - Significant advancement of known technology.**

Tier II measures include already demonstrated control technologies and "on-the-horizon" technological advancements that can reasonably be expected to occur in the near future.

- **Tier III - Technological breakthrough required.**

Tier III requires commitments to research, development, and widespread application of technologies that may not exist yet, but may reasonably be expected given the rapid technological advances experienced over the past 20 years.

Modelling studies indicate that through application of Tier I strategies, carbon monoxide and nitrogen dioxide standards can be met in the next ten years. The federal standard for fine particulate matter can be achieved through Tier II strategies. However, Tier III strategies will be required in order to meet the federal standards for ground-level ozone.

This long-term planning effort has vast potential for building consensus on the mitigation of urban air quality problems in Arizona. By establishing a regional air quality district, the southern California region was able to build consensus around a plan and an organization with the authority to meet the requirement of clean air for the basin by the year 2007. The Department of Environmental Quality should prepare for adoption similar long-term plans for the mitigation of air quality problems in the urban areas of the State.

Recommendation 3. The Legislature should require the development of cost-effective, mandatory curbside separation and recycling programs for counties and incorporated communities throughout Arizona. Cities with over 25,000 people should recycle 25 percent of their trash by 1998, and 50 percent by 2005, or face substantial daily fines.

It is estimated that 14 billion pounds of trash are dumped into the sea every year. Americans throw away enough iron and steel to supply all of the domestic auto industry continuously. Every 3 months, the United States throws away enough aluminum to rebuild our commercial air fleet. A recycled aluminum can is typically re-melted and back in the store within six weeks. When you toss out one aluminum can you waste as much energy as if you'd filled the same can half full of gasoline and poured it onto the ground. In the United States, about 70 percent of all metal is used just once and is then discarded. In 1987, the United States produced over 50 billion pounds of plastic. About 75 percent of America's glass is used for packaging. Each year we throw away 28 billion glass bottles

and jars—enough to fill the twin towers of New York's World Trade Center every two weeks.¹²

Over 1 billion trees are used to make disposable diapers every year. The junk mail Americans receive in one day could produce enough energy to heat 250,000 homes. It takes an entire forest—over 500,000 trees—to supply Americans with their Sunday newspaper every week. Americans produce enough “styrofoam” cups every year to circle the Earth 436 times. Americans use approximately a billion gallons of motor oil every year—and 350 million gallons of it winds up in the environment. During a beach cleanup along 300 miles of Texas shoreline in 1988, 15,600 plastic six-pack rings were found in three hours. Every year, Americans generate about 1200 pounds of solid waste per person. Connecticut, Rhode Island, New Jersey, and Oregon have all passed legislation that either encourages or requires recycling by residents.¹³

In 1987, Japan was reported to have 360 resource recovery plants serving a population of 120 million people, while the United States had only about 70 plants serving 240 million people.¹⁴ In 1988, Japan recycled 50 percent of its waste paper, 55 percent of glass containers, 66 percent of beverage and food cans, and converted much of the remainder into fertilizers, fuel gases, and recycled metals. In 1986, the United States recovered only 23 percent of paper products, 9 percent of glass containers, and 25 percent of aluminum.

With few exceptions, residents in Japan's cities separate their trash into six classifications to simplify recycling. Municipal solid waste is recycled in many European cities including Rome, Vienna, and Madrid. In various parts of the United States, many components of the solid waste stream are separated and processed for reuse including newspaper, paper, aluminum, and glass.

The State, in association with its counties and municipalities, should develop programs for recycling trash and purchasing recycled goods. The economic and environmental benefits of this effort are unquestioned. American Telephone and Telegraph (AT&T) reported it saved \$1,000,000 in disposal costs and collected \$365,000 in cash by recycling just office wastepaper. Part of this effort must be to assist local business in the effort to acquire goods that are the result of recycling efforts.

Recommendation 4. The Legislature should develop and implement an emissions tax for all stationary and mobile sources of particulates, NO_x, CO, CO₂, and SO_x pollution throughout the State based on quantity and quality of emissions with all revenue dedicated to energy conservation and energy-related pollution abatement.

Burning fossil fuels (i.e., coal, natural gas, and oil) releases oxides of carbon, nitrogen, sulfur, and various hydrocarbons that contribute to ozone formation. These substances all contribute in one way or another to various air quality problems, including the build-up of greenhouse gases, acidic deposition, and urban air pollution. At the point of combustion, natural gas contributes only about 60 percent as much carbon dioxide (CO₂) per British thermal unit (Btu) as does coal.

¹² The Earth Works Group, *50 Simple Things You Can Do to Save the Earth*, 1989.

¹³ *Ibid.*, p. 20.

¹⁴ Global Tomorrow Coalition, *Citizen's Guide to Sustainable Development*, 1989, p. 271.

Energy-related sources of air toxic emissions include: automobiles; gas, oil, and coal-fired utility boilers; petroleum refineries; and exploration and production operations for oil, gas, and coal. Since 1970, the Environmental Protection Agency has set emission standards for only seven out of hundreds of potentially toxic air pollutants, in part because of difficulty in implementing the current Clean Air Act (Section 112, the National Emissions Standards for Hazardous Air Pollutants).¹⁵ However, reacting to local and regional air pollution problems, the oil industry has taken several steps to reduce emissions from automobiles.

The use of tall smokestacks to reduce the local impact of emissions became prevalent in the 1960s and early 1970s. This resulted in utility emissions being carried long distances—thus reducing local concentrations of sulfur dioxide (SO₂), but broadening the regional impact of acidic deposition.¹⁶ About 94 percent of utility SO₂ emissions come from older plants which are not subject to New Source Performance Standards.

In an effort to restrict the use of fossil fuels, and their associated environmental and public health problems, California Representative Pete Stark in June of 1990 proposed placing a national tax equivalent of \$25 per ton on fossil fuels.¹⁷ The tax would be phased in over five years. Representative Stark indicated that, “as the global military threats fade, we must focus on the two things that threaten our national security: environmental destruction and the budget deficit. There is no doubt that a carbon tax can lead the charge on attacking the heart of both of those problems.”

Representative Stark advocates the bill as a market-oriented approach to reducing CO₂ emissions and indicates that in addition to slowing global warming, it would encourage research and development of non-fossil fuel alternatives, lower oil imports, and reduce the use of fossil fuels. The Bush Administration has issued a report saying that such a fee would “lead firms and individuals to consider the social cost of greenhouse gas emissions in their private decisions Because market-based approaches are flexible and provide incentives that affect decisions at all points along the production-consumption chain and across all industries, they automatically focus on those activities where emissions reductions can be achieved at the least cost.”

The automobile industry, reportedly, is favoring such a tax as an alternative to a gasoline tax. However, the electric utility industry appears to be united in opposition to such a tax. The American Public Power Association passed a resolution opposing the tax at their national convention in June of 1990. The APPA argues that studies on the contribution of CO₂ to global warming are inconclusive, the tax would weaken the nation’s industrial competitiveness, that it would unfairly burden taxpayers residing in communities relying on fossil-fuel generation, that emissions taxes are regressive, and that it is unclear if the tax would in fact reduce carbon emissions.

Some public utility regulatory commissions have considered or implemented a “tax” on pollutants. For instance, in New York, the most environmentally disruptive power source (considered in a bidding program) is assigned a cost of 1.405 cents per kilowatt hour. Less disruptive sources are assigned lower costs. The costs are apparently based on the costs of mitigating the environmental impacts. Wisconsin utilities are required to credit non-combustion technologies by adding 15 percent to the cost of combustion technologies.¹⁸

15 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990.

16 National Acid Precipitation Assessment Program, *Annual Report*, 1986.

17 House Resolution 4805, 101st Congress of the United States, 2nd Session, May 10, 1990.

18 Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. 60.

Recommendation 5. The Legislature should require that all public and private organizations receiving public grants, loans, and contracts purchase recycled products when they are available at a reasonable cost as a substitute for virgin products.

Recycling is a term commonly applied to the process of putting post-consumer waste into new products that may or may not resemble the original material. Recycling not only reduces waste; it also lowers energy, water, and primary raw material requirements. Recycling can also create jobs and small business opportunities, while reducing dependence on foreign sources of energy and raw materials. Japan, with a highly sophisticated source reduction and recycling program developed over many years, has been able to recycle 50 percent of its waste compared to only about 11 percent in the United States. After burning 23 percent of its waste in waste-to-energy facilities, the Japanese dispose of only 27 percent of waste in landfills compared to 83 percent in the United States.

Recommendation 6. The Department of Commerce should develop and make available to the public and business community a database of sources and availability of recycled products.

Recommendation 7. The Department of Commerce should explore ways to expand production facilities that manufacture products using recycled materials.

Occasionally, the only obstacle to the purchase and use of recycled products is locating distributors. The Department of Commerce could fill this void by regularly publishing a database of sources of recycled products. In the past, the Department of Environmental Quality has published a Directory of Arizona Recyclers. A similar document detailing the source of recycled products would be of great benefit to the public and business community.

Opportunities also exist to expand or attract businesses to Arizona that use waste materials in their manufacturing processes. Tire recycling is a fairly untapped area. But it's a promising one. Some 240-260 million tires are discarded annually in the United States. Some landfill operators don't accept scrap tires ... or they charge more because tires often don't stay buried—they trap gas and float to the top of landfills. The energy used to produce a pound of virgin rubber is 15,700 BTUs. Producing one pound of recycled rubber requires only 4600 BTUs—a savings of 71 percent.¹⁹ Several components of old car batteries can be recycled. Motor oil can be recycled and reprocessed as fuel for ships and industrial boilers.²⁰

Recommendation 8. The State should immediately fund an investigation into the possibility of developing regional waste-to-energy systems for solid waste that cannot

¹⁹ Ibid., p. 29.

²⁰ Ibid., p. 53.

be recycled.

United States industry generates more than 300 million tons of liquid and solid hazardous waste per year.²¹ An estimated 613 million tons of non-hazardous wastes are also produced by industry each year.²² Many industries have identified techniques to minimize and reduce waste as the most cost-effective way to satisfy increasingly stringent environmental requirements. Municipalities generate an additional 154 million tons of solid waste annually. Excluding agricultural waste, the United States generates about 11 billion tons per year.

This waste was deposited in about 20,000 landfills in 1978; by 1988 the number of landfills still operating had dropped to about 6,000. It is projected that by 1993 only 4,000 landfills will still be operating in the United States and few new sites will be available. To manage our growing volume of solid waste we will need to rely upon a combination of waste reduction, recycling, composting, use of landfills, and incineration (since 1980, 100 percent of new incineration capacity has been equipped with heat-recovery systems²³). Waste recycling saves energy and material resources, and reduces air, water, and habitat pollution (Table Six).

Waste that cannot be recycled can be used to produce heat, liquid, and electrical energy. Currently, 77 percent of waste in Switzerland is incinerated, compared to approximately 15 percent in United States. Energy from waste is found in 41 states, with most of the development in the Northeast. By the turn of the century, as much as 40 percent of the nation's municipal solid waste may be burned for electricity.²⁴ Canadian researchers project that a waste-to-energy system in that country could provide sufficient energy to power the entire land-based transportation system. Because a waste-to-energy system will require inputs from several communities and counties, the State should fund an investigation into the plausibility of developing a publicly funded waste-to-energy system.

21 U.S. Environmental Protection Agency, *Waste Minimization*, October 1986.

22 U.S. Environmental Protection Agency, *Summary of Data on Industrial Nonhazardous Waste Disposal Practices*, 1985.

23 Radian Corporation, "Database of Existing Municipal Waste Combustion Studies," database maintained for the U.S. Environmental Protection Agency, Radian Corporation, Research Triangle Park, NC, 1989.

24 Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. 65.

Table Six Environmental Benefits Derived from Substituting Secondary Materials for Virgin Resources				
Environmental Benefit	Aluminum	Steel	Paper	Glass
Reduction of:				
Energy Use	90-97%	47-74%	23-74%	4-32%
Air Pollution	95	85	74	20
Water Pollution	97	76	35	—
Mining Wastes	—	97	—	80
Water Use	—	40	58	50
Source: Letcher and Sheil, <i>Source Separation and Citizen Recycling</i> , in "The Solid Waste Handbook" (New York, 1986)				

Recommendation 9. The Department of Environmental Quality should maintain a stringent enforcement mechanism to test regularly for degradation of the groundwater in the State associated with the provision of energy. Significant fines should be assessed and collected for violations with all revenue dedicated to energy conservation and energy-related pollution abatement.

The State of Arizona has developed several measures to protect the groundwater of the region from leaks associated with the underground storage of liquid fuels. These efforts attempt to identify violators and assist in the mitigation of damage. Efforts such as these are to be commended. However, additional efforts must be taken to enforce all regulations regarding the indiscriminate dumping of waste oil and other materials associated with the provision of energy services.

While the environmental impacts of major oil spills on marine and coastal ecosystems have received more public attention, minor spills and chronic discharges are believed to be a serious environmental hazard to inland freshwater resources.²⁵ In Michigan alone, more used oil is dumped onto the ground and into sewers each year than the quantity spilled by Exxon at Valdez, Alaska.

²⁵ American Petroleum Institute, *The American Petroleum Institute Task Force Report on Oil Spills*, Washington, D.C., June 1989.

Section 2 - Energy Efficiency and Conservation



The next issue to be addressed by the state energy policy and recommendations for implementation is the conservation and the efficient use of energy in four major sectors: commercial and residential buildings, personal and product transportation, energy delivery systems, and manufacturing process systems. It is appropriate to focus on energy efficiency because the inefficient use of any resource is a drain on the economic systems and infrastructure of Arizona. Efficiency includes both technological improvements and behavioral change in the pattern of use. Decisions made now by utilities, customers, and government will enable Arizona to substitute efficiency and conservation for future increases in supply, thereby lowering the total cost of meeting the demand for energy services. Energy efficiency can provide more than just economic benefits, as the efficient combustion of fossil fuels reduces the amount of damaging emissions into the environment and allows for a greater reliance upon existing energy resources and infrastructure.

Energy efficiency in this context is different than the concept of energy conservation. For example, conservation of electrical energy by definition would require a reduction in use (removing or turning the light bulb off), while an efficient use of electrical energy in this context would require using the least power necessary to preform the same task (a different type of light bulb). The United States Department of Energy, in preparing a National Energy Strategy has indicated that, "Higher efficiency of energy use, where cost-effective, can help reduce energy costs to consumers, reduce energy demand, balance environmental concerns with economic development, and enhance energy security."²⁶ For these reasons, the following section will focus on how Arizonans may maintain the same or an improved quality of life while reducing the consumption of energy to deliver the identical energy service. Unfortunately, a variety of existing governmental and market-based subsidies continue to make it cheaper in some cases to consume energy than to save energy.²⁷

Energy consumption per capita in the United States and Arizona is significantly higher than in other western industrialized nations per unit of gross national product. We use enormous amounts of energy in our society (Table Seven). This misapplication of finite energy resources to inefficient consumption precludes applying economic resources to other pressing issues within our society. Although energy consumption per capita has declined in the Arizona since its peak in the late 1970s (Table Eight), additional gains have been identified by United States Department of Energy investigators that are economically beneficial to society and the individual.²⁸

The economies of the United States and of Arizona have demonstrated the ability over the past seventeen years to reduce energy consumption in response to changing energy market conditions. Since 1973, the United States has increased energy consumption only 7 percent while constructing 20 million new homes, increasing the motor vehicle fleet by 50 million units, and increasing the gross national product (GNP) by 46 percent.²⁹ The ability

26 National Energy Strategy, public hearings Washington, D.C. and Tulsa, August 1989, p. 152.

27 *Ibid.*, p. 152.

28 U.S. Department of Energy, *Energy Conservation Trends: Understanding Factors that Affect Conservation Gains in the U.S. Economy*, September 1989, p. 31.

29 *Ibid.*, p. 2.

of Arizonans to effectively (economically) reduce per capita energy consumption through improvements in energy efficiency while maintaining or improving living standards is the key to the long-term sustainability of our local economy and environment.

Table Seven Energy Consumption Per Unit of Gross Domestic Product in Western Industrialized Nations	
United States	6.1
Sweden	4.0
United Kingdom	3.5
Italy	3.3
Japan	2.9
West Germany	3.1
Denmark	2.7
Metric tons of oil equivalent per \$10,000 U.S. dollars of gross domestic product.	
Source: Adapted from WRI and IIED, <i>World Resources 1988-89</i> , p. 114.	

Table Eight Historical Energy Consumption Per Capita in Arizona	
1960	211 million Btu
1965	232
1970	289
1975	285
1980	273
1984	255
1985	256
1986	250
1987	248
1988	251
Source: Arizona Energy Office	

Energy efficiency and conservation provide the foundation upon which a transition to any new set of energy resources will be built. The next generation of energy resources will have to be environmentally benign. The nature of the resources will almost certainly cause them to be more expensive to harness in terms of investment in technology and infrastructure.

In order to maximize the effectiveness of investments in these next generation resources, whatever they may be, it makes sense to minimize the demand for energy inputs necessary for energy services.



2 Buildings

Energy consumption within residential buildings represents approximately 20 percent of the total primary energy consumed in the state of Arizona. This energy is primarily used in three areas: space heating and cooling, water heating, and appliances (refrigerators, television, computers, clothes washing and drying). Because of the vast amount of energy consumed by this sector and the sensitivity of most modest energy consumers to price changes, substantial opportunities for reduction in energy consumption exist without negatively, and perhaps positively, impacting life quality.

Often, the amount of energy consumed by older buildings is significantly greater than energy consumed by new construction. Nationally, houses built in 1980-1984 are using slightly more than half the energy used in the oldest houses and the same is true of commercial buildings. The largest share of the new level of energy efficiency is attributable to better design, material, and construction techniques.³⁰

In Arizona, as in all regions, the orientation of a building to the movement of the sun and shading play a significant role in building energy consumption. Studies indicate that, through proper orientation, a building's energy consumption relative to space heating and cooling can be reduced over 50 percent.³¹ This has large implications affecting local and state government's role in the design and siting approval process of new construction.

Cheap energy in the past allowed the construction of inexpensive non-climate sensitive buildings that relied on massive energy inputs to mitigate daily and seasonal temperature changes. This immense existing inventory of low-efficiency buildings leaves substantial energy savings to be captured in that sector. If the relative efficiency of older structures could be raised to current standards, the economic and environmental savings could be significant.

There is an enormous opportunity to reduce energy consumption in Arizona through improvements in the insulation, heating, cooling, and lighting of buildings, at the same time creating new jobs and reducing the long-term cost of energy. For example, the number of U.S. households increased by 33 percent between 1972 and 1986, while energy consumption per household decreased 34.3 percent.³²

30 *Ibid.*, p. 20.

31 Jack Haenichen, Senior Technical Advisor of the Arizona Energy Office, interview with Michael Walters, June 7, 1990.

32 U.S. Department of Energy, *Energy Conservation Trends: Understanding the Factors that Affect Conservation Gains in the U.S. Economy*, September 1989, p. 6.

In Arizona, however, electric energy consumption per household has progressively increased. This has happened as air conditioning has replaced evaporative cooling, electric resistance water heating has replaced gas water heating (on a larger scale than solar water heating has replaced either electric or gas water heating), and as larger new homes are built with more gadgets and appliances than the existing housing stock.

In 1988, approximately 36,000 new housing units were authorized for construction in Arizona.³³ When residential units are added to the commercial construction authorized in the same year, it is clear that improvements in the level of energy efficiency achieved in new construction can have a significant impact on total energy consumption in Arizona.

Recommendation 1. The State should work with private organizations to immediately develop and apply a standard residential and commercial building energy rating system to fully inform consumers about new building energy consumption. This system would provide consumers with a simple scale to identify the relative energy efficiency of new construction. Beginning January 1, 1995, no new building in Arizona should be sold or leased unless it has been rated under the Arizona Building Energy Rating System.

In order for energy consumers to make astute decisions about the purchase or lease of newly constructed buildings, it is important they have reasonable information about the structure's level of energy efficiency relative to similar buildings. Currently, it is impossible for most untrained energy consumers to distinguish between an energy efficient or inefficient building. This is because much of the technology used to improve energy efficiency is difficult to identify and measure (e.g., insulation).

The purchase of a building (residential and commercial) is the largest single monetary transaction most consumers will make in a lifetime. Yet, unlike the purchase of a new automobile or appliance (both of which must be labeled as to relative level of energy efficiency), a building has no mandatory energy efficiency rating system. Without a standardized energy efficiency rating system, consumers are largely unable to distinguish between a highly energy-efficient building (with a low operating cost) and a less energy-efficient building (with a high operating cost).

Warehouse	25.6%
Service	22.0
Office	16.4
Assembly	12.6
Education	12.6
Lodging	23.7
Health Care	3.6
Food Sales/Service	3.4
Source: Energy Information Administration, <i>Nonresidential Buildings Energy Consumption Survey, 1986.</i>	

33 Valley National Bank, *Arizona Statistical Review*, December 1989, p. 51.

It is in the new building consumers' best interest for state government and the private sector to require the development and implementation of a standardized energy efficiency rating and label system. In this manner, all consumers of new construction will be able to make informed decisions about their building purchases including long-term energy consumption costs. The existing "Arizona Energy Office - Home Energy Rating System" could become the accepted model and represent the required minimum standard for programs designed to "rate" the energy performance of a new building. The Arizona Energy Office could then be charged with the responsibility to set Home Energy Rating standards and provide Home Energy Rating compliance verification statewide.

Recommendation 2. The State should work with private organizations to immediately develop and apply a standard residential and commercial building energy rating system to fully inform consumers about existing building energy consumption. This system would provide consumers with a simple scale to identify the relative energy-efficient new construction. Beginning January 1, 1995, no existing building in Arizona should be sold or leased unless it has been rated under the Arizona Building Energy Rating System.

It is in all consumers' best interest for state government to require the development and implementation of a standardized energy efficiency rating and labeling system. In this manner, consumers will be able to make informed decisions about their building purchases including long-term energy consumption costs. The existing "Arizona Energy Office - Home Energy Rating System" could become the accepted model and represent the required minimum standard for programs designed to "rate" the energy performance of homes. The Arizona Energy Office could then be charged with the responsibility to set Home Energy Rating standards and provide Home Energy Rating compliance verification statewide.

By making historical data about energy consumption or the results of an energy audit available to prospective purchasers or renters of existing structures, the consumer is permitted to make this important economic decision with full knowledge of both immediate transaction costs and long-term operating costs. This information is particularly important in the desert communities of Arizona where monthly energy expenditures can be high.

Recommendation 3. The State, acting in a leadership role, should implement stringent uniform energy efficiency standards for all existing and proposed publicly-funded buildings to demonstrate the costs and benefits of energy-efficient technologies and strategies.

The state of Arizona has historically taken an active role in the research, development, and demonstration of energy-related technologies. Yet, it has occasionally recommended changes for the general public that it has been unwilling or unable to adopt itself. The time has come for state government in Arizona to take a leadership role in the development and implementation of energy efficiency and renewable technologies. To this end, it would be beneficial both economically and psychologically for the State to immediately implement a stringent energy efficiency standard for all existing and proposed publicly-funded buildings within the State.

Through the development and implementation of stringent public buildings energy standards, the State will be able to demonstrate the economic benefits and costs of various strategies to achieve energy efficiency. Additionally, the State will enjoy the economic benefits of increased energy efficiency in its own day-to-day operational accounts.

Another method to increase public acceptance of experimental and existing energy efficiency technologies is the use of public and private demonstrations of successful efficiency and conservation technologies. By providing "hands-on" examples of the practical use of energy conservation and efficiency techniques, consumers are better able to transfer the technology to their own use.

The city of Phoenix, in association with the Arizona Energy Office and private sector actors, currently is planning construction at the Phoenix Civic Plaza of a hands-on demonstration of various commercial applications of solar and shading technologies. Additionally, the Desert Botanical Garden (a non-profit educational institute), in association with the city of Phoenix, Salt River Project, and others, is planning construction of the "Center for Desert Living," a project to demonstrate passive solar energy and "grey-water" recycling technologies. Many of these technologies are "old." They were incorporated in the buildings of ancient Greeks and American Indians.

"Cool in the summer, warm in the winter, rammed earth (and adobe) homes (with 18" to 36" exterior walls) are energy efficient and highly compatible with living in a desert environment. Costs range from \$40 per square foot up. In some cases, 2,000 square feet can be cooled and heated for \$60 per year."³⁴

"Cool towers" are an "old" technology from the middle east and from Arizona's evaporative cooling past that would contribute to a way of life that is compatible with the desert, as opposed to the relatively high-energy sealed-off summer living that air conditioning requires.

By taking an active role in the research, development, and funding of energy efficiency and renewable energy demonstration projects, the State could significantly speed the market penetration and public acceptance of these "new" efficiency technologies. By increasing the total penetration and speed of the conservation and efficiency technology transfer process, the goals of the energy policy can most quickly be realized.

Recommendation 4. The State should work with utilities, private and municipal organizations to develop sliding-scale application, building permit, and energy service hook-up fees that reward developers/consumers for the utilization of energy-efficient building design, solar energy, and material technologies in new construction and penalize developers/consumers who select inefficient technologies.

Another method for improving the level of energy efficiency inherent in new construction in Arizona is the implementation of sliding-scale hook-up fees and rebates based upon the total level of energy efficiency achieved through design, material, and construction techniques. Buildings that fail to achieve a significant level of energy efficiency through design, material, and construction techniques relative to an established governmental or utility standard would be charged a high fee at the time of utility connection, and buildings that use less than the government or utility standard could be charged a reduced rate or receive a rebate (paid for out of fees).

Using a system of sliding-scale hook-up fees more equitably distributes the economic burden of energy infrastructure construction costs based upon level of increased demand. Of course, a portion of the fees charged against inefficient users should be reserved to cover any administrative costs of such a program.

³⁴ Dean Pritchard, *San Manual Miner*, March 7, 1990, p. B1.

Recommendation 5. The State should put into law a state-wide energy conservation building code for all new and remodeled buildings similar to Title 24 in California.

Promoting tougher residential and commercial building practices and standards is one method of improving the base level energy efficiency of all new buildings. In the past, the development and implementation of local building practices and standards in Arizona has been primarily the responsibility of local governments. Although this system permits direct local control and a diversified architectural style, the system has led to the development of a disparate array of building codes that vary from community to community throughout Arizona. Some codes address issues of enhanced energy efficiency, while others do not. Previously, the state of Arizona through the Arizona Energy Office requested that municipalities adopt uniform energy efficiency standards for new construction. However, only one community adopted the standards developed by the Arizona Energy Office through a panel of building industry representatives. Nor has any city adopted the National Energy Codes advocated by building code officials.

Additionally, the use of solar-powered technologies in new construction can reduce the total load on energy production facilities and reduce several types of pollution. The reduction in total energy usage from fuels that pollute and the substantial savings on one's utility bill are reasons enough to install economically feasible solar technologies.

An improved level of energy efficiency can easily be incorporated into the design of all new buildings in Arizona. However, all new energy efficiency standards should be economically beneficial to the consumers, taking into account complete life cycle costs rather than merely the transaction cost of installation. In recent years, great strides have been made in the development of new building shell and material technologies to reduce energy use in new construction. The techniques of "super-insulating" a building through the use of improved materials and high performance windows have been proven to reduce energy consumption significantly when heating or cooling a building while providing lower life cycle costs to the consumer.

Sometimes efficiency improvements can reduce or not impose new construction costs. But where improved energy efficiency design, material, and construction techniques do increase cost, they are typically offset by decreased operating costs over the life of the building. Unfortunately, to reduce the initial cost of new construction in a tight new construction market, many in the building industry are not automatically employing these long-term energy and cost saving techniques. Nor are the vast majority of municipalities requiring the use of energy-efficient technologies in the construction of new buildings.

The commercial sector currently accounts for over 15 percent of the Nation's total primary energy use.³⁵ The fastest growing use for electricity in this sector is air conditioning. Fifty percent of commercial building owners lease their buildings and pass energy costs directly to the buildings tenants.³⁶ These owners have little economic incentive to incorporate energy efficiency features into building designs they will not occupy. Energy costs in the commercial sector are a relatively small percentage of total business expenses. Therefore, they are frequently ignored in corporate strategies to improve cash flow and profits.

35 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 26.

36 *Ibid.*, p. 28.

Current solar building technologies contribute, in some cases, up to half of the total thermal energy needs of a building and a significant fraction of the lighting needs. By using advanced solar technologies and improved design techniques, residential and commercial buildings can cost-effectively derive up to 80 percent of their heating requirements and up to 60 percent of their cooling requirements, although implementation barriers remain.³⁷ However, improved lighting efficiency is another area which contains great potential for energy savings. Improved lighting also saves in cooling costs, especially where fluorescent lights are used to replace incandescent lights.

Table Ten States With Energy Conservation Building Codes
California
Florida
Idaho
New York
Source: Arizona Energy Office

Of course, where energy efficiency provisions are developed, they must be fully enforced if they are to have high impact when implemented. The huge beneficial economic, environmental, and social impacts from improvements in the energy efficiency of building design and material technology evidence a role for government and the private sector in assuring the quick market penetration of these technologies. Every economical effort should be undertaken to promote and assure the energy efficiency of all new buildings. For example, the state of Idaho has passed new minimum construction standards designed to increase energy efficiency in new construction and utilities are prohibited from serving new homes that have not obtained permits guaranteeing compliance with the standards (Table Ten).³⁸

The addition of each new building to the energy distribution system of Arizona requires further production capacity and increases various types of pollution. Currently, each singular class of new buildings is charged a standard fee for connection to the utility regardless of its level of demand or total impact on energy production infrastructure requirements. In essence, those who expend funds to improve energy efficiency of new construction significantly subsidize those who ignore the economic and environmental value of increased energy efficiency by equally sharing the costs of energy infrastructure.

Recommendation 6. The State, in concert with the utility industry and financial institutions, should examine the development of cost-effective conservation and efficiency programs, and solar energy technology and weatherization programs, including financing incentives, for energy efficiency upgrades of existing buildings.

Although energy efficiency in new construction can significantly reduce future energy demand, new construction represents a small part of the total building inventory in

³⁷ Global Tomorrow Coalition, *Citizen's Guide to Sustainable Development*, 1989, p. 208.

³⁸ Idaho Department of Water Resources, *Idaho Currents*, May 1990, p. 1.

Arizona. The 1980 census indicates there are 1,110,558 existing housing units in Arizona.³⁹ When added to the inventory of existing commercial structures, improvements in the energy efficiency of the existing building stock represent an immense potential for reductions in energy consumption and pollution abatement.

Even though there have been significant improvements in the energy efficiency of existing buildings due to both private and public sector weatherization efforts, national studies indicate that due to continued advances in lighting and building shell technology, additional energy consumption savings may be captured by building owners.⁴⁰ However, the method to best secure the cooperation of building owners in making these energy efficiency retrofits is questionable and will require additional study by policy makers.

Various methods exist to ensure the maximum feasible energy efficiency of existing structures without significantly harassing current ownership or by offering a variety of incentives. Requirements for mandatory independent energy audits or upgrades at time of sale have been undertaken in other states as one method of achieving a higher level of energy efficiency in existing structures; another is making historical information about a structure's energy consumption available to prospective purchasers or renters; another is to provide short or long-term energy improvement financing to the building owner at below-market rates.

The utilization of energy in the building sector represents a large percentage of the total energy consumption in the State of Arizona. However, it is not always the structure (shell technology) that is the cause of energy waste. Each building, whether commercial or residential, contains a wide array of energy-consuming appliances (Table Eleven). Although the range of appliances is wide, from central heating, ventilation, and air conditioning systems (HVAC) to the electric can opener, the major energy consumers are central air conditioners and heat pumps, gas furnaces, water heaters, refrigerators, freezers, and dryers.

Recommendation 7. By 1995, the Legislature should adopt stringent energy efficiency standards based on the California Public Resources Code Section 25402 (c)(1) for appliances available to consumers in Arizona.

Since the early 1970s, appliances used in buildings have steadily improved in energy efficiency. The increase in energy prices, new technologies, and energy efficiency labeling have all contributed to these improvements. Despite these significant technological advances in appliance energy efficiency, many marketers continue to merchandise appliances that have low energy efficiency. Transaction price competition between manufacturers has, in some cases, precluded the introduction in the market of high-efficiency appliances.

In 1987, President Reagan signed the National Appliance Energy Conservation Act. This act mandated minimum levels of energy efficiency for selected appliances. These minimum national standards were loosely based upon stringent appliance standards developed in the state of California as mandated by the Public Resources Code Section 25402 (c)(1). In California, it has been calculated that existing appliance standards will save 996 million

39 Valley National Bank, *Arizona Statistical Review*, December 1989, p. 53.

40 U.S. Department of Energy, *Energy Conservation Trends: Understanding the Factors that Affect Conservation Gains in the U.S. Economy*, September 1989, p. 31.

therms of natural gas and 5,756 megawatts of electricity annually by 2007. This savings represents five utility-sized power plants and gas savings sufficient to supply 1.4 million homes.⁴¹ Improvements in refrigerators and freezers have been particularly effective. For example, the New York State Energy Plan projects no increase in electricity use by refrigerators and freezers over the next twenty years, in spite of an expected rise in overall residential electricity consumption. Because of the possibility of “dumping” of inefficient products in Arizona from stricter jurisdictions, it is in the best interest of Arizona consumers to develop a stringent energy efficiency code for appliances in Arizona. These codes should be equally as strict as those in adjoining states or regions.

Table Eleven U.S. Residential Consumption of Primary Energy by End Use	
Space Heating	36%
Water Heating	15
Other	15
Refrigerators	12
Air Conditioners	9
Lighting	6
Ranges/Ovens	4
Freezers	3
Source: Office of Energy Markets and End Use, Energy Information Administration, <i>Residential Energy Consumption Survey, 1987</i> .	

The use and efficiency of passive and active solar energy in buildings have increased dramatically in the last decade. There are over 800,000 solar water heaters (183,000 estimated in Arizona by Public Citizen) and 100,000 actively solar-heated and 200,000 passive solar residences in the United States. Passive systems can now provide an average of 39 percent of heating requirements.⁴² Solar water heaters have become a mature technology and can save from 40 to 70 percent of annual water-heating expenses.

Recommendation 8. The State, in concert with the utility, construction, and real estate development industries, should promote access to all energy types. Through the assurance of consumer choice in energy type selection, the lowest cost energy alternative can be implemented by the consumer.

Basic economics teaches that pricing is a function of supply versus demand for a product or service. If prices for an individual commodity rise, the availability of substitutes for a commodity will have a direct impact on the supply and demand for the original commodity.

⁴¹ California Energy Commission, *Agenda for 1989*, 1989, p. 51.

⁴² *Ibid.*, p. 111

For example, if the price of oranges is rising due to a supply shortage, the availability of inexpensive apples will have a direct impact on the price of oranges because of the ability to substitute apple juice for orange juice.

In the same manner, there is an economic correlation between the cost and availability of various fuel types. For example, if it is your desire to heat water, you can substitute various fuel types. Water can be heated with natural gas, propane, solar-thermal panels, or electricity. Depending on the cost and availability of each fuel type, the consumer can choose which fuel to consume.

By providing consumers of new buildings in Arizona the access to each fuel type, the consumer is able to shift among fuels depending on local market conditions. If the cost of electricity is rising, the consumer can shift to natural gas; if the cost of natural gas rises, the consumer can shift to solar-thermal panels, but only if access to these energy resources has been designed into the structural elements of their buildings and sub-divisions.

Recommendation 9. By 1995, the State, in concert with the utility industry, should develop incentives and a pricing structure that significantly rewards (cost-based) consumers for reducing peak loads and/or total energy use through the use of cogeneration, solar technologies, energy conservation, and other efficient technology or lifestyle changes.

How we as consumers use our energy resources has a direct impact on the total energy infrastructure necessary to serve our energy demands. These "lifestyle" or behavior considerations can have a significant impact on the efficient use of energy infrastructure. For example, electric generating facilities are constructed to meet the highest probable energy demand on the hottest (or coldest) day of the year. At off-peak hours this immense energy infrastructure often sits idle. If it were possible to shift energy demand from the hours of peak consumption to off-peak hours, energy infrastructure could achieve greater economic and perhaps energy efficiency.

There are two goals in all demand-side management strategies: peak demand/energy shifting and peak demand reduction. Strategies that shift demand do not always reduce total energy consumption, they merely move the load to off-peak hours (typically between 9:00 pm and 9:00 am). These programs are typically based upon altering the price for energy consumption at different hours of the day, week, month, or year (i.e., cheaper rates during off-peak). In this manner, consumers are economically rewarded for changing their consumption patterns. An example of demand shifting is a thermal storage system that uses off-peak energy to make ice that eventually melts and cools buildings during peak hours. Demand-shifting programs are preferred by most energy producers because they represent a more leveled use of infrastructure.

The second demand-side management strategy is peak demand reduction. In this scenario, peak demand is reduced by altering the amount of consumption by consumers over peak load periods. This can be accomplished through many energy efficiency improvements in buildings, manufacturing processes, and altering utilization by end-users. This technique for demand reduction is often favored by business interests and environmentalists because it may substantially reduce pollution from energy production or business costs associated with the purchase of energy.

The methods available to government and the private sector to shift energy demand are many, including altering rate design, thermal storage, and alterations in energy consumption behaviors or lifestyle. For example, most businesses in Arizona operate on a standard

five day per week schedule (9:00 am to 5:00 pm on Monday through Friday) out of long-established habit. It might be possible through an alteration in the energy pricing structure or other incentives to convert these users to alternative use patterns (i.e., four day per week schedules or Saturday and Sunday (8:00 am to 6:00 pm or night only consumption)). Residential users could also be convinced to alter their energy consumption patterns by changes in energy pricing (i.e., time of use rates, load controllers, etc.).

Because of the huge economic and environmental costs associated with the creation of new energy infrastructure, it may be cost-effective to first alter our consumption pattern of energy before creating new infrastructure. But, where possible, the use of infrastructure in a more level manner may spread its cost over more kilowatt hours and effectively reduce the per unit cost. In essence, the issue of when we use energy is as important as how we use energy.

Recommendation 10. The State should work with all financial institutions to assure that long-term energy costs are properly recognized in calculating the financial qualification of buyers for mortgages.

Over the past ten years, a number of new technologies have been introduced that have improved the efficiency of buildings. For example, solid-state ballasts and other lighting system improvements have reduced the energy requirements of fluorescent lighting by almost 25 percent.⁴³ Replacing furnace pilot lights with electronic ignition would cut fuel use by up to 10 percent. Additionally, new reflectors in lights, variable-air-volume conversion, re-sized chillers, daylighting controls, and reset of supply air temperature could potentially save 45 percent of commercial sector electricity use.⁴⁴

One of the major obstacles to improving the energy efficiency of existing structures is that the initial transaction cost of energy efficiency retrofits (Table Twelve) have a payback period, in some cases, of several years. In other words, the initial investment in energy saving technologies is not recouped by the underwriter for as many as several years. In order to assist and encourage building owners in the completion of energy efficiency retrofits at the earliest possible date, reducing the need for additional generation capacity and improving the environment, low-cost financing or other incentives to owners may be necessary.

Available financing, for energy efficiency retrofits, is very important relative to the purchase and maintenance of new and existing buildings. An affordable monthly mortgage payment quickly becomes unmanageable when high energy costs undermine the ability of an owner to meet total shelter expenses. If the cost of energy efficiency improvements could be incorporated in the mortgage at the time of purchase or added to an existing mortgage at the time improvements are undertaken, energy consumption costs could be reduced sufficiently to offset a higher mortgage payment. This is particularly true when the cost of energy efficiency improvements are amortized over the full length of a commercial or residential mortgage (15 to 30 years).⁴⁵

43 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 29.

44 Oak Ridge National Laboratory, *Federal Roles to Realize National Energy-Efficiency Opportunities in the 1990s*, October 1989, p. 10.

45 Pennsylvania Energy Office, *An Energy Policy for Pennsylvania*, Decembr 1988, p. 14.

**Table Twelve
Various Retrofit Options for Existing Buildings**

Install More Efficient Lighting
Install an Energy Management System
Add Window Shading (vegetation, screens, awnings)
Replace Heating and Air Conditioning Systems
Caulk and Weatherstrip Doors and Windows
Paint Walls and Roofs Reflective Colors
Install Low Flow Water Fixtures
Install Solar Water Heater
Install More Efficient Windows
Install Additional Ceiling Insulation
Install Additional Wall Insulation

The development of incentive programs for energy efficiency retrofits of existing structures (e.g., financing, rebates, rate reductions, or tax incentives) could significantly forestall the need for development of new energy infrastructure in Arizona and the importation of fuels. And the reduction in existing energy demand could lead to reductions in various types of atmospheric and habitat pollution.



3 Transportation

Energy consumption by the transportation sector represents approximately 27 percent of total United States energy consumption and about two-thirds of all petroleum use, at a cost of approximately \$150 billion annually.⁴⁶ Oil currently supplies 97 percent of the energy used to transport people and goods.⁴⁷ In the United States the amount of oil used for transportation annually has been greater than the nation's entire output annually since 1976.⁴⁸ The cost of oil imports in 1989, \$40 billion, accounted for 45 percent of the nation's \$109 billion trade deficit.⁴⁹ Harmful emissions (pollution) from the transportation sector are primarily produced by vehicles that are more than 10 years old.

Transportation is the largest and fastest growing end user of refined crude oil in the state of Arizona. In 1988, Arizona on-road gasoline consumption exceeded 1.759 billion gallons.⁵⁰ Almost 100 percent of this energy is imported to the state of Arizona from the west coast and west Texas refineries. This energy source is used primarily by the transportation sector for four purposes: transportation of goods, commuting to and from work, running local errands, and vacation travel. Because of the vast amount of energy consumed by the transportation sector of the Arizona economy and due to the sensitivity of most petroleum consumers to price changes, substantial opportunities for reduction in energy consumption exist without negatively and perhaps positively impacting life quality in Arizona.

From 1970 to 1988, the populations of both Phoenix and Tucson grew at average annual rates of 3.4 and 3.1 percent, respectively. Infrastructures in both areas expanded to accommodate growth; highways and city streets were a large portion of this expansion. In 1987, Phoenix had more than 800 miles and Tucson more than 400 miles of roadway.⁵¹ The metropolitan (urban spatial) structures of Arizona are heavily dependent upon the automobile as a method of personal transportation to complete the four purposes referenced above (Table Thirteen). For this reason, among others, Arizonans register motor vehicles at a rate significantly higher than the national average.⁵² In the sixteen years between 1970 and 1986, vehicle registration increased 101 percent, an average of 6.3 percent per year.

46 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 12.

47 *Ibid.*, p. 42.

48 *Ibid.*, p. 13.

49 *Ibid.*, p. 43.

50 Arizona Energy Office, *Arizona Energy Data Quarterly Report*, December 1989, p. 27.

51 Arizona Department of Transportation, *Arizona Transportation in Review 1987*, 1987, p. 40-41.

52 Arizona Energy Office, *Arizona Motor Fuels Price Differentials*, December 1989, p. 3.

Large numbers of motor vehicles, widely dispersed urban structures, and limited forms of alternate transportation services have created a contemporary community thoroughly dependent on the consumption of fossil fuel for conveyance of people and goods. A comparison of gasoline consumption per capita in American cities indicates that Phoenix has one of the highest consumption rates (Table Fourteen). This is largely because of land use and transportation planning policies, not income or fuel price factors.⁵³ Unfortunately, the fossil fuels currently used to power the transportation system, particularly in older vehicles, have a deleterious effect on environmental quality.

Table Thirteen Distances Between Home and Major Activities in Phoenix	
Food shopping	1.2 trip distance in miles
Religious	2.9
Clothes shopping	3.3
Leisure	3.7
Medical	5.1
Employment	6.3
Source: Pickus and Gober, <i>Urban Villages and Activity Patterns in Phoenix</i> , Urban Geography, 1988.	

Table Fourteen Gasoline Consumption Per Capita (1980) for Selected Cities	
Houston	567 gallons
Phoenix	532
Detroit	503
Denver	483
Los Angeles	445
San Francisco	422
Boston	413
Washington	390
Chicago	367
New York	335
Average	446
Source: Newman and Kenworthy, <i>Gasoline Consumption and Cities</i> , APA Journal, Winter 1989	

53 Newman and Kenworthy, *Gasoline Consumption and Cities*, APA Journal (Winter 89), p. 24.

The need to transport people and goods will not diminish significantly over time. But the methods, systems, and fuels we use to meet these demands are questionable. Again, we need to do things more efficiently in order to meet societal goals successfully. The amount of energy (gasoline) consumed by older automobiles is significantly greater than energy consumed by new automobiles. The need will continue, yet the demand for vehicle miles traveled can be significantly reduced. A train can carry hundreds of people—300 persons per mile per vehicle; while 300 single occupant vehicles would have to travel 300 miles to deliver the same 300 people. If individuals lived in close proximity to their workplace, the vehicle could be eliminated from the trip altogether.

The abrupt rise in fuel price throughout the 1970s and the awareness of the finite nature of crude oil resources boosted consumer demand for fuel-efficient transportation and spurred personal conservation. Between 1972 and 1986, the total miles traveled for personal and commercial vehicles increased 45 percent, while the energy required to meet this need increased only 22 percent.⁵⁴ It has been projected, that without any change in fuel efficiency of new vehicles, consumption of gasoline per capita will continue to drop as inefficient vehicles are retired from the vehicle fleet and replaced with more efficient vehicles. However, as the number of vehicles increases, the environmental gains from efficiency are offset by the increased size of the vehicle fleet and greater absolute fuel use.

The massive transportation infrastructure already developed and currently under construction in Arizona (funded by a combination of general funds, gas taxes [Table Fifteen], and sales taxes) is not effectively or efficiently utilized by corporate and individual citizens of the State. Heavy traffic, gridlock, and diminished capacity generally occur only during peak morning and afternoon “rush” hours (driving to and leaving work) on our existing transportation system. In essence, we fail to plan our use of the existing infrastructure in the most efficient manner possible.

Table Fifteen State Gasoline Taxes as of 1 January 1990					
State	Rank	Tax	State	Rank	Tax
Illinois*	01	25.2	Louisiana	10	20.0
Nebraska	02	22.0	Minnesota	11	20.0
North Carolina	03	21.7	Montana	12	20.0
Tennessee	04	21.0	Rhode Island	13	20.0
Wisconsin	05	20.8	Indiana	14	19.9
West Virginia*	06	20.4	Utah	15	19.0
Colorado	07	20.0	Michigan	16	18.9
Connecticut	08	20.0	Maryland	17	18.5
Iowa	09	20.0	Idaho	18	18.0

⁵⁴ U.S. Department of Energy, *Energy Conservation Trends: Understanding the Factors that Affect Conservation Gains in the U.S. Economy*, September 1989, p. 12.

Table Fifteen
State Gasoline Taxes as of 1 January 1990 (Continued)

State	Rank	Tax	State	Rank	Tax
Mississippi	19	18.0	Hawaii	36	15.1
Ohio	20	18.0	Kansas	37	15.0
Oregon	21	18.0	Kentucky	38	15.0
South Dakota	22	18.0	Texas	39	15.0
Washington	23	18.0	California * **	40	14.6
District of Columbia	24	18.0	New Hampshire	41	14.0
Virginia	25	17.7	Arkansas	42	13.5
Arizona	26	17.0	Pennsylvania	43	12.0
Maine	27	17.0	Georgia*	44	11.4
North Dakota	28	17.0	Alabama	45	11.0
Nevada	29	16.3	Massachusetts	46	11.0
New Mexico	30	16.2	Missouri	47	11.0
Delaware	31	16.0	New Jersey	48	10.5
Oklahoma	32	16.0	Florida*	49	9.7
South Carolina	33	16.0	Wyoming	50	9.0
Vermont	34	16.0	Alaska	51	8.0
New York*	35	15.6	* total of excise and sales taxes ** will increase by 5 cents per gallon 8/90		
Source: Federation of Tax Administrators, Energy Information Administration					

Recommendation 1. The State, in concert with private and public transportation specialists, should develop a strategy to improve the utilization of our existing transportation infrastructure.

Measures to alter the existing behavior of automobile users should be implemented. This can be done through the implementation of telecommuting programs, rewards for the purchase of fuel efficient vehicles, rewards for use of existing mass transit and ridesharing, increases in the state gasoline tax, emissions and consumption fees, commuter taxes, staggered work hours, staggered work weeks, four day work weeks, higher parking fees, and increased license fees for the purchase of low fuel efficiency vehicles.

Recommendation 2. The State, in concert with its counties and municipalities, should further develop existing "least-cost" transportation systems. This could include further developments of local and regional walkways, bicycles, mass transit,

toll booths, variable tolls, bus and freeway systems.

Because excess capacity exists during "off-peak" hours, efficient use of infrastructure would suggest altering our use pattern of the resource. For example, we have learned that only a certain number of aircraft can use an airport during peak hours of the day, while excess capacity exists during night hours. To partially remedy this problem, costs for peak hour flights are significantly greater than "overnight" flights. This is a method of using price incentives (reduced ticket prices) in an effort to shift demand for a scarce resource (runway access).

Small changes in the habits we have developed affecting our utilization of transportation energy and infrastructure can have pronounced effects on total energy consumption and the overall quality of our lives. Because of the considerable public good achieved by making these modest changes in the utilization of energy and infrastructure, the State should take an active role, with the private sector, to develop programs that reward individuals by reinforcing "conscientious" public behavior (e.g., driving off-peak) and penalizing "dubious" behavior (e.g., driving on-peak).

The Legislature should review all existing materials on the topic of pedestrian and bike use. The State should consider the further development of bike paths, lanes, and sidewalk ramps; bike and pedestrian crossings of canals, parks, golf courses, freeways; and the development of bike friendly facilities such as workplace showers, lockers, parking, and bus carriers.

As indicated previously, the utilization of the existing transportation network can have a significant impact on energy consumption in the transportation sector. Every morning, millions of Arizonans rise at the same hour, shower at the same hour, eat breakfast at the same hour, and drive to work at the same time. If only minor changes were made in these well established habits we have collectively developed, Arizona may be able to stretch the capacity of our existing transportation infrastructure and save immense amounts of energy. For example, if all employers varied the start time of their employees over a 1.5 hour period (7:00, 7:15, 7:30, 7:45, 8:00, 8:15, and 8:30 am), road congestion could be substantially reduced and energy efficiency would increase as a more even flow of traffic was established, potentially mitigating both morning and afternoon rush hours in the process.

The best method(s) to achieve a more efficient utilization of existing transportation infrastructure are many and varied in long-term impact. Telecommuting programs (working at a distant location), rewards for the purchase of high fuel economy vehicles (cash incentives or reductions in registration fees), rewards for use of existing mass transit (cash incentives or free fares), increases in the state gasoline tax, emissions and consumption fees (carbon taxes), commuter taxes (varying by distance traveled to work), staggered work hours (coming and going before or after rush hours), staggered work weeks (Saturday and Sunday inclusive), four day work weeks, higher parking fees (in congested areas), and increased license fees for the purchase of low fuel efficiency vehicles can have a significant impact upon the consumption of energy for transportation. Additional studies of cost versus benefit and impact will have to be completed before a particular strategy for enhanced utilization is adopted by the legislature of the state of Arizona.

Recommendation 3. The State and metropolitan counties should immediately develop and jointly fund an efficient urban mass transit network. Additionally, the State, in concert with government and private sector transportation specialists, should develop a planning mechanism for the development of new "least-cost"

transportation systems. This planning mechanism should consider and review the social, environmental, and capital costs of new transportation systems prior to approval.

Another problem affecting the automobile and truck fleet's overall vehicle efficiency is growing traffic congestion. This is particularly true for urban areas, where construction of new roads has increased 15 percent since 1975, while "urban miles traveled" have increased by 57 percent. The U.S. Department of Transportation estimates that in 1987 traffic congestion increased consumption of gasoline by 2.2 billion gallons. Development of new transportation systems could substantially reduce traffic congestion and decrease fuel consumption.

The development of new transportation systems has been the basis of economic development throughout world history. The first transportation system between the Far East and the Mediterranean made Venice the center of commerce for many years. The British Empire, "upon which the sun never set," was the result of a massive investment in an ocean-based transportation network. When North America was originally discovered, and for many years thereafter, it was less expensive to move freight across the Atlantic than a mere nine miles inland — all commerce occurred therefore in port cities during the colonial period. The huge economic might of the United States in the 19th and 20th centuries has been attributed to the development and installation of the most integrated transportation system on the globe. The quality and quantity of transportation infrastructure has a direct and long-term impact upon the economic development and energy efficiency of nations, states, and cities.

In order to capture significant statewide economic development opportunities while improving energy efficiency, it is in the best interest of all Arizonans to invest in new technology public transportation systems. This transportation network should be operationally self-supporting once fully developed, or publicly subsidized to the same degree as the road system. In essence, in order to make each transportation system competitive with the other, charges to users should represent total cost for use.

The state of Texas has already begun examining the development of a high-speed rail system that could eventually carry passengers between Dallas, Houston, and San Antonio at speeds up to 180 miles per hour. The Texas High-Speed Rail Authority was created by the Legislature to determine whether high-speed rail is the appropriate response to the State's crowded airports and highways. The rail system is expected to be financed privately, but the Rail Authority does have the ability to issue up to \$1.32 billion in revenue bonds.

The nature and costs of the new technology transportation system best suitable for the state of Arizona and its metropolitan areas have not been sufficiently studied. However, basic criteria for the development of a "new generation" system should include service between Arizona's large metropolitan and recreational areas and quality of life opportunities. A future that includes, for example, an integrated "mag-lev", hydrogen-based, or light rail system throughout the state of Arizona from Yuma to the Grand Canyon and a mass transit system serving the heavily populated metropolitan counties should be the focus of our first step into the 21st century. To begin this process, the State and metropolitan counties should begin the development of an integrated and efficient urban mass transit network.

Currently, transportation systems/services are developed or improved based upon a hierarchy of demand. In other words, as transportation systems reach maximum capacity, resources are committed to surmount the capacity constraints. Very little consideration, if any, is given to alternative solutions to restricted capacity. As an example, if a road network hit maximum capacity during the early morning commute hours, the immediate

consideration of transportation planners is, usually, to determine the best construction technique to expand capacity. No, or little, consideration is given to less costly methods of reducing demand (i.e., altering work schedules, using more buses, or ridesharing).

Much discussion has occurred nationally and in Arizona about the development of least-cost planning mechanisms for the electric and gas utility sector. The Arizona Corporation Commission currently uses a system of least-cost planning for the development of new energy infrastructure. A similar system should be set in motion for use in the planning process for the development of transportation infrastructure in Arizona. The transportation system (car, bus, bicycle, walkways, or rail) that represents the least total cost to the public (including capital outlays, maintenance, police enforcement, and potential liability) should be augmented with public funding when that transportation system reaches capacity.

In a least-cost transportation planning system, alternative strategies to meet demand (e.g., new freeways versus more buses versus altered work schedules versus rail systems) would be compared and contrasted for total impact on a basis of least total cost (economic, social, and environmental). The concept of evaluating competing strategies based upon least-cost can easily be applied to the transportation sector. Rather than analyzing the need to build new roads, the concern becomes how to move the most people and freight at the lowest total cost to society and the individual.

Recommendation 4. The state of Arizona, in concert with its counties and municipalities, should compel the use of energy efficiency as an evaluation tool in the urban planning, zoning, and transportation design approval process. This might include incentives for high density, "in-fill," or for mixed-use developments, and disincentives for long commutes.

Table Sixteen Population Density Per Square Mile of Metropolitan Areas	
Chicago	13,119
Los Angeles	6,647
Boston	5,903
Denver	4,724
Honolulu	4,287
Tucson	2,928
New Orleans	2,804
Las Vegas	2,731
Mesa	2,314
Phoenix	2,208
Indianapolis	2,018
Source: U.S. Bureau of Census, <i>State and Metropolitan Area Data Book</i> , 1986.	

In 1979, the city of Phoenix adopted an "Urban Village" concept for future urban development that may reduce primary energy consumption. As greater opportunities exist to work, live, and recreate in a smaller geographical area, less energy will be consumed by

citizens for transportation. The Phoenix Urban Village concept seeks to create nine largely self-contained sub-communities where residents can satisfy their basic needs and desires within a small geographic area. The major impetus for this plan was an effort to reduce the demand for transportation infrastructure within the metropolitan area, but its supplementary benefits are increased energy efficiency and reduced pollution.⁵⁵

When petroleum-based energy resources were inexpensive, plentiful, and there was inadequate understanding of their environmental impact, little consideration was given to the energy efficiency of urban form. Now that petroleum prices are again on the rise, supplies are recognized as finite, and the environmental impacts of fossil fuel combustion are better understood, it is time to begin consideration of energy efficiency in the design, planning, and zoning approval processes for urban growth. If we are to achieve energy efficiency, we must weigh the potential energy impacts of urban growth options on the community. As part of this effort the city of Phoenix and Arizona State University have already undertaken a project to evaluate the urban form of Phoenix relative to a post-petroleum scenario for the future.

Recommendation 5. By 1995, the State should alter the current vehicle fuel, sales, and registration tax system to acknowledge environmental impact:

1. The value-based vehicle license tax should be altered by basing all vehicle license taxes on a revenue-neutral ratio of fuel efficiency (mpg), level of atmospheric emissions, and vehicle value.
2. The State should alter the current flat percentage sales tax on new, non-commercial vehicles to a revenue-neutral, sliding-scale sales tax from 0 to 12 percent, based on fuel efficiency and harmful atmospheric emissions.
3. The state fuel tax (gasoline tax) should be altered to a revenue-neutral, sliding-scale fuel tax based on harmful atmospheric emissions from different fuel types.

Currently, owners of on-road vehicles pay registration fees in Arizona based upon a percentage of the prevailing economic value of their automobile. This system does not alter the vehicle registration costs based upon the vehicle's economic or environmental impact upon the State. A system that recognized the varying impact of different types and classes of vehicles upon the state's economy and environment could recognize and reward the public for using alternatively fueled vehicles, high mileage per gallon vehicles, and low atmospheric emission vehicles.

The taxation system associated with vehicle registration should be altered to recognize the varying impacts of different types and classes of vehicles. The current system assesses the same fee upon an individual who purchases a \$10,000 automobile that gets 10 miles per gallon (with its associated level of required petroleum imports), as the individual who purchases an automobile for \$10,000 that gets 50 mpg. Because of the public good associated with decreased importation of petroleum (both environmental and economic), on-road vehicles should be taxed based upon their impact upon the energy sector (i.e., miles per gallon), environment (i.e., emissions), and economic value.

A vehicle registration system that would reward individuals who purchase high fuel efficiency and low-emission vehicles would have a positive long-term effect on the economics of Arizona. As previously indicated, any funds not spent on the importation of fuels from California and Texas can be spent in the local economy. Fortunately, the mechanism

55 Pickus and Gober, "Urban Villages and Activity Patterns in Phoenix," *Urban Geography* (1988): p. 85.

for implementation of this type of vehicle registration is already available in Arizona's metropolitan counties.

Similarly, the Legislature should alter the current flat percentage sales tax on new, non-commercial vehicles to a revenue-neutral, sliding-scale sales tax from 0 to 12 percent based on fuel efficiency and harmful atmospheric emissions.

Lastly, the Legislature should alter the state fuel tax (gasoline tax) to a revenue-neutral, sliding-scale fuel tax based on harmful atmospheric emissions from different fuel types. For example, regular gasoline would have a higher fuel tax than unleaded gasoline.

Recommendation 6. Arizona's Congressional delegation should aggressively pursue enactment of legislation increasing the Corporate Average Fuel Efficiency standards.

The increasing fuel efficiency of new vehicles, which was responsible for substantial energy efficiency improvements in the transportation sector in the mid 1970s through the mid 1980s, is now stagnating (Table Seventeen). The fuel economy of new cars and light trucks actually has declined since 1988. Due partially to a period of reduced international crude oil prices, consumer demand for fuel-efficient vehicles has declined and changes in national policy have permitted modifications in the federal goal for fuel-efficient vehicles.

Table Seventeen Mandated Corporate Average Fuel Economy Standards	
1978	18.0 miles per gallon
1979	19.0
1980	20.0
1981	22.0
1982	24.0
1983	26.0
1984	27.0
1985	27.5
1986	26.0
1987	26.0
1988	26.0
1989	26.5
1990	27.5
1991	27.5*
* Subject to modification due to ongoing rule making.	
Source: U.S. Department of Transportation, <i>Automotive Fuel Economy Program, 11th Annual Report to Congress</i> , Washington, DC, January 1987.	

In 1975, the Federal Energy Conservation Act established the Corporate Average Fuel Economy (CAFE) standards to increase the fuel efficiency of the American automobile fleet and reduce dependence on foreign sources of oil. Average fuel efficiency for all passenger cars on the road, as measured by average miles traveled per gallon, increased 42 percent from 1978 to 1988.⁵⁶ In 1975, the new cars sold in the United States had an average fuel efficiency of 14.7 miles per gallon.⁵⁷ In 1987, the average fuel efficiency was 28.2 miles per gallon. However, the average age of the United States automobile fleet rose from 6 years in 1975 to 7.6 years in 1988, reducing the impact of new-car mileage improvements.⁵⁸

With the current dependence of the United States on foreign sources of crude oil, it is in the best interest of the United States and the state of Arizona to assure the increased fuel efficiency of the automobile and truck fleets. Lower oil prices bring many immediate economic benefits for the United States economy, but are expected to encourage higher imports in the future.⁵⁹ An increase of 1 mile per gallon in the efficiency of the United States automobile fleet could mean a savings of about 5 billion gallons of gasoline each year—a decrease of 350,000 barrels of foreign oil imported to the United States **daily**.⁶⁰ Although this is currently an issue addressed by the federal Department of Transportation and the United States Congress, the state of Arizona should encourage Arizona's Congressional delegation to work toward increased CAFE standards for both automobiles and trucks. Every improvement in these fuel efficiency standards will have a long-term positive economic and environmental effect on Arizona and the nation.

Of course, there is great contention concerning the effectiveness of such federal regulations as the Corporate Average Fuel Efficiency. Some interests maintain that CAFE standards are vital to fuel efficiency and have demonstrated their effectiveness since their introduction. Others contend that CAFE standards, which focus upon the manufacturer in the transportation marketplace, impair the ability of the U.S. automobile industry to respond to changing consumer demand, weaken the industry's economic viability, and actually help foreign producers to increase their market share in the United States. However, these standards have been active for more than a decade and the big American automakers continue to show corporate profits.

The on-road gasoline consumption in the state of Arizona is used largely for commuting to and from the workplace and for local transportation. The urban form embraced by the people and state of Arizona (i.e., central business districts, large suburban lots, low population density, and strip commercial zoning), as indicated above, has evolved into an extremely energy-intensive lifestyle. Few individual citizens live within comfortable walking distance of commercial or retail establishments. The low population density (Table Sixteen) pattern of urban areas throughout Arizona requires additional energy for transportation.

56 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 11.

57 U.S. Department of Transportation, *Annual Fuel Economy Program—Twelfth Annual Report to Congress*, 1988.

58 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 14.

59 United States Department of Energy, *Energy Security, A Report to the President of the United States*, March 1987, p. 7.

60 Worldwatch Institute, testimony before Subcommittee on Water and Power Resources, United States House Committee on Interior and Insular Affairs, 1987.

4 Delivery Systems

The companies that deliver energy services in Arizona are quite varied in nature of ownership, service territory, and regulatory environment. There are three major electric power utilities in Arizona (Salt River Project, Arizona Public Service, and Tucson Electric Power) which provide the majority of the electric power consumed in Arizona. Arizona also has two major natural gas distributors (Southwest Gas and Southern Union Gas), and several motor fuels distributors (e.g., Circle K, Arco, Texaco, Mobil, Chevron) that provide the majority of petroleum products. The investor-owned public utilities (franchised monopolies) are regulated by the constitutionally-formed Arizona Corporation Commission. Currently, none of the motor fuel suppliers nor the municipal power suppliers (regulated by elected officials from within their jurisdictions) are regulated by the Arizona Corporation Commission.

The existing infrastructure to generate/produce, transmit, and deliver energy within Arizona is owned both by private and public sector organizations. This infrastructure represents an investment of many billions of public and private dollars over many decades. Additionally, several out-of-state energy companies own production and transmission facilities within the State. The energy production/distribution sector in Arizona has become a large consumer of energy, water, and other finite resources. The electric generating sector, for example, is a prodigious and growing consumer of primary energy. More than one-third of all primary energy consumed in the United States currently is consumed in electric power generation.

How the energy production and distribution systems are integrated to meet the energy service needs of the people of Arizona represents a major challenge to the owners, operators, and regulators of the electric, petroleum, and natural gas infrastructure systems. In the recent past, failures of major regional electric generating facilities have demonstrated the need to plan for access to alternative electric generation capacity in the event of local shortages or failures.

Recommendation 1. The State should promote the optimum use of energy transmission systems. Competition in the bulk power market can exist only where there is fair opportunity to reach and utilize new supplies. The State, in cooperation with the energy production and distribution industries, should work to gain access to economic energy supplies from outside Arizona.

During the past decade, commercial users of energy have also sought access to other energy markets by demanding the right to use privately and publicly owned transmission lines (at a reasonable cost) to acquire cheaper energy resources from distant markets. Wholesale customers in some regions of the nation are currently permitted to use private distribution systems to bring in cheaper energy resources from other markets. In theory, unfettered

access to larger markets and alternative energy resources should benefit local consumers of energy, although it may decrease the profitability of local energy providers.

It is in the public interest to promote the optimum use of the public and private sector energy transmission infrastructure (e.g., petroleum and natural gas pipelines and high voltage systems). With direct access to regional energy markets, bulk power consumers will have access to the lowest cost energy resources at all times. However, the widespread availability of alternative supplies of energy is a relatively new and untested phenomenon in the wholesale energy markets. How access to other energy markets will ultimately affect the individual ratepayers of the host utility remains open to debate.

Many forms of energy can be easily transmitted over great distances (e.g., electricity, natural gas, and petroleum products). The Palo Verde Generating Station, fifty miles outside Phoenix, produces power which is transmitted as far west as California and as far east as Texas. And, most of the motor fuel consumed in Arizona arrives from Alaska via California petroleum refineries. Because of seasonally uneven supplies and demands for energy in the western United States, occasional opportunities exist to purchase and transport energy from other regions at a lower economic cost than it can be produced or generated locally. However, to take advantage of these seasonal and periodic price fluctuations, access to several regional markets is necessary.

For example, because of Arizona's high summer temperatures (high energy demand) and other regions' moderate summer temperatures (low energy demand), opportunities exist to purchase and transport energy resources from distant low-cost producers during local periods of peak demand, high economic price, or shortage. An example of this is the regional diversity power-sharing agreement currently under consideration between Arizona Public Service and PacifiCorp. Unfortunately, access to many of these distant regional energy resources does not currently exist. It would be in the best interest of the people of the state of Arizona to develop access to alternate energy supplies outside of the State.

Currently, petroleum pipelines serve Arizona's growing demand for transportation fuels only from California and Texas. Access by petroleum pipeline currently does not exist to the potentially low-cost supplies of Mexican refined product (or possible refineries in the Gulf of Mexico) nor to ethanol from the mid-western United States. In the same manner, access to the low-cost hydroelectric power of the Pacific Northwest is limited at this time.

Recommendation 2. Utilities should continue to integrate dependable/economic energy sources into the utility system. Energy purchase and sales contracts should be structured to encourage alternative and or renewable sources of energy while adequately protecting the interests of utilities and their ratepayers. Contracts for regulated electric utilities to purchase power from non-utility generators should be subject to a one-time review and approval proceeding at the Arizona Corporation Commission at the time the contract is entered into by the parties.

Other economic energy resources include electricity that is a by-product of industrial and manufacturing processes. For example, several local companies that require large amounts of heat for their production operations can generate significant amounts of commercial electrical power in the process of creating heat. This method of power generation is commonly called cogeneration or waste heat recovery. Cogeneration was a common source of electric power early in the industrial revolution in the United States, but with the advent of large central station power plants its economic benefits declined and cogeneration fell out of favor in North America.

During the past decade, however, locally high electricity prices and new technologies for cogeneration and transmission have resulted in many commercial and industrial customers turning to cogeneration to achieve lower overall energy costs. To achieve additional cogeneration and avoid the need for additional utility capacity, utilities will have to limit negotiating special contracts to prevent or delay potential cogenerators from generation.⁶¹

Implementation of the Public Utility Regulatory Policies Act of 1978 (PURPA) contributed to the increase in cogeneration by providing favorable regulatory treatment to certain "qualifying facilities." The Federal Energy Regulatory Commission (FERC) has also given relaxed treatment to other non-traditional energy producers. Currently, over 5500 megawatts of non-traditional generation occurs in southern California, eliminating the need for five 1000 megawatt central station generation facilities.⁶²

Recovery of waste heat from industrial sources lends greater efficiency to the manufacturing process and can assist local utilities in meeting demand upon their systems. Because cogeneration represents, in many instances, a low-cost and highly efficient source of energy, the State of Arizona should promote the integration of this energy resource into the energy production and distribution system. Because cogeneration often relies on alternative technologies for energy production (i.e., solar, waste, or biomass), it should be encouraged as a source of high-efficiency, relatively clean energy.

Another source of economical energy is independent power producers (IPPs). The passage of PURPA was designed to encourage the development of certain types of alternative power producers, to improve overall efficiency of the electric power system, and to provide greater diversity in the Nation's electric power sources. Such favored alternative power sources, or qualifying facilities (electric generation plants of 80 megawatts or less), include cogeneration plants (as described above) and IPPs. Recently, legislation which had been introduced in the Congress by Indiana Representative Phil Sharp to lift PURPA size restrictions has been enacted. Although there is currently no need for additional generation capacity in most regions of Arizona, utilities should continue to integrate these energy resources into the electric power system.

The ability of an independent power producer to generate power at a profit is a function to the rate at which it can sell the power to the local utility. The utilities' buy back rates for this power should be based on long-term avoided costs. It is important that the rate a utility pays for power from qualifying facilities be properly structured to send the appropriate price signals and to assure that ratepayers do not pay more for electricity produced by qualifying facilities than for electricity produced by utilities.⁶³

However, because central station energy production infrastructure must be carefully planned long in advance of projected demand, any additions to public capacity in the form of industrial cogeneration or by independent power producers should be planned in association with local utilities and not cause an excess supply of electricity. Because the cogenerator or independent power producer will have a direct and measurable impact on the future needs for energy production capacity in the region they locate and upon the local regulated utility, the Arizona Corporation Commission should review all energy purchase and sales contracts between cogenerator and regulated utilities.

61 Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. 68.

62 California Energy Commission, *Energy Development Report*, August 1988, p. 51.

63 Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. 69.

Recommendation 3. The Arizona Corporation Commission should develop appropriate utility cost recovery mechanisms which facilitate utility investments in economic demand-side measures for efficiency and conservation.

In the past, if a regulated utility in Arizona desired to enhance supply, there was a well-established economic incentive to increase capacity through capital expenditures on new facilities. The expenditure on new supply or generation infrastructure became part of the "rate-making base" upon which return on investment is calculated by the Arizona Corporation Commission. On the other hand, if an investor-owned utility selects to enhance capacity by investing in long-term demand reduction, there are few methods available to recover this investment at a comparable rate of return.

The Arizona Corporation Commission and other state agencies, in association with the regulated utilities, should work to develop a system that adequately rewards a regulated utility for its investments in energy demand reduction efforts and efficiency improvements. Only by making the franchised monopolies a full partner in the economic and environmental benefits of demand reduction and efficiency improvements can these programs be successful. The same market and governmental forces that have produced the current level of energy demand can be subtly altered to procure a substantial measure of demand reduction and energy efficiency with the assistance of the franchised monopolies.

An additional consideration in establishing criteria for evaluating demand-side programs is the nature of the experience of the evaluators. Fair evaluation demands an unbiased set of criteria. The traditional utility is experienced in central station supply technology, and may tend to bias resource selection criteria towards those technologies. The evaluation criteria to be established should explicitly include environmental benefits and costs, which have tended to be ignored (except where regulation exists) in traditional decision-making processes. The goal is fair evaluation, and that is best achieved when all parties are speaking the same language.

It is not currently in the long-term economic interest of investor-owned or public utilities to commit extensive funds for the reduction in demand for their sole product (energy). Although one of the purposes for granting a franchise monopoly was to assure energy services to society at the lowest cost, methods must be established that allow the appropriate cost recovery for private and public sector investment in demand reduction and energy efficiency programs. Part of the granting and maintenance of a franchised monopoly for a specific service territory must be an obligation to serve the needs of society (including the societal benefits derived from energy conservation and efficiency).

Energy providers in Arizona have shown a strong preference for the development of large, capital-intensive generation plants that take full advantage of economies of scale in the production of energy. This strategy was beneficial to investors, ratepayers, and citizens in a time of declining marginal costs of energy production. Today, the marginal costs for production are increasing, cogenerators and independent power producers are producing low-cost energy, and economical supplies are available outside Arizona. Additionally, demand reduction strategies provide significant opportunities for reducing the need for future supplies through demand shifting, efficient technologies, and conservation at costs competitive with new generation and distribution capacity.

Recommendation 4. Arizona utilities should implement the PURPA (1978 Public Utilities Regulatory Policies Act) rate-making standards as soon as possible, if not

already done. PURPA sets forth six standards which include: rates should reflect cost; prohibition of declining block rates; consideration of time of use rates; seasonal rates; interruptible rates; and load management techniques, to encourage three purposes:

- 1. conservation of energy by end users**
- 2. efficient use of facilities and resources by utilities**
- 3. equitable rates to consumers.**

Because consumers react positively to price variations in the marketplace for energy services, the rate structure designed by energy companies can have a direct impact upon the time and amount of total energy consumption in both the commercial and residential sectors. Rate structures have been developed that reward customers for efficient utilization patterns of consumption, while others have been developed that penalize a customer for inefficient use and still others have been designed to reward specific customers for locating operations in a specific region. All Arizona energy utilities should be encouraged to implement rate structures that promote the most efficient use of energy resources and economic development of Arizona.

Seattle City Light has the lowest residential rates in the country. In the late 1970s, in response to concerns that declining block rates lead to inefficiency, inequity, and waste, Seattle City Light instituted inclining block rates, in which the second block is now 100 percent more than the first block of 600 kwhs in the summer and 960 kwhs in the winter. Contrast this with an Arizona utility, whose last winter block is 50 percent less than the first block—a severe declining block rate 17 years after the first oil embargo and 12 years after PURPA.

Recommendation 5. The Arizona Corporation Commission should develop and adopt unbiased criteria for the measurement of the effectiveness of demand-side utility strategies.

Because of the numerous methods available for reducing total demand for energy services, both temporarily and permanently, the State should develop a system to evaluate demand-side reduction strategies of least-cost energy supply programs. The standardization must incorporate a method for determining the risk and uncertainty associated with each option. It is important to realize that the benefits of many demand reduction strategies will be difficult to quantify. For this and other reasons, it is imperative that a “level” playing field be established for the evaluation of demand reduction strategies.

Demand-side programs remain a largely undeveloped, cost-effective source of supply for meeting future energy demand. The Arizona Corporation Commission should continue to encourage all energy providers to develop economic demand reduction strategies. The Arizona Corporation Commission should assist in this effort by establishing standard methods for the analysis, review, and approval of these strategies. Because of the possibility that many demand reduction strategies cannot presently be reliably measured, this criteria should assist utilities in selecting demand reduction programs and recovering investments where benefits are “concealed” or unmeasurable.

Recommendation 6. The Arizona Corporation Commission should assure that utility and state incentives for efficiency are balanced. For example, rebates for evaporative coolers, solar technologies, and high-efficiency air conditioners should

be included if there are rebates for electric heat pumps. Rebates should not be granted merely to enhance utility cash flow to the detriment of overall societal efficiency and equity.

The use of rebates in demand control strategies can have a significant impact on the consumption of finite energy resources. A report from the Alliance to Save Energy demonstrated an approach to the design and evaluation of rebate programs for demand-side management in electric utilities.⁶⁴ The report concluded that proper rebate programs could enhance conservation opportunities. Arizona may benefit from a similar study.

Rebates have been used to encourage replacing aging equipment and installation of high-efficiency equipment in new construction. Currently, several utilities throughout the State provide incentive rebates for the purchase of "preferred" energy consumption technologies. The State, in association with utilities, should assure that all energy conservation and efficiency technologies are equally rewarded upon installation when and where incentives are available.

Recommendation 7. The State, counties and municipalities, in cooperation with energy providers and real estate developers, should produce urban plans that include environmental impact and efficient siting for future generation, transmission, and distribution facilities.

The location of energy generation/production and transmission facilities relative to the point of consumption may have a substantial impact on the efficient production of energy (e.g., line loss), as well as the aesthetics and well-being of the communities they adjoin. Currently, because of potentially negative impacts, state and local licensing requirements impede the timely development of useful new energy resources. Because of the large role of the State, counties, and municipalities in the siting of energy infrastructure, it is important that a successful and timely planning and approval method be developed that involves all pertinent parties.

Because of the possible negative economic, environmental, and health impacts the siting of energy infrastructure may have upon the surrounding community, it seems prudent to plan energy infrastructure long in advance of residential, commercial, or even industrial development. Just as school and park sites are planned in advance of development in a cooperative planning process with real estate entrepreneurs and developers, energy infrastructure (i.e., central station generation, neighborhood solar, and distribution networks) should be planned in a similar cooperative method in advance of development. Consideration of the environmental, energy, and economic trade-offs associated with various siting options should be incorporated into the decision-making process.

FERC's 1989 Transmission Task Force Report indicated that only 100 miles of transmission lines (proposed or under construction) are on the current "troubled" list of the North American Electric Reliability Council. More than 29,000 circuit-miles of extra-high-voltage transmission lines were built between 1980 and 1987—indicating that problems associated with siting transmission lines may not be as formidable as siting new production facilities.

⁶⁴ The Alliance to Save Energy, *Designing and Evaluating DSM Programs: Analytical Tools and Case Study Application*, April 1988.

5 Manufacturing Systems

U. S. industry currently accounts for approximately one-third of total energy consumption in the United States—about the same proportion as the residential and commercial sectors combined. In 1988, the U.S. industrial sector consumed nearly 29 quadrillion British thermal units (Btus) of energy (including the distributed energy losses associated with electricity generation, transmission, and distribution), at a cost of approximately \$100 billion. About 70 percent of this energy was consumed by a handful of energy-intensive manufacturing industries that have an appreciable presence in Arizona: chemicals and allied products; petroleum and coal products; primary metals industries; paper and allied products; stone, clay, and glass products; food and kindred products (Table Eighteen).

Petroleum	20.1%
Chemicals	16.9
Primary Metals	14.1
Pulp and Paper	9.9
Mining	7.3
Food	4.9
Agriculture	4.5
Stone, Clay, Glass	4.3
Construction	3.2
Transportation	2.2
Fabricated Metal	1.9
Textiles	1.7
Source: Energy Information Administration, <i>Manufacturing Energy Consumption Survey: Changes in Energy Efficiency 1980-1985, 1985.</i>	

Industrial output (in constant dollars) relative to energy use has increased significantly since 1970. This increase is due partially to changes in the mix of products and services

demanded and produced in the national economy since 1970, as well as efficiency improvements in manufacturing processes. Compared to 1973, industrial energy use is down 8 percent while industrial production is up approximately 25 percent. Yet, many United States and Arizona industrial processes still have energy efficiencies far below the efficiencies of processes in other countries with which we must compete in the global economy.

Recommendation 1. The Department of Commerce should promote the development and application of dependable, economic, and efficient systems such as cogeneration and waste heat recovery in manufacturing processes.

As indicated in an earlier chapter of this document, implementation of the Public Utility Regulatory Policies Act contributed to the increase in cogeneration by providing favorable regulatory treatment to certain "qualifying facilities." The Federal Energy Regulatory Commission has also given relaxed treatment to other non-traditional energy producers. As previously stated, over 5500 megawatts are generated in southern California by cogenerators or independent power producers.

Recovery of waste heat from industrial producers lends greater efficiency to the manufacturing process and energy production and distribution systems. Because cogeneration, in many instances, represents a low-cost and high-efficiency source of energy, the State should promote the integration of this energy resource into the energy production and distribution system. Cogeneration often relies on alternative technologies for energy production (solar, waste, biomass, or natural gas) and should be encouraged as a source of high-efficiency, relatively clean energy.

Recommendation 2. The Arizona Corporation Commission, in association with energy production and distribution utilities, should develop a system of incentives for energy efficiency in manufacturing processes. These might include rate design, energy audits, tax benefits, financing of energy efficiency improvements, or cost-effective rebate incentives.

As mentioned above, to obtain energy efficiency improvements beyond those already instituted by the commercial and industrial sector will require significant capital investments in new plants, processes, and facilities. Because many manufacturing firms in Arizona are medium to small concerns, they usually do not operate significant research and development departments to identify and implement energy and cost savings strategies. To assist these firms in competing on a national and international scale, the State should aid these corporate citizens in identifying and implementing new energy-saving processes and technologies.

The Arizona Corporation Commission Staff Report on Resource Planning suggests that the energy utilities sponsor energy audits at reduced charges to industrial customers to identify savings resulting from variable speed drives and offer incentives to install variable speed motors.⁶⁵ The Staff Report also includes a recommendation to retrofit 49,000 commercial lighting fixtures statewide over the next 18 months.

⁶⁵ Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, September 1990, p. vi.

Additionally, because of the high costs of capital for small and medium size manufacturing firms in Arizona and throughout the nation, it may become necessary to assist private sector manufacturers in locating suitable financing alternatives for energy conservation and efficiency improvements. It must be recalled that capital improvements to capture energy efficiencies must be depreciated over more than one year for tax purposes, but energy costs can be expensed annually. This tax system favors the inefficient consumption of energy over efficiency improvements.

Recommendation 3. The State should encourage the implementation of recycling programs including the adoption of new conservation and energy-efficient processes at the manufacturing level to eliminate financial losses from the waste of energy, and funding a study of deposit legislation for beverage containers.

The State, in association with the private sector, should assist local business enterprises in identifying and implementing energy efficiency improvements and create incentives where possible for their introduction. These incentive programs are encouraged to assist small firms in maintaining price competitiveness in large markets and maintain a growing work force in Arizona.

One form of energy and economic waste that can be quickly corrected throughout the United States is losses attributed to failure to capture value from waste. All commercial and manufacturing establishments propagate waste from their operations. Much of this waste has economic and energy value. Large corporations in America have learned this lesson and are beginning large-

scale recycling and efficiency programs. American Telephone and Telegraph (AT&T) reported it saved \$1,000,000 in disposal costs and collected \$365,000 in cash by recycling just office wastepaper. Dupont Canada, which in the past disposed most of its waste in landfills, now incinerates 84 percent in a waste-to-energy system, reducing their consumption of oil and natural gas.

What once was considered merely a public relations gimmick to placate environmentalists has become a significant avenue for cost cutting and a source of potential income for industrial concerns. If all Arizona-based commercial and manufacturing concerns implemented a program of recycling, the savings of energy and money would be enormous. For example, the remanufacture of aluminum from cans saves approximately 90 percent of the energy required to manufacture the same can from raw materials.

Recommendation 4. The Department of Commerce, working with industry groups, should provide technical information conferences and educational programs about conservation and efficient industrial energy technologies and the costs and benefits of energy efficiency improvements.

In order to "capture" improved energy efficiencies in the manufacturing or industrial sector, a change must take place in the historical pattern of replacing equipment and facilities only through obsolescence. Since 1973 (the first contemporary energy crisis), efficiency improvements in the manufacturing sector have accelerated in response to high fuel costs, fear of further energy price swings, and foreign price competition. To obtain energy efficiency improvements beyond those already instituted will require significant capital investments in new plants, processes, and facilities.

The State should assist local business enterprises in identifying and implementing energy efficiency improvements. These industrial, manufacturing, and economic development programs should be structured to facilitate firms in maintaining a stable and thriving work force in Arizona.

Recommendation 5. The Department of Agriculture, Arizona Power Authority, and the university system should encourage existing programs that further research and investigate the feasibility of energy-efficient agricultural practices and techniques.

In 1987, agricultural crop production in Arizona reached \$938,468,000.⁶⁶ This enormous economic output from the largely irrigated and mechanized desert farms of central and southern Arizona is a testament to the commitment and ingenuity of the Arizona farmer. Braving adverse temperature and water conditions, the agricultural sector has been able to produce a cornucopia of products from the parched Sonoran Desert south of the Colorado Plateau.

Still, more advanced low water use agricultural techniques are being investigated, developed, and implemented by local growers every year. The use of solar energy technologies for water pumping in remote locations has already proven cost-effective in many applications. Because of the high costs and energy expenditures of pumping water from deep aquifers, the Colorado River and Northern Arizona to the deserts of the southern counties, the State should encourage programs that develop energy and water efficient technologies for use in farming.

⁶⁶ Valley National Bank, *Arizona Statistical Review*, September 1988, p. 43.

Section 3 - Planning for the Future



The third issue to be addressed by the State energy policy and implementation plan is the efficient operation of the energy markets in Arizona and the United States, particularly in the areas of planning, affordability, and public education. Currently, unlike markets for other products or services, the consumer of energy has a restricted number of providers. There will be more consumer choice as energy efficiency and renewable energy, such as household-level photovoltaics, become more prevalent. Presently, utility regulators try to simulate the free market for the monopolies they regulate. However, the transaction cost associated with the discovery or recovery, refinement or production, distribution or transmission, and consumption of energy often does not reflect total social cost.

In the past, the role of the free market in accurately reflecting the total cost of each fuel-cycle has been distorted with the sanction and acknowledgement of government because of the essential nature of the commodity. Only recently has significant environmental degradation from the life-cycle of fuels led to a concern about using the environment as a "free" dumping ground. Although not all citizens believe that the existing system must be altered, some changes may be necessary if we are to attain the goals of a clean environment and reliable energy supplies for the future development of Arizona.

High sulfur coal miners, oil drillers, and fossil fuel power plant operators have all objected strenuously to the alteration in public policy that calls for the inclusion of negative environmental costs by the energy industry in its pricing structure. Even President Bush (a former oil industry executive) has called for a slow pace for the internalization of these costs due to the economic and energy security problems a change in public policy may create. The President has indicated that the environment of the United States must be protected, but not at the cost of American jobs.

Yet, many recognize that without an inclusion (internalization) of negative environmental (external) costs to correct an inefficiently operating market for energy services, the system of energy production, delivery, and consumption will continue to assault the environment and public health on a global scale. Yet, in this energy policy effort to assure an efficient market (one that includes all costs of production and distribution), we can follow the lead of the Environmental Defense Fund (principally Dr. Daniel Dudek) and Senators Tim Wirth and John Heinz and their bipartisan report entitled, *Project 88, Harnessing Market Forces to Protect Our Environment*. Dudek, who desires injection of market incentives into pollution control programs, prescribes emission trading schemes to cure ills from ozone depletion, acid rain (the acid rain section of the 1989 Clean Air Bill reflects Dudek's work) and greenhouse warming, sees market mechanisms as the invisible hand or magical force that could buffer the clash between demands for environmental quality and economic vitality—and that all of this would increase efficiency and sustainability, and save money.

Insuring the efficiency of the energy markets has benefits beyond accurately and completely distributing the costs and benefits associated with depletion of finite resources and environmental degradation. Unlike the current market system for energy services (where many external costs are ignored according to public policy), an efficient energy market will allow for the proper allocation of all costs and benefits to users and provide funds for the mitigation of the environmental costs. The efficient operation of the free market can faithfully allocate the costs of public health impacts, environmental degradation and

restoration across users and producers of deleterious fuel types, effectively penalizing those who pollute and rewarding those who do not.

The manufacturers of petroleum products for consumption as primary fuels only include the cost of the production of the product and its delivery infrastructure in the transaction cost to the consumer. The price structure for the production of petroleum products does not include:

1. complete costs associated with clean-up of production facilities,
2. costs of environmental degradation from the production process,
3. military security costs associated with importation,
4. full costs of environmental degradation from improper storage, and
5. costs of environmental degradation from fuel consumption.

In essence, the market system for the production and distribution of some fuel types (e.g., oil and coal) fails to give economic consideration to environmental values (i.e., public goods), while the market for other fuel types (e.g., renewables) incorporates many environmental values in their pricing structure for energy services. This flaw in the current market for energy services creates economic and social inefficiencies on a global scale.

Our challenge in the creation of this state energy policy and implementation plan is to fully integrate environmental values (public property rights) into the marketplace for energy services. Whether this is completed by government intervention into the energy markets or by the private sector is an ideological struggle that can only be resolved through deliberative and legislative action of either the Arizona State Legislature or the Arizona Corporation Commission. Unless the private sector is willing to begin fully incorporating environmental values in their pricing structure without a mandate from government, the market will not accurately reflect the impact of fossil fuel consumption upon society.

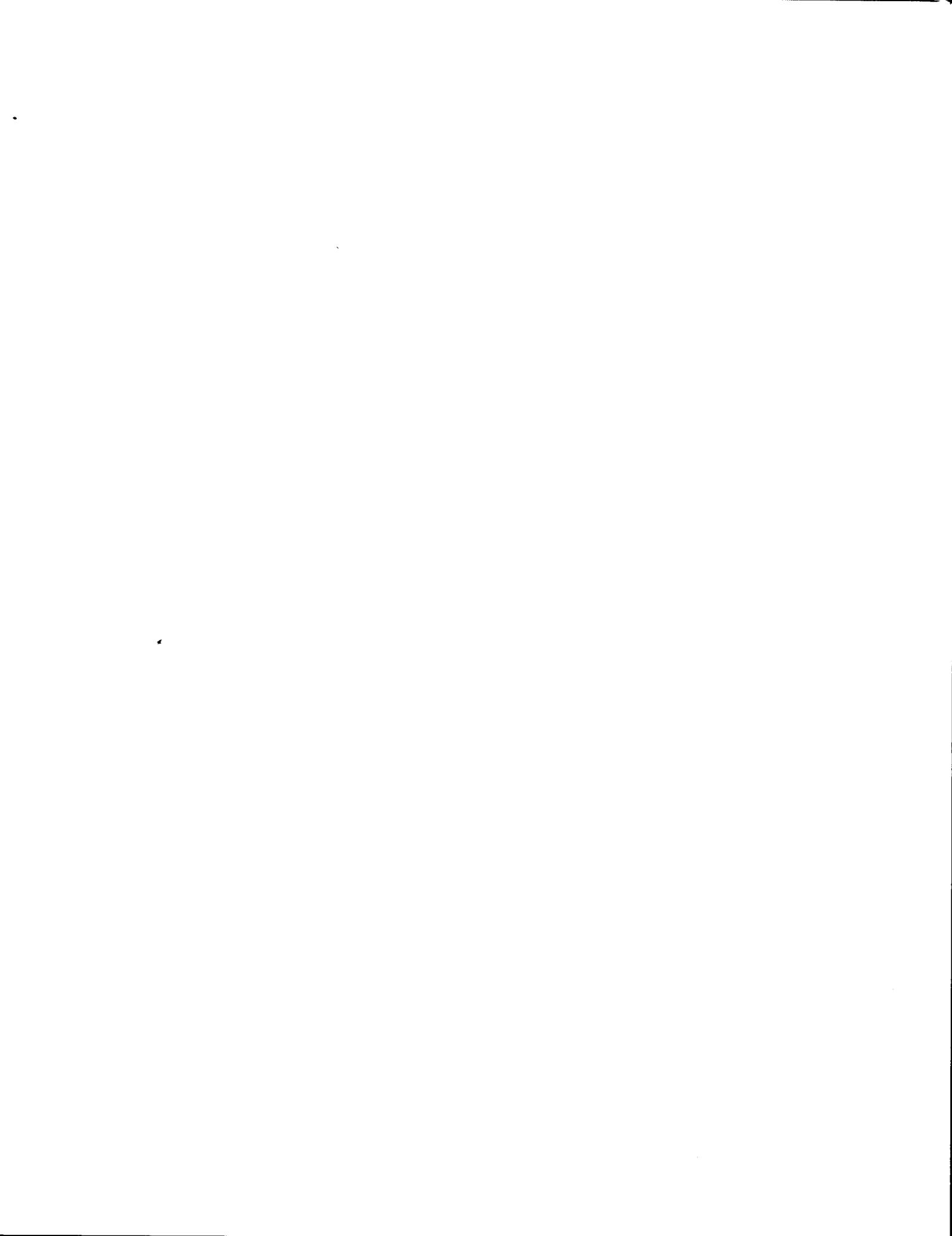
Recently, the Exxon Corporation was required by state and federal statute to repair the environmental damage caused by a failure of its delivery system in the Port of Valdez, Alaska. The \$2 billion clean-up effort to restore the environment will be included in the future pricing of products from that firm. In the same manner, some committee members indicated that future environmental impacts, whether accidental spills from ships, pollution from coal-fired generators, or the pollution discharged into the air from petroleum consumed by automobiles, must be included in the transaction cost of the product delivered to the consumer.

This "convention" of internalizing negative externalities can occur without direct government intervention. Recently, several United States-based harvesters of tuna fish have voluntarily altered the method of fishing to assure the protection of indigenous dolphin populations. Obviously, altering the method of harvesting tuna will add to total production costs, but, as indicated by the action of the companies involved, a fully informed/educated consumer is willing to accept this increased cost to protect public goods or other forms of life (dolphins).

Similarly, if producers, consumers, and governments were thoroughly apprised of the total expense associated with an energy fuel-type selection (from production through disposal), the invisible hand of the free market could reliably perform its function of protection of property rights. The free market has largely created the economic dynamo that is the United States, and perhaps this free market system is capable of solving many of the environmental and energy supply issues that give rise to this document.

The resources held in trust by government for the people of Arizona (e.g., water, air, and habitat) provide few immediate incentives for their preservation. In a free market, society (the consumer, business, or government) can place established value upon these resources and recover economic value when their use or degradation leads to irreparable damage. In principle, the committee suggests that the theory of private property rights be applied to public property (e.g., air, water, habitat) that is held in trust by government as an intergenerational representative of the people and other forms of life.

In order to achieve a free market for energy services that includes environmental values and is reflective of the true costs associated with the production, distribution, and consumption of energy, methods/strategies must be developed to implement this public policy planning process. It is suggested that by altering the current planning process, assuring long-term affordability, and educating the public about the total cost of each energy alternative, it will be possible to develop a market in energy services that is more reflective of free market principles.



6 Planning Process

The international, national, regional, and local energy markets are presently characterized as less than free markets. Monopolies and oligopolies exist in several sectors of the energy marketplace including, but not limited to the Organization of Petroleum Exporting Countries and franchised utility monopolies. Because this industry has been conceded the right by government to form cartels for the production and distribution of energy, government has been compelled to take an active role in the economic, safety, and environmental regulation of these industries.

In the 1970's, the United States suffered through much economic and political turmoil arising out of the 1973 Arab Oil Embargo. Among the responses to the situation was the imposition of a complex set of crude oil and refined petroleum product price and allocation controls. Violations, both intentional and unintentional, of these regulations resulted in the overcharging of American consumers. In excess of \$4 billion has been recovered through court-ordered settlement agreements, and redistributed through the federal and state governments to effect restitution. While the effectiveness of the specific regulations can be debated, government action was precipitated by petroleum markets unable to cope with the actions of the Organization of Petroleum Exporting Countries.

Since the time of the Arab oil embargo during the Nixon Administration, each succeeding presidential administration has faced, to varying degrees, rigorous energy "crises." Presidents Ford, Carter, and Reagan faced national economies driven to the brink of ruin by fossil fuel supply and price disruptions. President Jimmy Carter compared the dire energy situation in the United States of the late 1970s to the "moral equivalent of war." Currently, the Bush Administration is under tremendous economic and environmental pressure as the consumption of foreign fossil fuels wreaks havoc with our international balance of trade and the air quality in major American urban areas.

Recommendation 1. The State should develop a comprehensive energy plan and planning process coordinated with the Integrated Resource Plan of the Arizona Corporation Commission designed to help the State meet its long-term needs for energy services. The plans should evaluate and address increased energy efficiency, the development of appropriate renewable energy resources including hydroelectric, greater energy independence, and preparedness for future energy emergencies.

Because the regional and local energy markets are currently characterized as less than free markets, national, state, and local governments have a large, constitutionally established role in regulating these markets. This is partially because publicly-franchised monopolies and municipal entities exist in several sectors of the energy marketplace including Arizona Public Service, Tucson Electric Power, Southwest Gas, and Salt River Project. Because this industry has been conceded the franchise rights to specific service

territories for the distribution of energy, state government is obligated to take an active role in the economic, safety, and environmental oversight of these industries.

Additionally, because the availability of affordable energy is an essential element of the quality of life in Arizona, it is important for the State to take an active role in the planning and evaluation process of energy infrastructure development and planning. Although the Arizona Corporation Commission is available for regulatory oversight of certain utilities, there is currently no fully integrated (e.g., petroleum, natural gas, and electricity) planning process for the development of energy plans for the state of Arizona.

In order to improve energy efficiency, develop indigenous resources, and assure a stable supply of energy, the State should develop and implement a formal planning process for the energy industry regarding the acquisition and distribution of energy resources at the lowest possible cost to society. This planning process would be a coordinated effort between the energy industries and government to assure that the energy services needs of Arizonans can and will be met at the least environmental and economic cost.

Utility energy systems, whether they are investor-owned, cooperative, or municipal, are dominant players in the economic, energy, and environmental policies of Arizona. If such systems are not regulated by the Arizona Corporation Commission, there is concern that these "non-regulated" systems are not fully accountable to the citizens of Arizona through their election processes.

Recommendation 2. The State should immediately prepare an energy supply emergency plan. This plan must consider the needs of residential, industrial, commercial, and agricultural energy consumers. This plan should be closely coordinated with energy suppliers, neighboring states, and the federal government.

Currently, if a natural disaster, human error, or terrorist attack were to disrupt the refinery capacity of west Texas and California, the citizens of Arizona would face running out of petroleum supplies within days or weeks of the disruption. Or, if the electric generation infrastructure of the utility industry were to sustain a long-term outage for similar reasons, the citizens of the State would be forced to seek scarce electric resources from other areas of the region or nation.

Adequate supplies of energy are essential to maintain the economy of Arizona and assure the quality of life and health of its citizens. Without adequate supplies of energy, the businesses that fuel our local economies, the automobiles and airplanes that provide transportation, and the farm machinery that assures an abundant supply of food will come to a sudden grinding halt. And without substantial supplies of affordable energy, the unique summer climate of the Sonoran Desert will become intolerable.

The role energy plays in our daily lives is so great that even a temporary or minor disruption in the flow of energy to consumers could threaten financial ruin or physical destruction of many commercial and agricultural interests in the State. Our dependence is so great that it is imprudent for state government not to plan for supply or demand emergencies. Currently, within the state of Arizona there is less than a two-week supply of liquid fuels for powering the transportation systems of the State. With no local refinery capacity, a supply of crude oil from the national Strategic Petroleum Reserve would sit idle in the face of refinery outages on the west coast or in Texas.

To assure that the economic, physical, and social disaster associated with a supply disruption is fully mitigated, the state of Arizona should develop alternative emergency

strategies to provide energy services in the event of a supply disruption or demand crisis. These plans should address alternative strategies to replace supply in the event of disruptions from both natural and man-made system failures and supply disconnections or in the event of a demand crisis. In the event of any supply or demand disruptions, the physical and economic health of the State must be assured by elements of state government. The plan should plan to mitigate the situation through emergency demand reduction strategies, such as telecommuting, carpooling, rescheduling of work hours, etc.

Recommendation 3. The Arizona Corporation Commission should actively continue its efforts to implement its Integrated Resource Plan. The Integrated Resource Plan should include an evaluation of alternative economic supply and demand strategies for meeting future demand.

The electric and natural gas capacity planning process for regulated utilities in Arizona currently includes a review of all energy supply strategies, including those that increase generation infrastructure or significantly reduce demand. This planning method attempts to compare and contrast supply increase options and demand reduction options based upon total cost to the community. The strategy that has the highest impact (either new generation infrastructure or reduced demand) at the "least-cost" is considered the preferable alternative. It is important that all Arizona-based energy providers (regulated and non-regulated) and the Arizona Corporation Commission continue this effort to provide energy services at the lowest possible cost to society. Of course, the criteria used to compare all resources should be designed to provide a "level" playing field.

All public preferences and subsidies provided to specific energy producers identified through this process should be investigated and analyzed with the goal of calculating and including their total costs to society in the decision-making process. For example, the municipal utility industry currently receives a subsidy in the form of tax-advantaged bonding authority. The cost of this subsidy to the public should be included in any least-cost strategy for energy production.

While some entities may wish to opt out of such processes as least-cost planning, it may be in society's best interest to require participation. The public should fully understand that the development of a least-cost planning mechanism in Arizona may not reduce rates. In fact, the least-cost planning process which advocates inclusion of the costs of environmental damage from energy production and distribution in rates may substantially raise the transaction cost of energy services in Arizona.

Recommendation 4. The State, Arizona Corporation Commission, and energy production and distribution companies should adopt a system of least total social cost for the complete fuel life cycle in all energy decision-making. Part of this process would include the development of a public policy process to determine the appropriate balance between transaction cost for energy and its total social cost.

As indicated earlier, energy is among the most essential resources of modern society. Without the cooling, light, and food it provides, the metropolitan communities of the Sonoran Desert in Arizona could not exist in their current form. Since the end of World War II, the population of Arizona has literally exploded, and with the advent of air-conditioning in the mid-1950's, the need for energy to sustain these communities has grown equally. Yet, widespread use of fossil fuels to power automobiles and electric generation facilities threatens the air quality, vegetation, and climatic stability of the region. In

essence, the equilibrium in humankind's relationship with the environment is currently out of balance. We have discovered that to a large extent, the long-term ability of the desert environment to support life depends on the kind of energy consumption choices we make, and especially on how effectively we use our energy supplies.

Until very recently, the traditional approach to government and private sector energy decision-making was simply to meet the increasing demands for energy through the construction of additional generation or production capacity. But, during the past two decades, several factors have fused to challenge this approach to energy policy-making. The growing realization that fossil fuel resources are being depleted; energy prices are increasing steeply; prospects are diminishing for current nuclear power generation technology; and environmental damage from the production, distribution, and consumption of fossil fuels is increasing have combined to create the existing economic and environmental predicament.

As a result, the traditional energy policy of merely increasing supply has been supplanted by approaches that emphasize a focus upon environmental and economic least-cost energy planning and attempts to stabilize or reduce the current demand for energy. This approach is considered feasible because the United States currently uses approximately twice the energy per capita as the West Germans or Japanese. It is hoped that by demand reduction through efficiency improvements, we may provide the same energy services (i.e., air conditioning, transportation, lighting, etc.) at a moderate economic cost with the least environmental damage.

In the past, energy infrastructure/services have been constructed or improved based upon a projection or in anticipation of customer demand. In other words, as existing infrastructure reached maximum capacity, resources were committed to surmount the capacity constraints (i.e., new generation plants were planned or new oil wells were drilled). Very little consideration, if any, was given to alternative solutions to restricted capacity. As an example, if peak demand approached an anticipated point near system capacity, the immediate consideration of energy planners was, usually, to determine the best fuel-type and construction technique to expand capacity. No, or little, consideration was given to less costly methods of reducing demand (i.e., load controllers, retrofit lighting, or rate design).

Much discussion has occurred nationally and in Arizona about the development of least-cost planning mechanisms for the electric and gas utility sector. The Arizona Corporation Commission recently adopted a system of least-cost planning for the development of new energy infrastructure for regulated utilities. The National Association of Regulatory Utility Commissioners, the Department of Energy, the states of New York, California, and Wisconsin, and several private sector organizations are currently in the process of developing acceptable governmental regulations for the inclusion of total social costs in energy decision-making.

The total social cost test examines the net benefits of a program to society. Costs to society are the capital and operating costs of each alternative including fuel costs and environmental costs, whether borne by the utility customers or others. Benefits of an alternative will be the savings of that alternative relative to other actions plus any additional benefits not resulting from other actions. For example, societal benefits of conservation and demand management are avoided utility production and capacity costs, environmental improvements, and improved comfort or convenience. The social costs of conservation and demand management are the capital and operating costs of the measure plus any environmental

costs. The total social cost test is consistent with the resource planning rules which refer to the total cost of electrical energy services (Arizona Corporation Commission R14-2-701).⁶⁷

Current retail and wholesale electricity and natural gas prices do not accurately reflect the total costs to society of providing these energy services. Until these costs are fully quantified and internalized in the decision-making process, Least Cost Utility Plan (LCUP) alternatives are likely to be distorted. It is recognized that internalization of environmental costs may significantly increase electricity prices, and this could have a disproportionate impact upon particular fuel types and regions of the State. However, in order to assure free market efficiency, these genuine costs must be internalized in the decision-making process.

Recommendation 5. The State should develop a system to accurately monitor energy supply and consumption for all energy types locally and regionally, including a system of mandatory reporting of supply and consumption by large-scale commercial suppliers and users. The results should be published and made available to the public.

In order for the State and private sector to react expeditiously to changes in the marketplace for energy resources and services, information about the supplies and demands for various fuel types must be maintained in a central repository. Because the energy needs for the state of Arizona are provided by a regional marketplace for energy (i.e., New Mexico, Texas, Colorado, Utah, Oregon, California, Washington, and even Alaska), this information may be more than any single private sector actor could find useful or profitable to maintain. Because of the intrinsic value of information regarding supply and demand for energy supplies to all Arizonans, the State should assemble a mechanism to track, collect, and report this information to all interested parties in the State. The Arizona Corporation Commission and the Arizona Energy Office maintain data bases containing some of this information. While current energy data systems are substantial, more complete information is needed. The State should adequately fund the development of an energy information network that would be available to business, policy-makers, scholars, utilities, government, and the general public. The availability of this information would assist private and public sector organizations in long-term planning.

Only with this type of information can important public and private policy decisions be made about the development of future supply, the nature of future demand, and the ability to manage large-scale commercial consumers and energy suppliers in the event of supply or demand disruptions.

Recommendation 6. The State should assess and evaluate whether its current level of involvement (i.e., regulation, taxing, siting, etc.) with all private and public/municipal energy production, transmission, distribution or supply organizations in the State is optimal and results in the most efficient allocation and/or use of energy resources.

Currently, the Constitution of the State of Arizona requires the Arizona Corporation Commission to regulate "all corporations other than municipal engaged in furnishing gas,

⁶⁷ Arizona Corporation Commission, *Staff Report Resource Planning Docket No. U-0000-90-088*, p. 4.

oil, or electricity for light, fuel, or power; or in furnishing water for irrigation, fire protection, or other public purposes ..."⁶⁸ This grant of authority to regulate corporations engaged in furnishing natural gas or oil for fuel has been interpreted to exclude the regulation of providers of liquid fuels for transportation. And the precise interpretation of the article prohibits the regulation of municipal utilities involved in energy distribution.

There are many practical reasons for these exemptions. The complexity of regulation of the petroleum industry or municipal energy suppliers would require additional staffing and funding for the already burdened Arizona Corporation Commission. And, there is no consensus as to the effect of regulation of these energy sector companies.

Because of the manifold costs and benefits associated with the constitutional change required for oversight of municipal energy providers, the State should undertake a study of this complex public policy issue. Additionally, many concerns have been voiced recently about the equity of the current tax burden placed upon the utility industry. It has been reported that 24 percent of the average Arizona Public Service Company bill is local, state, and federal taxes.

If the study of regulatory and taxation policy indicates that benefits to consumers outweigh the costs associated with regulation of the municipal energy industry, the issue should be properly brought to the people of the State for consideration. On the other hand, if it is determined that the costs and benefits associated with regulation and taxation policy of government under the current system is inefficient, the State should alter its public policies. It is in the best interest of all Arizonans to assess the efficiency and equitability of the current tax and regulatory process faced by franchised monopolies.

Recommendation 7. The State should continue to encourage local divisions of government to emphasize "in-fill" within their communities and urban planning/zoning with an emphasis on energy efficiency and conservation.

The on-road gasoline consumption in the State of Arizona is used largely for commuting to and from the workplace and for local transportation. The urban form embraced by the people and state of Arizona (i.e., central business districts, large suburban lots, low population density, and strip commercial zoning), as indicated in earlier chapters, has evolved into an extremely energy intensive lifestyle. Few individual citizens live within comfortable walking distance of commercial or retail establishments. The low population density (Table Sixteen, page 61) pattern of urban areas throughout Arizona require additional energy for transportation. Current research reports indicate that Salt River Metropolitan Area residents are among the largest consumers of petroleum in the United States, second only to Houstonians.

In 1979, the City of Phoenix adopted an "Urban Village" concept for future urban development that may reduce primary energy consumption. As greater opportunities exist to work, live, and recreate in a smaller geographical area, less fossil fuel energy will be consumed by citizens. The Phoenix Urban Village concept seeks to create nine largely self-contained sub-communities where residents can complete their basic needs and desires. The major impetus for this plan was an effort to reduce the demand for transportation infrastructure within the metropolitan area.⁶⁹

68 Constitution of the State of Arizona, Article XV, Section 2, p. 56.

69 Pickus and Gober, "Urban Villages and Activity Patterns in Phoenix," *Urban Geography* (1988), p. 85.

When petroleum energy resources were inexpensive, plentiful, and there was inadequate understanding of their environmental impact, little consideration was given to the energy efficiency of urban form. Now that petroleum energy prices are again on the rise, supplies are recognized to be finite, and the environmental impacts of fossil fuel combustion are better understood, it is time to begin consideration of energy efficiency in the design, planning, and zoning approval processes for urban growth. If we are to achieve energy efficiency, we must weigh the potential energy impacts of urban growth on the community.

The State and municipal government have a direct effect on the amount of energy consumed in Arizona through their urban planning process. By emphasizing in-fill in the further development of the metropolitan areas of Arizona, it may be possible to decrease the per capita energy consumption. The State should continue to assist local units of government in encouraging in-fill in the development of communities in Arizona.

Recommendation 8. The State should work with the federal Department of Energy to assure that the Strategic Petroleum Reserve drawdown procedures are implemented to assure petroleum supplies to Arizona.

Currently, the federal government has approximately 580 million barrels of crude oil stored in the Strategic Petroleum Reserve (SPR). This pool of emergency reserves is expected to reach 750 million barrels by the end of this century. The Strategic Petroleum Reserve provides the entire United States with substantial short-term security, but could not protect the United States from a prolonged cutoff of foreign oil supplies. The United States government has developed plans with its Organization for Economic Cooperation and Development (OCED) partners for the distribution of this government-controlled stock in the event of major supply disruptions.

It is anticipated that these reserves could sustain the United States and its close allies for a period of up to six months. However, no specific plans currently exist for the distribution of these supplies inside the United States in the event of a major emergency. And, no plans exist in the event of minor or localized supply disruptions. This problem was recently evidenced in the northeastern United States when the local price of fuel oil for home heating temporarily jumped over 100 percent.

The National Governors Association has advocated the development of regional emergency supplies of both refined and crude supplies of liquid fuels. The concept advocated by the organization is to have on hand sufficient governmental supplies to avert local economic disruptions as a result of a temporarily constrained supply.

Recommendation 9. To the extent practical, when the State government is involved in aspects of regulation, control, review, plan approval, reporting requirements, and siting approval as these relate to the energy sector, a single bureau of state government shall be clearly designated as responsible and accountable for coordinating the activity.

In the state of Arizona, there are many government agencies that have a regulatory, economic, or public policy interest in the activities of energy producers, distributors, and consumers. In order to assist these industries and the citizens of Arizona, it would be practical to vest one agency of government with responsibility for these issues to the extent practical. A good example of the need for this coordination is the controversy that has arisen between the Arizona Department of Commerce and the Arizona Corporation

Commission over the siting of high energy consumption manufacturing businesses that desire significant rate discounts in the Arizona Public Service territory.

Additionally, because of potentially negative impacts, state and local licensing procedures for energy facilities impede the timely development of useful new energy resources. Because of the large role of the State, counties, and municipalities in the siting of energy infrastructure, it is important that a successful and timely planning and approval method be developed that involves all pertinent parties. By providing a "one-stop-shop" for the regulation, control, review, plan approval, reporting, and siting approval, procedures may be streamlined and greater public involvement may be achieved.

Recommendation 10. The State should assess and evaluate whether the current level of public input and control over municipal energy utilities is appropriate.

One municipal energy provider held an election in April, 1990, in which .3 of 1 percent of the potential voters voted. This was despite the fact that with a May, 1990 rate increase, bills for many customers served by that municipality would be higher than for like usage of a neighboring investor-owned utility criticized for its high rates and bills. Reasons for this low voter turnout could include: (1) voting is based on property ownership (proportional property ownership for the majority of the board or council); (2) no other elections or ballot issues were being voted on that day; (3) there are few polling places in the geographical area served by the municipality; people often have to vote at unfamiliar polling place miles from their homes; (4) people are generally satisfied with the service of this municipal energy provider and see no reason to vote.

Recommendation 11. The State should continue to work at the national level to encourage the federal government to develop a comprehensive national energy policy focused upon economic and environmental sustainability.

Arizona has a direct and compelling interest in the development of a bipartisan national energy strategy that is in concert with the needs of all current and future generations of Arizonans. The development of this federal policy and its complete implementation will have far reaching effects on the future economic and environmental circumstances of Arizona. For this reason, among others, the state of Arizona should take an active role in the development and implementation of the National Energy Strategy.

At the direction of President Bush, the Department of Energy is currently in the process of "build(ing) the national consensus necessary to support the (national energy) strategy." As the President indicated, "We must balance—achieve balance—our increasing need for energy at reasonable prices, our commitment to a safer and healthier environment, our determination to maintain an economy that is second to none, and our goal to reduce dependence by ourselves and our friends and allies on potentially unreliable energy suppliers." Although this process is occurring at a national level, it seeks substantial input from other units of government and the private sector.

Representatives of state government, the business community, and private citizens must undertake the effort to assure Arizona's economic and environmental future as a full participant in the development of this important national public policy. Only through frequent interaction with the Department of Energy, Congress, and the President's Office can Arizona protect and enhance its interests. To this end, the State, in association with other interested parties, should continue its efforts to influence the development of the

Bush Administration's National Energy Strategy and others as they are developed and implemented.

Recommendation 12. The State should identify and remove financial and regulatory impediments to the use of solar and renewable energy technologies.

In several circumstances identified by testifiers at public hearings held throughout the State, many citizens indicated that there are substantial financial and regulatory impediments to the use of solar and renewable energy technologies in Arizona. The State should identify and remove those unnecessary impediments to the use of these important energy technologies. For example, in several areas of the State, there are deed restrictions to the installation of solar technologies on the roofs of buildings. Because of the major public benefit from the use of solar technologies on the roofs of buildings, these types of impediments should be investigated and removed.

7 Public Awareness

To make well-reasoned decisions about the risks and benefits of a wide range of economic development and environmental issues related to the production and consumption of energy, the average citizen must possess at least a basic understanding of energy-related subjects. To fully participate in the energy decision-making process, citizens must be given an understanding of the relationship between inefficient consumption of fossil fuels and pollution, the role of imported energy in the economic profile of the community, and the value of an unpolluted environment to the economic development of the State.

Recommendation 1. The State should seek ways to enhance general public, government and business community awareness of energy issues through the effective use of public workshops and forums, publications, and the use of mass media communications. The State, in association with the business community and other appropriate groups, should develop a program of energy education for all employees and develop community-wide energy education programs.

Currently, many citizens have little, if any, understanding of the relationship of energy to the quality of their and their children's lives. This lamentable situation must be altered. Educational and informative programs must be developed and actively promoted to provide the adult population of the State a full appreciation of the role of energy in their and their family's lives.

The State, in cooperation with public and private energy companies, must develop programs to educate the general populace through the use of workshops, forums, publications, and particularly the mass media. Recently, the Arizona Energy Office, in cooperation with KAET-TV/Channel Eight, underwrote the broadcast of a four-part energy education program developed by the Colorado Energy Office. This program was viewed, in whole or part, by over 250,000 Arizonans and signifies an important step in the continuing process of community education.

The ability of Arizona and her citizens to meet and surmount their energy-related environmental and economic development challenges in the ensuing decades depends on the successful development and implementation of many technologies and human resources. Education—not just energy education—is key to surmounting this foremost challenge faced by Arizonans. We must ensure that every student studies and develops an appreciation of mathematics and science every year in grades Kindergarten through High School graduation as a core curriculum, so that knowledge by Arizona elementary and secondary students of these subjects will be the best in the United States.

As with many challenges we collectively face in contemporary society, environmental pollution and economic development require sophisticated answers to complicated

questions. These solutions can not be developed or implemented by an uneducated or disinterested community. As was indicated during one committee meeting, "a plumber can fix a solar-thermal energy system, but he can not fix a nuclear power plant." If we are to succeed in balancing mankind's desire for energy with our need for an uncontaminated environment, only an educated people can discover and implement the correct answers.

In 1980, the National Energy Education Development Project was launched by congressional resolution. A subsequent presidential proclamation initiated a decade-long effort to introduce or enhance energy education programs throughout the fifty states. The National Energy Education Development Project (currently active in 32 states) believes that concerned, energy-literate students will become informed adults capable of making intelligent energy decisions and formulating wise energy policies. The state of Arizona was an original participant in this project. During 1988, however, the State's participation was canceled.

Recommendation 2. The Departments of Commerce and Education, working with energy utilities, education professionals, and other appropriate groups should encourage the development and implementation of a fully integrated energy education curriculum for primary schools, secondary schools, technical and vocational schools, community colleges, and universities. Additionally, the State should develop a teacher training program on energy and environmental topics and scholarships for students and teachers to attend energy education programs and to perform energy research.

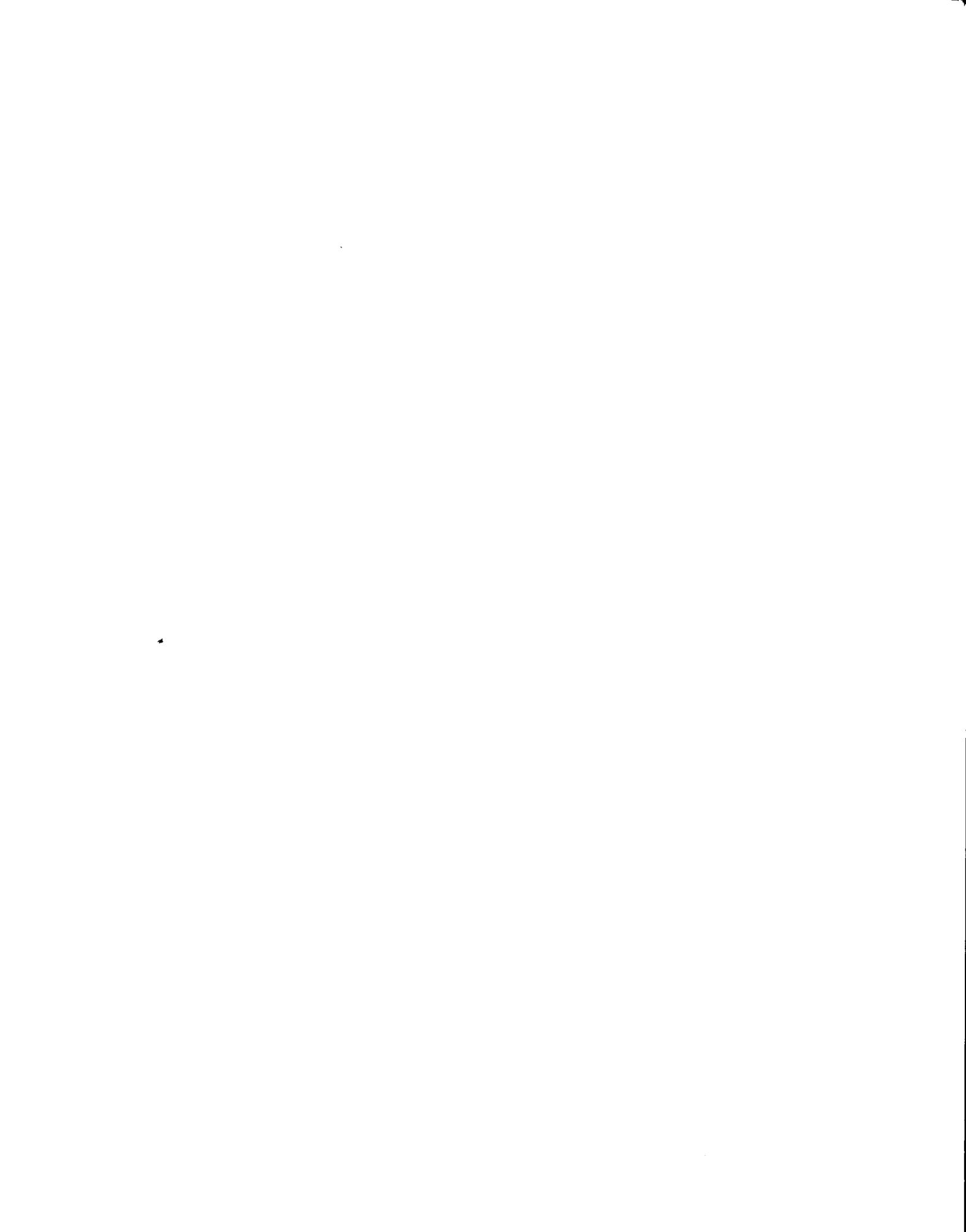
As indicated throughout this document, the energy-related problems that confront the people of the state of Arizona are immensely complicated. Issues surrounding the use of nuclear energy, development of photovoltaic systems, disposal of hazardous waste, and mitigation of environmental pollution will require scientists, technicians, engineers, and plant operators to resolve. Unfortunately, the necessary skills to solve these complex questions can not generally be developed in short-term technical programs, but require many years of exposure to and understanding of mathematics and science. If it is our desire to "harvest" scientists from our state universities, we must plant scientist "seeds" in the primary and secondary schools of the State.

The State of Arizona cannot boost the achievement of its students without addressing the preparation of teachers who will educate the current generation of students. Part of producing good students is cultivating and retaining good teachers. Currently, the highest quality students of science and mathematics are hired directly out of college by the private sector. They are lured to these private sector positions by good salaries and benefits. If the state of Arizona is to attract the top classification of graduating students for positions in the field of teaching, we may have to re-examine the current methods of hiring and rewarding new candidate teachers.

Recommendation 3. The State should immediately expand funding for community college, university, and specialized training scholarships and programs for students who will pursue careers as energy specialists in all career fields.

The U.S. Secretary of Energy, Admiral Watkins, has stressed repeatedly in public hearings that we have a significant shortage of trained scientists, engineers, and technicians who can deal with energy problems. Without properly trained individuals in the areas of energy

policy, conservation, production, distribution, efficiency and others, we will be unable to meet the energy needs of the future.



Section 4 - Affordability

8 Affordability

As the economic costs associated with the protection of the environment are applied to each fuel type over the ensuing decades by implementation of recommendations contained in this document and through directives from federal legislation, it is likely that the cost of energy services (e.g., electricity from fossil fuels, petroleum products from fossil fuels, and natural gases) will increase moderately. The costs of reformulated petroleum products, new clean coal technologies, and improved nuclear generation facilities will be passed on to the consumers of these products in proportion to their use. These increases in the transaction cost of energy services will unquestionably be offset by decreases in costs of other services (e.g., health-care, mass transportation, and environmental restoration), yet the direct economic impact upon the average energy consumer of the State will be higher transaction costs that reflect the authentic cost of energy services at the petroleum pump, from the utility meter, and even at the grocery store.

The availability of energy services at affordable rates is necessary to the quality of life, physical health, and economic well-being of all residents of Arizona. Affordable energy is necessary to shield all from harsh desert and frigid mountain environments, to provide food, to provide transportation, and in some cases even to provide jobs. Luckily, the harsh desert climate can be ameliorated with low-energy use evaporative cooling, which is also less costly for Arizona utilities to serve because of its low demand coincident with utilities' summer peak. Unfortunately, low-income people lack the resources to convert their cooling systems from air conditioning to evaporative cooling. Energy services have become an essential commodity of life in the latter part of the 20th century, and it is unacceptable to force low-income citizens to choose among essential needs for food, housing, and energy. Mechanisms should be developed that will assure accessibility to essential energy services for all citizens. Examples of such mechanisms could include the provision of evaporative cooling systems by utilities to reduce the energy demands of low-income citizens, and for these costs to be accepted into the rate base.

The cost of energy services in other regions and nations can be much higher or lower than in Arizona. Petroleum for transportation in some nations is as much as 300 percent higher than in the United States (Table Nineteen). Hydroelectric power rates in the northwest are as much as 75 percent lower than current electric rates in Arizona (Table Twenty).

Certainly the concept of an energy crisis is much more immediate for low-income users for whom an "economic energy crisis" is unending in the face of annual increases in the cost of energy services. In fact, during the peak summer months, low-income households may spend as much as one half of their disposable income on energy services (e.g., air conditioning and transportation).⁷⁰ More specific information about the issue of energy

⁷⁰ Bob Young, Maricopa County Human Resources Department, interview with Michael Walters, March 22, 1990.

services for low-income residents is available in Appendices C and D in the form of a January 1990 report to the Legislature prepared by the Arizona Departments of Commerce and Economic Security.

Table Nineteen Petroleum Prices Vary Substantially Worldwide 25 August 1990	
Italy	\$4.92
Sweden	4.85
Denmark	4.46
France	4.37
Switzerland	3.87
Belgium	3.80
Britain	3.56
Spain	3.14
W. Germany	3.05
Japan	3.01
Brazil	2.28
Australia	2.20
Kenya	1.81
USA	1.33
U.S. Dollars per Gallon.	
Source: AP, Lundberg Letter, and Time correspondents	

A recent letter to the Arizona Corporation Commission stated: "Median income in Yuma is \$17,000 annually, compared to \$27,000 in Maricopa County ... that electric bills of \$380 for a three bedroom house and \$170 for a two bedroom apartment are not uncommon ... Yuma has an 'ability to pay' situation that needs addressing." It must be admitted that Arizona has "the most hellish summer climate this continent offers" and that low-income people cannot afford air conditioning, as it is presently engineered, to tame it. With evaporative cooling, those \$170 - \$380 bills should be lowered to a more manageable \$30 - \$100 range. If low-income people still have trouble with those kind of bills, they should be assisted. Short of a medical emergency, it is questionable whether assistance should be provided for air conditioning.

Approximately 10 percent of Arizonans have incomes which fall under the federal definition of poverty. The 1980 census indicated that over 300,000 Arizonans were past the age of 65, approximately 11 percent of the population.⁷¹ Some of these senior citizens are among the low income population. It is in the interest of the state of Arizona to devise programs

⁷¹ Department of Commerce, *Arizona's Changing Economy*, 1986, p. 17.

that will mitigate the impact of increases in the cost of energy services in Arizona to low-income residents.

Table Twenty Electric Prices Vary Substantially in the West								
	500 kwhs per Month				1000 kwhs per Month			
	Summer 1989	Winter 88/89	Summer 1990	Winter 1990	Summer 1989	Winter 88/89	Summer 1990	Winter 1990
Arizona Public Service	\$46.27	\$48.83	\$47.42	\$49.97	\$ 96.90	\$ 90.14	\$99.19	\$92.43
Tucson Electric	39.54	38.43	42.44	38.33	76.84	65.56	81.55	72.31
Pacific Gas & Electric	52.81	52.50			116.50	115.07		
San Diego Gas & Elec.	51.81	52.74			114.18	115.84		
PS of Colorado	38.00	36.36			71.31	67.95		
Utah Power & Light	41.91	43.69			82.79	86.33		
Idaho Power	23.51	23.50			47.02	47.00		
Wash. Water Power	20.91	24.09			44.87	44.87		
Montana Power	24.12	34.19			45.25	65.39		
Nevada Power	27.74	26.94			51.95	50.36		
PS of New Mexico	49.67	44.61			100.44	86.92		
PacificCorp - Oregon	27.94	27.94			52.71	52.71		
Salt River Project	47.27	42.27	45.90	50.84	88.63	67.45	91.79	78.18
Source: National Association of Regulatory Utility Commissioners								

Currently, several financial and demand reduction energy assistance programs are administered/operated on a state-wide basis by the investor-owned and municipal utilities, the Arizona Energy Office, non-profit social service organizations, and the Arizona Department of Economic Security (Table Twenty-one and Appendix D). These programs attempt to assist low-income consumers manage their energy service needs by providing direct financial assistance. Through their operation of these programs, Community Action Agencies and social service agencies have significant knowledge of the needs of low-income households for energy assistance and service. A major need is for a moratorium on utility shut-offs during extreme temperatures. In Arizona, the only shut-off moratorium that exists is for extreme medical conditions. There is currently no moratorium for extreme temperature conditions.

Recommendation 1. The State should fund a coordinated continuum of energy programs that include administrative costs to benefit low-income households through a dedicated funding source.

Since federal funding became available in the 1970s, the Department of Economic Security has received funds which are administered through the Community Action Agencies. These and all other programs are described in Appendices C and D. The graph on page three of the appendix shows clearly that only a very small percentage of eligible households are being served.

These programs have been hampered since their inception by inadequate funding and by little or no administrative funding. Only a minimal amount of state funding has been available for energy programs and associated administrative costs. Without adequate

administrative funding it is difficult to reach all eligible candidates. Programs should not be considered unless they include full administrative funding.

Table Twenty-One Low and Moderate-Income Energy Programs in Arizona		
Program	Sponsor	Funding Source
Weatherization	Arizona Energy Office	U.S. Department of Energy Weatherization Assistance Program
	Department of Economic Security	Department of Health & Human Services Low Income Home Energy Assistance Program
Financial Assistance	Department of Economic Security	U.S. Department of Health & Human Services Low Income Home Energy Assistance Program
Lifeline Discount	Arizona Public Service	Ratepayers
SHARE	Salvation Army	Private Donations
SHARE	Salt River Project	Private Donations
SHARE	Southwest Gas	Private Donations
Lifeline Discount	Tucson Electric Power	Ratepayers
All of the above programs are operated by community action agencies and other social service agencies.		

Federal financial support has steadily diminished, and the prospect of maintenance/increase of this support is not promising. A coordinated continuum of energy programs to benefit low-income households, and designed to help them become/remain self sufficient, as well as to meet emergency needs, should be funded by the State. There is precedent for making the local public utility commission responsible for these programs (Wisconsin) and program evaluation is an important part of this responsibility. Increased involvement of the Arizona Corporation Commission with Department of Economic Security and Department of Commerce regarding the development of low-income programs will assure that state agencies are working in concert.

Recommendation 2. The State, in association with energy utilities, social service organizations, and other interested parties, should develop and implement programs that reasonably assure the availability of vital energy services to all residents and avoid energy utility shut-offs during periods of extreme temperatures.

A mechanism must be developed that will assure that vital energy services are available to all residents during the extremely hot days of summer and cold of winter. Although we recognize the financial responsibility of each individual for their energy consumption, it is

in the best interest of the community to avoid disconnections during these potentially life-threatening days of extreme heat and cold in the various regions of Arizona.

Notwithstanding the existing programs (Appendices C and D), no comprehensive evaluation has been done of the energy needs of low-income Arizonans or of the impact of changes in the transaction costs for energy services upon these consumers. A preliminary study has been conducted by the National Consumer Law Center. The results of this study are summarized in Appendix C. Only with a complete understanding of the problems of this unique group of citizens can high-impact strategies be developed to mitigate any adverse economic impacts of environmental protection. Without adequate funding, such an assessment will remain a lower priority than providing essential energy services.

Recommendation 3. The State should design energy assistance programs, including transportation assistance, with a focus on providing energy services at the most cost-effective price. Demand reduction programs should be carefully balanced with financial assistance programs, and education about energy consumption management should be a key component of all programs.

The State, in cooperation with the energy production and distribution companies in Arizona, should evaluate all existing or proposed energy assistance programs as to cost and benefit. Those programs that demonstrate the highest cost/benefit ratio should be improved and expanded. Those programs that show a low cost/benefit should be altered to enhance impact or eliminated.

At the same time, no permanent or temporary assistance programs have been developed for energy services related to personal transportation by the petroleum distribution companies, the Arizona Department of Transportation, private social service agencies, or the Arizona Energy Office. Why public and private utilities participate in the social and economic costs of energy assistance programs while the petroleum industry fails to participate in any energy assistance programs (e.g. subsidizing buses or providing low-income rates) should be examined.

Affordability programs for the low income segment of the local population must be implemented in such a manner to permit individuals the opportunity to improve their energy circumstances. Energy assistance programs, whether permanent or temporary, should include elements of education and demonstration that provide the recipient the chance to alter their energy service needs through conservation or efficiency.

Recommendation 4. The State, in association with all interested parties, should work to expand energy efficiency and conservation programs that are successful in increasing the energy efficiency of low-income housing. These programs should include installation of solar and energy-efficient technologies, conservation of energy, and self-help programs.

Permanent energy services in the form of demand reduction programs (i.e., weatherization) are a key element in providing long-term energy security and affordability for low income households. Weatherization programs have demonstrated that success in long-term

affordability is achievable by reducing demand while providing the same energy services.⁷² Weatherization programs for low-income people attempt to lower the total energy cost to eligible low-income consumers by providing weatherization services including insulation, shell improvement, and appliance retrofits.

Since the beginning of the federally funded low-income weatherization program in 1977, the Arizona Energy Office funded community action agencies and other non-profit social service agencies to assist in the weatherization of over 10,000 single-family homes (98.5 percent) and multi-family units (1.5 percent).⁷³ In fiscal year 1990, an additional 1400 housing units will be weatherized. In this manner, the low-income clients are assisted in permanently reducing total energy demand (and energy costs) rather than providing temporary financial assistance for a higher level of energy demand.

Recommendation 5. The State should work with the federal government to assure that federal and state programs (e.g., weatherization and energy assistance) consider local climatic conditions (i.e., cooling and heating degree days) in their administration and evaluation.

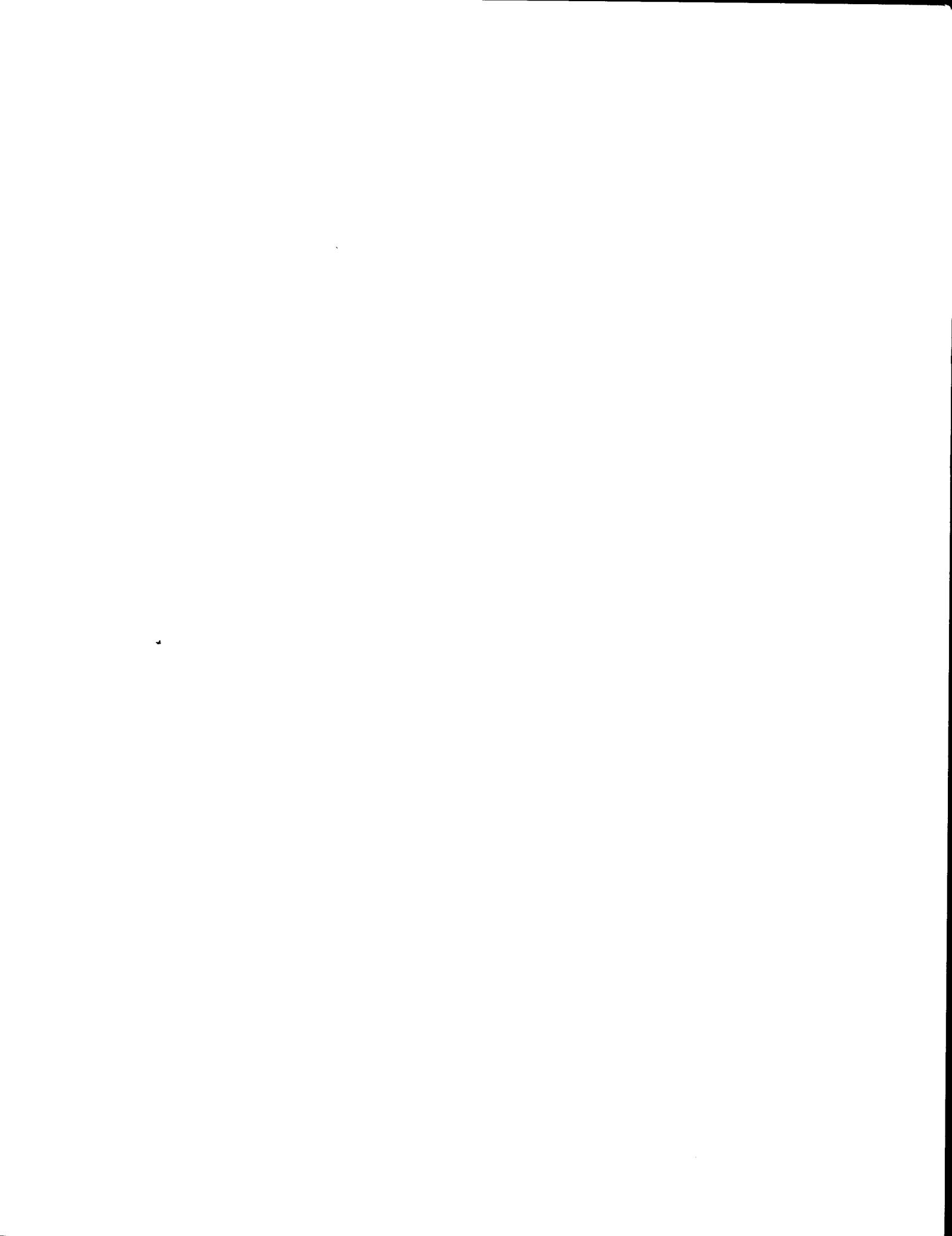
Currently, the Department of Energy weatherization assistance funds are distributed by a funding approach which utilizes a formula that over-emphasizes heating and cooling degrees. There is no technical basis for this method, and funding is skewed to northern states as a consequence. The Governor and the Arizona Congressional delegation should take a firm position with the Federal Government with respect to funding distributions which do not utilize defensible variables. Arizona has historically lost millions of dollars in Department of Energy weatherization funding because of this issue.

Because of the large numbers of individuals requiring low-income energy assistance in Arizona, the State should work with the federal government, our Congressional delegation, and private social service organizations to assure that programs designed to mitigate affordability problems related to energy consumption include information about the unique needs of all residents of Arizona. Arizona's climate ranges from alpine to low desert.

⁷² Russell Clark, Weatherization Program Administrator with the Arizona Energy Office, interview with Michael Walters, June 18, 1990.

⁷³ *Ibid.*

Section 5 - Technology Development and Demonstration



The final issue to be addressed by the state energy policy is the development of new energy technologies in the state of Arizona. The citizens and businesses of Arizona annually expend in excess of \$5 billion on energy, representing approximately 1/7 of the state domestic product. This represents a massive economic, environmental, and health impact upon the State and its citizens. Principally because most of these are fossil fuel resources imported from outside state boundaries, it is estimated that over \$4 billion escapes the State's economy in the form of energy purchases.

Any negative environmental impact from the utilization of fossil fuels potentially harms the growing tourism and agricultural base of the State. Clean air and visibility at the natural monuments of the State are part of the "drawing card" for many temporary and permanent visitors to the region. Tourism contributed \$5.18 billion to the local economy in 1984 and probably near \$8 billion in 1990.⁷⁴ Can this important sector of the State's economy be preserved in the face of declining visibility at national and state parks or in metropolitan areas?

The answer is likely no. Like other regions of the world, a decline in environmental quality can spell doom for tourism or immigration of new residents to the region. In an era of increased environmentalism, vacationers and new residents will likely seek uncontaminated destinations—where wilderness survives; where visibility is sufficient that you can view the majesty of grand mountains or canyons; where your health is not endangered during your habitation. Southern California has recently experienced an out-migration of citizens to the Oregon and Washington areas. Many of these individuals have indicated they were attempting to relocate away from the pollution and congestion of southern California. This attitude is confirmed by a recent study which concluded that children raised in the Los Angeles region have 15 percent diminished lung capacity by age 20.⁷⁵

Because we import a large percentage of the primary energy resources consumed in the State, whether it be low-sulfur coal from New Mexico, uranium from Wyoming, or petroleum products from California and Texas, the people and state of Arizona are exporting billions of dollars annually for energy services. A myth has persisted in the fields of energy and economics that greater economic development requires greater energy resources. This assumption is fundamentally false, as both Germany and Japan have been able to maintain substantial economic growth without increases in energy consumption. It is much more reasonable to assume that the export of currency for the purchase of energy resources will have a greater negative economic impact than a temporary shortage of energy—as evidenced by the national economy reacting to the oil price shocks of the 1970s, 1980s and the recent Persian Gulf Crisis.

The economic development of the state of Arizona is ponderously restrained by the exportation of money for primary fossil fuel energy resources. Each dollar that leaves the State in pursuit of energy is one less dollar available to circulate and recirculate in the local economy. It would greatly assist the state's economy if fewer energy resources were

74 Valley National Bank, *Arizona Statistical Review 44th Annual Edition*, September 1989, p. 1.

75 James M. Lents, Ph.D., Executive Officer of the Coast Air Quality Management District, interview with Michael Walters, June 15, 1990.

imported, more renewable energy resources were developed locally, or energy resources were conserved locally to slow the drain of our economy relative to energy purchases.

The economies of the United States and of Arizona have demonstrated the impressive ability over the past two decades to reduce energy consumption (per capita) in response to changing environmental and economic conditions. Industrial output (in constant dollars) relative to energy consumption has increased significantly since 1970. This increase is due partially to changes in the mix of products and services demanded and produced in the national economy since 1970, as well as efficiency improvements in manufacturing processes. Compared to 1973, industrial energy use is down 8 percent while industrial production is up approximately 25 percent. From another perspective, the United States uses about 7 percent more energy today than it did in 1973, yet there are over 20 million more homes, 50 million more vehicles, and the gross national product is 46 percent higher.⁷⁶

Fortunately, Arizona has enormous potential for the development and use of indigenous resources such as solar energy, biomass, and geothermal heat reserves. When the local producers of power use indigenous resources, they assist local economies by creating jobs, maintaining the state's economy, and reducing the money drain from the importation of energy.

⁷⁶ Department of Energy, *Energy Conservation Trends*, September 1989, p. 2.

9 Solar and Renewable Energy

Renewable energy is supplied from sources that are continually replenished from the sun, from heat within the earth, and from the waste stream, and include hydroelectric, solar-thermal, photovoltaic, biomass (waste), wind, and geothermal heat. The use of renewable energy dates back to antiquity and was a primary source of energy in early America. Solar-heated homes were common in ancient Greece and American Indian villages of the southwestern deserts. Yet, few renewable energy technologies other than hydroelectric power and wood combustion were pursued after the discovery of inexpensive oil and natural gas supplies in the early part of the 20th century.

The oil price shocks of the 1970s and concerns about health impacts upon urban populations exposed to serious air quality problems revived interest in environmentally benign renewable energy. By the late 1980s, renewable energy resources provided about 9 percent of domestic energy supply and about 12 percent of all electric power.⁷⁷ The physical potential for expanding solar power in Arizona is large.

Arizona ranks eighth in the nation in its use of renewable energy resources, according to Public Citizen, a non-profit consumer organization founded by Ralph Nader. The state of Arizona received 8.87 percent of its energy and 15.8 percent of its electricity from renewable resources in 1989.⁷⁸ Renewable energy options in Arizona include a mixture of mature, developing, and long-term technologies. Mature renewable energy sources include hydroelectric, burning biomass, and solar-thermal. With additional research and demonstration projects, renewables like geothermal, wind, photovoltaics, and biofuels will make important contributions to energy supply in the future. Technologies like fusion and hydrogen will require many years to make a significant contribution to energy supplies in the United States. However, the technology for the implementation of hydrogen already exists and is being implemented in other areas of the world (particularly Germany and Japan).

The modest investment by the public and private sectors in research related to the development of solar technologies for the generation of electricity has been particularly effective. Ten years ago a photovoltaic system could deliver electricity at a cost of \$15 per kilowatt hour (kWh), and carried a 1-year warranty. Today, with a 7 cent per kWh national average cost of electricity from utilities, commercially available photovoltaic systems are guaranteed for 10 years and can deliver electricity for significantly less than 50 cents per kWh.⁷⁹ This makes them an increasingly popular power supply for off-grid applications

77 Energy Information Administration, *Annual Energy Outlook 1990*, Table A2.

78 *The Phoenix Gazette*, "State 8th in renewable energy," June 6, 1990.

79 Department of Energy, *United States Energy Policy 1980-1988*, October 1988, p. 110.

such as communications relays, weather stations, remote village power, irrigation pumps, and navigation aids.

In the area of solar-thermal, the LUZ Corporation in southern California has been able to deliver power to the electricity grid at approximately 9 cents per kilowatt hour (combined cycle solar-thermal/natural gas).⁸⁰ Since 1975 solar-thermal technology has proven to be technically and economically feasible in many applications.

The principle scientific challenge related to solar energy is how to capture and convert the sun's incident radiation into usable energy at total costs that are competitive with those of conventional fuels. Research related to this challenge involves chemistry, chemical engineering, solid-state physics, materials science, and engineering. The fundamental properties and mechanisms of photo-matter interaction, including photosynthesis, need to be better defined to guide the design of technologies for solar energy capture, conversion, and storage.

Recommendation 1. The State, in association with the federal government and private sector, should devote additional economic resources to further the state's solar and renewable research, demonstration, education, and technology transfer functions.

Today, some 40 utilities in all parts of the country have more than 70 experimental photovoltaic projects, testing both central station and distributed applications.⁸¹ To advance the technology will require high-efficiency materials, low-cost thin films, and advanced concentrators. The United States is currently the world leader in photovoltaic power system technology, but the Japanese and West Germans have begun to make large investments in domestic corporations with experience in solar energy.

The use and efficiency of passive and active solar energy in buildings have increased dramatically in the last decade. There are over 800,000 solar water heaters (183,000 estimated in Arizona by Public Citizen) and 100,000 actively solar-heated and 200,000 passive solar residences in the United States. Passive systems can now provide an average of 39 percent of heating requirements.⁸² Solar water heaters have become a mature technology and can save from 40 to 70 percent of annual water-heating expenses. With additional improvements in technology and with proper design of new construction, buildings can receive up to 80 percent of their heating requirements and 60 percent of their cooling requirements from solar technologies.⁸³

Recommendation 2. The Legislature should establish a consumption-based fee through energy utilities to be used for solar and renewable energy projects.

In order to fund much of the solar and renewable energy recommendations in this document, it necessary to identify a source of funding. By placing a small consumption fee on all energy utilities, the ultimate beneficiaries of solar and renewable energy

⁸⁰ Dr. Frank Mancini, Senior Energy Engineer with the Arizona Energy Office, interview with Michael Walters, June 5, 1990.

⁸¹ Department of Energy, *United States Energy Policy 1980-1988*, October 1988, p. 111.

⁸² *Ibid.*, p. 111.

⁸³ *Ibid.*, p. 112.

technology will fund its development. While the exact form of this fee is not specifically recommended, the committee discussed at length a fee per kilowatt-hour (at some multiple of one-tenth of a cent), or a fee on all energy sources.

Recommendation 3. By 1993, the State should create financial incentives such as sales tax reductions and tax credits to expand the domestic industry and market for solar and renewable energy usage.

Currently, many solar-powered products are available at transaction costs higher than similar products that are powered by fossil fuels imported from other regions which cause pollution of the environment. Because of the economic and environmental benefits associated with reducing the export of energy dollars for the purchase of fossil fuels, the State should consider providing financial incentives to invest in and consume solar and renewable energy resources.

Approximately 183,000 solar water heaters are now operating in Arizona, according to Public Citizen, a Washington, D.C.-based consumer advocacy group. Because of their environmental and economic benefits, the State should investigate what types of financial incentives would encourage installation of locally manufactured solar technologies that have low environmental impacts, create Arizona jobs, and slow the export of energy dollars.

Recommendation 4. The State, in cooperation with the State's universities and the private sector, should invest in the development and implementation of end-use applications that are powered with solar and/or renewable energy, new solar-powered communities, and central station solar power plants.

Because of the enormous solar energy resources of the southern deserts of Arizona, the State should take an active role in cultivating this resource. The environmental and economic benefits of effectively utilizing this indigenous resource will pay benefits to all living and future Arizonans. The current federal investment in solar technologies for 1990 fiscal year is \$92.4 million,⁸⁴ compared to a \$459 million request for investment in clean coal technologies in fiscal 1991.⁸⁵ The State, in association with the federal government and the private sector, will be investing in a "bright" future for all by devoting additional resources to pursuing the development of solar resources in Arizona.

Current solar building technologies contribute, in some cases, up to half of the total thermal energy needs of a building and a significant fraction of the lighting needs. By using advanced solar technologies and improved design techniques, residential and commercial buildings can cost-effectively derive up to 80 percent of their heating requirements and up to 60 percent of their cooling requirements from solar resources, but some implementation barriers remain.⁸⁶

By taking an active role in the development and funding of renewable energy generation and end-use technologies, the State could significantly speed the utility and consumer market penetration of these "new" renewable technologies, while improving local economic

⁸⁴ Business Publishers Incorporated, *International Solar Energy Intelligence Report*, June 15, 1990, p. 112.

⁸⁵ Joann Luczak, United States Department of Energy, interview with Michael Walters, June 21, 1990.

⁸⁶ Nancy Rader, "Power Surge," *Public Citizen*, 1989, II-41.

conditions by decreasing reliance on energy imports from other regions. By increasing the total penetration and speed of the construction of renewable generation facilities and end-use equipment, the goals of the energy policy can more quickly be realized.

Of particular interest to the state of Arizona ought to be the construction of appropriately scaled and reasonably priced projects related to the development and use of solar energy central station technologies. Phoenix and Tucson both experience 85 percent average possible sunshine.⁸⁷ Yet, not a single solar energy facility for the generation of commercial power is sited within Arizona. On the other hand, private and public organizations in California are actively pursuing the development of central station solar facilities. There are currently three "peaking" solar thermal units in the desert east of Los Angeles in operation, and another 300 megawatt system for Southern California Edison (which already uses power from existing solar thermal systems), is under construction and is expected to produce electricity for \$0.08/Kwh.⁸⁸

87 Valley National Bank, *Arizona Statistical Review*, 1988, p. 71.

88 Arizona Corporation Commission, *Staff Report Resource Planning Docket No. 0000-90-088*, September 1990, p. 63.

10 Research, Development and Demonstration

Recommendation 1. The State, utilities, and individuals should make a methodical transition from non-renewable to renewable energy systems. The State and energy providers should assist, where appropriate, in the research, development, demonstration, and funding of energy efficiency and renewable energy technologies.

Of particular interest to the state of Arizona ought to be the immediate funding of research and demonstration projects related to the development and use of solar and renewable energy technologies in new construction. With the measureless resources of solar radiation available in the southern deserts, Arizona is often considered the Saudi Arabia of solar energy. Phoenix and Tucson both experience 85 percent average possible sunshine.⁸⁹ Yet, not a single solar energy facility for the generation of commercial power is sited within the state of Arizona. On the other hand, private and public organizations in California are actively pursuing the design and construction of central station solar facilities.

Since so much air conditioning is used here, Arizona might lead the nation and world in developing a more appropriate air conditioning technology. "Efficiency alone," calculates Christopher Flavin of World-Watch Institute, "could cut global CO₂ emissions 3 billion tons yearly by 2010, from today's 5.6 billion."

"Nations might start with that symbol of energy profligacy, air conditioners. They use hydrochlorofluorocarbons (HCFCs) as the cooling fluid, and indirectly release CO₂ when electricity to run them is generated. HCFCs and CO₂ are greenhouse gases. But plug-in cooling needn't turn up the global thermostat. A model patented last year by Albers Technology Corporation of Arizona cools air to 54 degrees Fahrenheit, dehumidifies it and removes contaminants. It uses water, not HCFCs and draws half the electricity of conventional units. At \$2000 for a unit large enough to cool a 1500 square foot home, it cost about the same as current models. No American makers have expressed an interest—they don't care to fiddle with their products unless the government bans HCFCs. But, in June of 1990 a Saudi Arabian firm, Alessa Industries, agreed to manufacture 25,000 units annually beginning in 1992—and export 20,000 back to the United States."⁹⁰

A federal "model" currently exists for the development of an Arizona specific solar energy research program. The federally funded Solar Energy Research Institute (SERI) based in Golden, Colorado is currently conducting significant basic research into solar energy issues. The state of Arizona, with its huge solar resource, should closely examine the current opportunity for the development, demonstration, and funding of an Arizona solar energy building technologies research facility.

89 Valley National Bank, *Arizona Statistical Review*. 1988, p. 71.

90 Begley and Pedersen, "Fighting the Greenhouse," *Newsweek*, June 18, 1990, p. 51.

The state of Arizona has made significant contributions to several local and national research efforts since statehood. The state's three universities explore numerous topics of research including civil engineering, construction technology, mechanical engineering, and urban planning. Additionally, within Arizona, several major private sector research organizations conduct both basic and applied research into a broad range of transportation-related topics. These public academic and private research resources should be fully utilized by the state of Arizona to help overcome many of the problems faced by the State in effectively and efficiently providing transportation services for its citizens.

Recommendation 2. The State should assist in the research effort to develop low-emissions vehicles, improved road surface technology, improved efficiency vehicles, and alternate fuels vehicles through the funding of research projects at the state's universities and private sector research organizations.

Because the urban spatial structure (adopted by government units) currently requires such a massive reliance on the personal automobile for transportation purposes, the State has an obligation to assure that the road system and vehicles are of sufficient quality to promote energy efficiency. Additionally, because of this reliance on the automobile for movement within urban areas, and the huge investment in transportation infrastructure (directed by government units) that has been made with public funds, the State has an additional obligation to assure the availability of multiple fuel types for energy efficiency. The State should respond to these self-created obligations by furthering the research effort to improve the existing transportation technology.

General Motors and Toyota, as well as other automobile manufacturers, maintain testing grounds in Arizona. This private sector investment in research facilities should be further encouraged. The economic and environmental benefits that can be derived from improved personal transportation technology should not be overlooked. Investments in research and the advanced training of scientists and engineers are a precondition for reaping the practical benefits of science and technology. Yet, as of 1987, the growth of RD&D (not energy-specific) spending among Japanese companies was more than three times that for U.S. companies.⁹¹

Cooperative research, development, and demonstration efforts between business and government are needed to reduce the risks to investors associated with the first or early commercial-scale renewable fuel generation units and any new transmission technologies. By increasing the total penetration and speed of the conservation and efficiency technology transfer process, the goals of the energy policy can more quickly be realized.

Recommendation 3. The State should assist in the research effort to develop new energy production and transmission technologies through the funding of research projects at the state's universities and private sector research organizations.

Of particular interest to the state of Arizona ought to be the immediate funding of research and demonstration projects related to the development and use of end-use and central station solar energy technologies. Not a single commercial scale solar energy facility for the generation of commercial power is sited within Arizona. On the other hand, private

⁹¹ John Markoff, "A Corporate Lag in Research Funds Causing Worry," *The New York Times*, January 23, 1960.

and public organizations in California are actively pursuing the development of central station solar facilities in the Mohave Desert east of Los Angeles. Fortunately, some decentralized applications are occurring locally, including John F. Long Homes and the Tucson Solar Village.

The need for more research, development, and demonstration — whether to provide the basis for protecting or improving the environment, improving energy conservation or efficiency, or in helping to meet the energy supply needs of the United States reflects a broad consensus among Arizonans that fundamental research in science and engineering is beneficial to our society. Investments in research and the advanced training of scientists and engineers are a precondition for reaping the practical benefits of science and technology.

Recommendation 4. The State should assist in the research effort to develop new efficiency technologies through the utilization of existing university resources and funding of new research projects at the state's universities and private sector research organizations.

By taking an active role in the research, development, and funding of commercial, manufacturing, and agricultural energy efficiency demonstration projects, the State could significantly speed the market penetration and business community acceptance of these "new" efficiency technologies. By increasing the total penetration and speed of the conservation and efficiency technology transfer process, the goals of the energy policy can more quickly be realized.

Recommendation 5. The State should work with the federal Department of Energy to study the implications of clean coal technologies as they might apply to the coal resources of Arizona.

More than half of the nation's electric power (about 55 percent) is currently generated from the combustion of coal.⁹² Coal burning is accompanied by a number of atmospheric emissions. The electric utility industry is the source of nearly two-thirds of the nation's sulfur dioxide (SO₂) emissions and the second largest source of nitrogen oxide (NO_x) emissions; utility use of coal accounts for much of these totals.⁹³ One area not currently covered by environmental regulations is the emission of methane from coal mining. Methane is considered a potent greenhouse gas.⁹⁴

Coal is the source of 57.7 percent of the electricity generated in Arizona.⁹⁵ By the year 2000, 44 percent of the nation's coal-fired capacity will be at least 30 years old.⁹⁶ The state of Arizona contains significant coal reserves that could be more fully utilized in providing primary energy to existing coal-fired generators throughout the United States. However, these low sulfur coal reserves should be developed only when adequate clean coal technologies are available to prevent or mitigate damage from their use. Until that time,

92 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 69.

93 *Ibid.*, p. 69.

94 U.S. Department of Energy, *Interim Report—National Energy Strategy*, April 1990, p. 71.

95 Arizona Energy Office, *Energy Data Quarterly Report*, December 1989, p. 18.

96 Energy Information Administration, Form 860.

other demand reduction strategies should be fully implemented and all economical "clean" sources of energy fully utilized.

Appendix A - House Concurrent Resolution 2013



House Concurrent Resolution 2013

A Concurrent Resolution Prescribing the Energy Policy of the Arizona State Legislature

Whereas, the present national energy crisis will continue for the foreseeable future; and

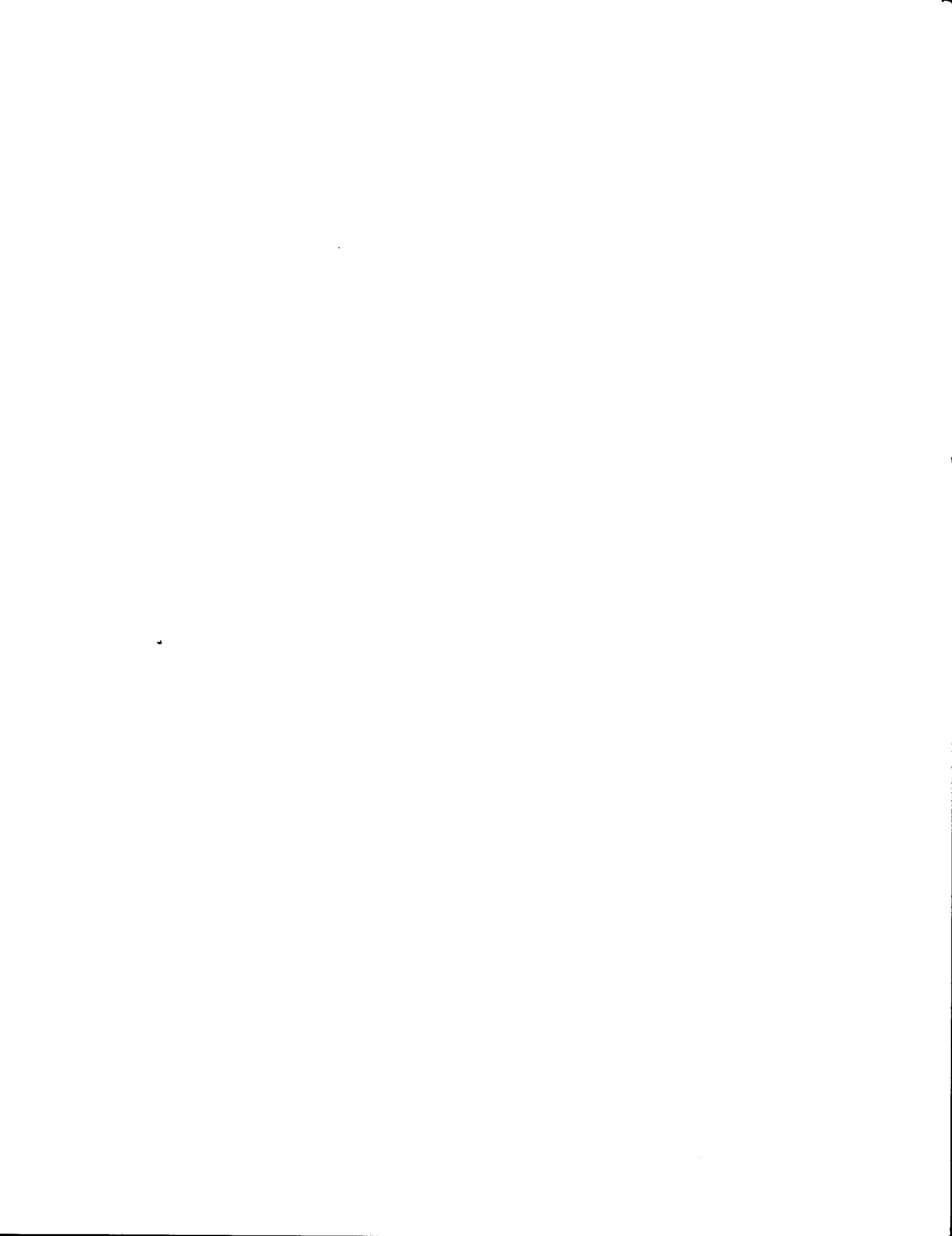
Whereas, the effects of this crisis on the people of the State of Arizona can be alleviated through a balanced state energy policy.

Therefore, be it resolved by the House of Representatives of the State of Arizona, the Senate concurring:

That the energy policy of the Arizona State Legislature shall be to:

1. Assist in obtaining and maintaining an adequate and continuous supply of safe, dependable and economical energy for the people of the state and to accelerate development and use within the state of renewable energy sources in order to promote the state's economic growth, create employment within the state, protect environmental values, husband the state's resources for future generations and promote the health and welfare of the people of the State of Arizona.
2. Encourage conservation of energy in the construction and operation of buildings and in the rehabilitation of existing structures through heating, cooling, ventilation, lighting, insulation and design techniques and the use of energy audits and life-cycle costing analysis.
3. Encourage transportation modes and equipment which conserve the use of energy.
4. Encourage the prudent development and wise use of limited energy resources.
5. Encourage a new ethic among its citizens to conserve rather than waste precious fuels, and to foster public and private initiative to achieve these ends at state and local levels.
6. Encourage state participation for the furtherance of the research and development of alternative energy sources throughout the State of Arizona.

Passed the House March 24, 1977 by the following vote: 45 ayes, 6 nays, 9 not voting. Passed the Senate May 16, 1977 by the following vote: 29 ayes, 0 nays, 1 not voting. House concurs in Senate Amendments and Final Passage May 18, 1977 by the following vote: 43 ayes, 7 nays, 10 not voting.



Appendix B - House Bill 2249

Energy Policy and Planning - Joint Legislative Task Force and the Advisory Committee

Chapter 133 House Bill 2249

AN ACT

ESTABLISHING THE JOINT LEGISLATIVE TASK FORCE AND THE ADVISORY COMMITTEE ON ENERGY POLICY AND PLANNING; PRESCRIBING PURPOSE OF TASK FORCE; PRESCRIBING MEMBERSHIP, PLANNING, POWERS AND DUTIES OF THE JOINT LEGISLATIVE TASK FORCE AND THE ADVISORY COMMITTEE ON ENERGY POLICY AND PLANNING, AND PROVIDING FOR A DELAYED REPEAL.

Be it enacted by the Legislature of the State of Arizona:

Section 1. Energy policy

The energy policy of this state was established pursuant to house concurrent resolution 2013, passed by the thirty-third legislature, first regular session.

Section 2. Joint legislative task force and advisory committee on energy policy and planning

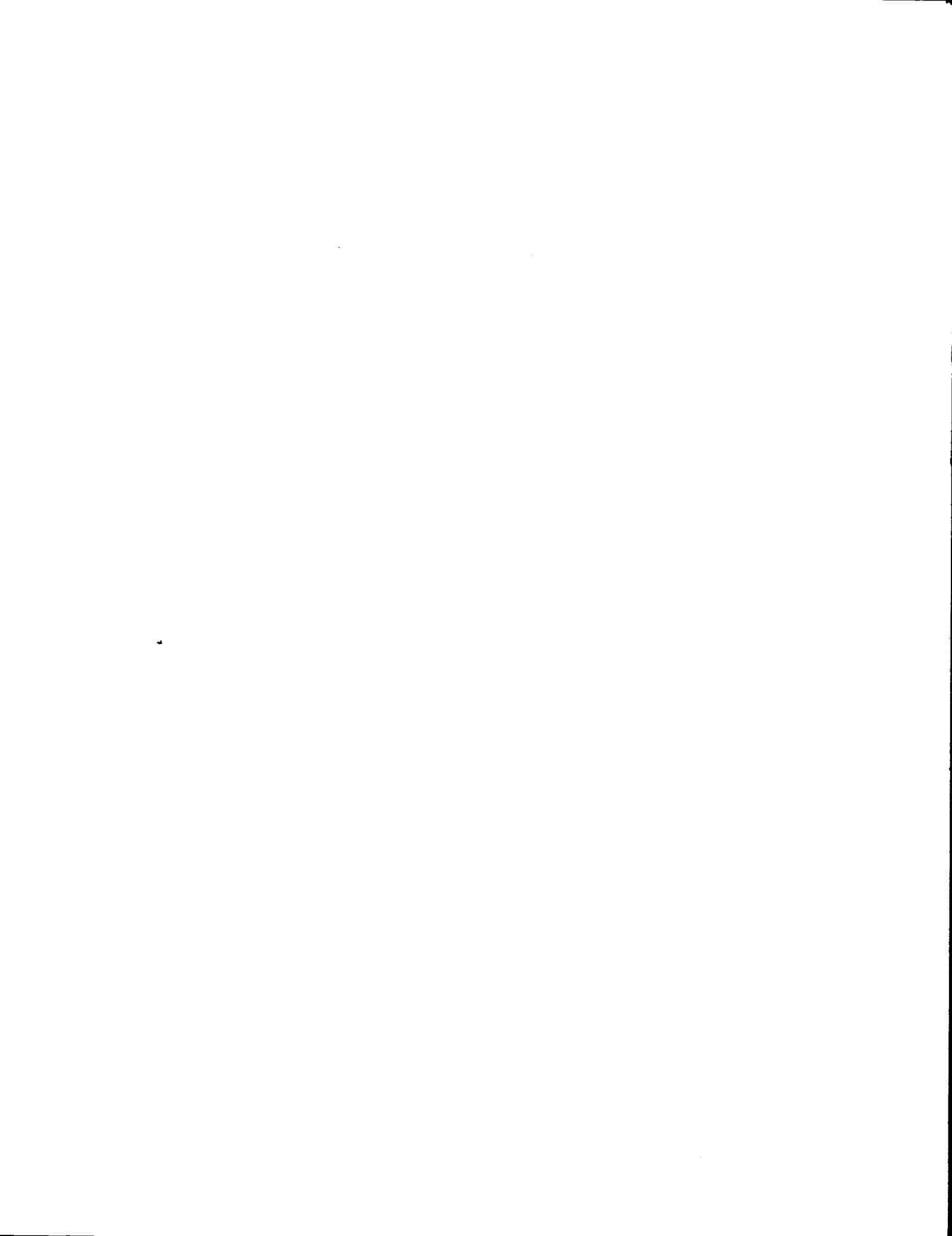
- A. The joint legislative task force and advisory committee on energy policy and planning are established beginning on the effective date of this act and continuing through December 31, 1990.
- B. The purpose of the task force is to study the best use of energy resources, to recommend revision of the goals of the energy policy, as adopted in house concurrent resolution 2013, passed by the thirty-third legislature, first regular session, to develop a strategic plan to achieve the goals of the recommended energy policy, and to submit the plan and recommended goals to the full legislature.
- C. The task force and advisory committee may make studies, conduct inquiries, examine laws and regulations that impact the development and use of energy resources in Arizona and recommend any statutory changes.
- D. The task force shall be composed of seven members consisting of:
 1. Three members appointed by the speaker of the house of representatives, two of who shall be members of the majority party in the house of representatives including the chairman of the house committee on natural resources and energy or its successor, and one who shall be a member of the minority party of the house of representatives.
 2. Three members appointed by the president of the senate, two of whom shall be members of the majority party in the senate including the chairmen of the senate committee on natural resources and agriculture or its successor, and one whom shall be a member of the minority party in the senate.

3. A representative of the office of the governor.
- E. The advisory committee shall be composed of nineteen members consisting of:
1. The director of the residential utility consumer office or his designee.
 2. An advocate for low-income energy users appointed by the speaker of the house of representatives.
 3. A member of the corporation commission appointed by the corporation commission.
 4. The director of the department of commerce or his designee.
 5. The director of the oil and gas conservation commission or his designee.
 6. A consumer residing in a county with a population of less than four hundred thousand persons according to the most recent decennial census, appointed by the speaker of the house of representatives.
 7. A member of the faculty at the University of Arizona appointed by the president of the university.
 8. A member of the faculty at Arizona State University appointed by the president of the university.
 9. A member of the faculty at Northern Arizona University appointed by the president of the university.
 10. One member from the private industry involved in the application of renewable energy to commercial, industrial or residential use in this state appointed by the speaker of the house of representatives.
 11. One member from the private industry involved in the application of renewable energy to commercial, industrial or residential use in this state appointed by the president of the senate.
 12. A representative from a municipal or public power entity providing electrical energy in Arizona appointed by the speaker of the house of representatives.
 13. A representative from a public service corporation certified to provide electrical energy in Arizona appointed by the speaker of the house of representatives.
 14. A representative from a public service corporation certified to provide natural gas service in Arizona appointed by the president of the senate.
 15. A representative from a commercial user appointed by the president of the senate.
 16. A representative from a commercial user appointed by the speaker of the house of representatives.
 17. A representative from the petroleum industry appointed by the president of the senate.
 18. A person who resides on an Indian reservation appointed by the president of the senate.
 19. A representative from the agricultural producers appointed by the president of the senate.

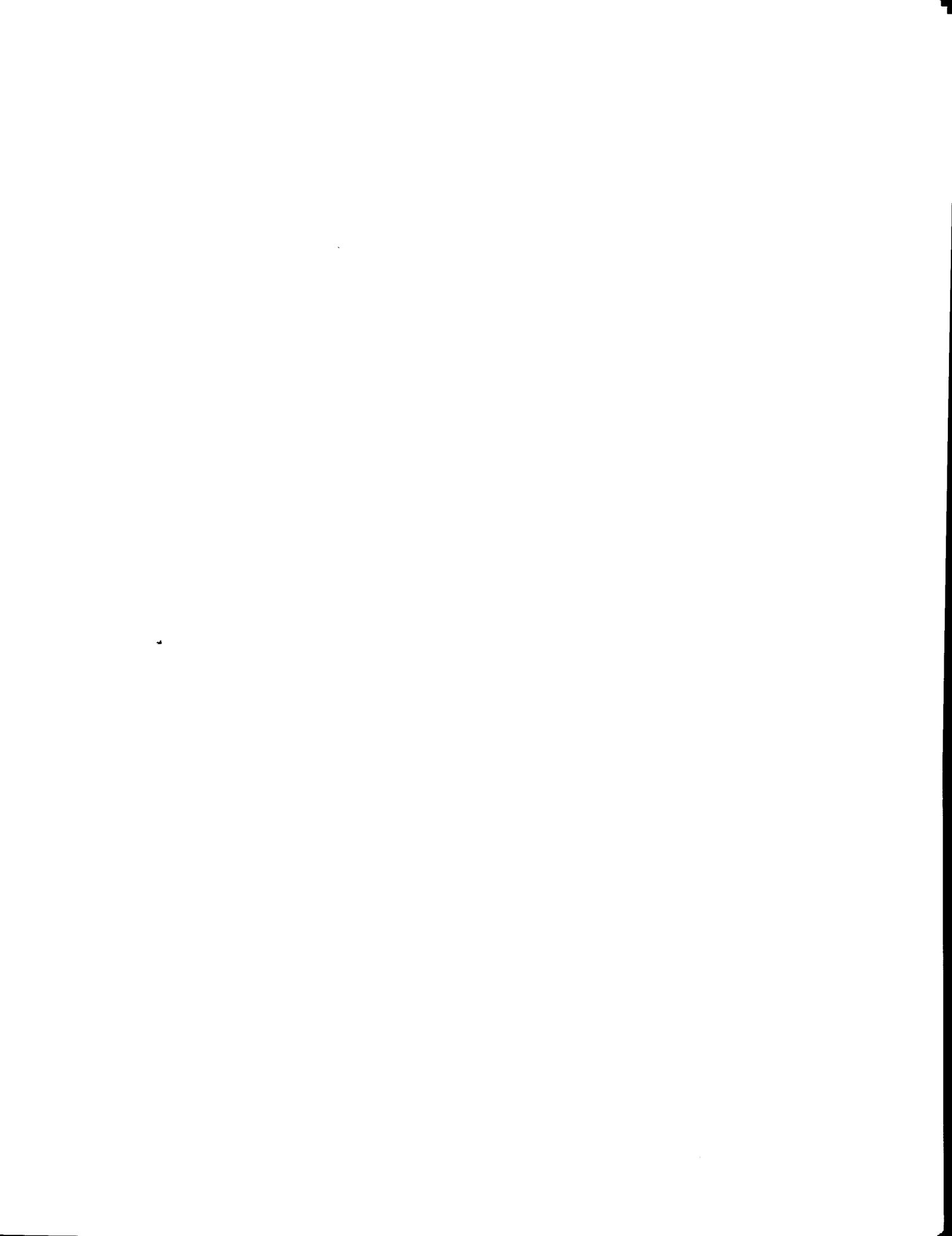
- F. The advisory committee will select a chairman and a vice-chairman from its membership.
- G. The chairman of the joint task force shall alternate annually between the two standing committee chairmen beginning with the chairman of the house committee on natural resources and energy.

Section 3. Delayed repeal

Section 2 of this act is repealed from and after December 31, 1990.



Appendix C - Energy Services Coordination



Report
to the
Arizona State Legislature



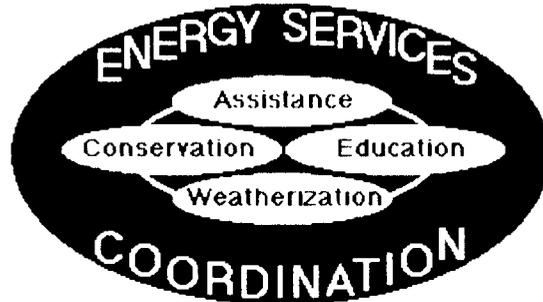
January 15, 1990

Submitted by
Arizona Department of Commerce
Arizona Department of Economic Security

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REPORT TO THE ARIZONA STATE LEGISLATURE EXECUTIVE SUMMARY



Submitted by
Arizona Department of Commerce
Arizona Department of Economic Security

The Arizona State Legislature directed the Department of Commerce (Commerce) and the Department of Economic Security (DES) to review energy assistance programs and report on findings and recommendations (Senate Bill 1099). To comply with this directive the departments:

- o Conducted an analysis of existing energy assistance programs for low-income households in Arizona and comparable programs in other states.
- o Formed a Work Group comprised of representatives from utilities, provider agencies and low-income advocacy groups.
- o Developed specific recommendations.

These efforts resulted in a clearer understanding of the problems associated with the lack of affordable energy and four major recommendations.

Problem: There is an energy crisis for low-income households in Arizona. Single parent with children and elderly households are especially vulnerable to this crisis. Low income households often go without food or medicine in order to pay their utility bills; and a disproportionate amount of their income is used to pay the increasing costs of utilities. In addition, these groups often live in homes that are in disrepair and poorly insulated, contributing to the high energy costs.

High energy costs contribute to the increasing number of homeless as families find themselves unable to pay the rising costs of housing and utilities. It is estimated that in Arizona, there are approximately 10,000 homeless individuals on any given night. The 1989 Report on Homeless Children and Youth in Arizona predicts a 20% increase in the number of homeless families within the next year.

While energy assistance programs exist for low-income households, problems persist which affect the coordination and delivery of services provided through these programs. Some of these problems are due to variances in age and income eligibility criteria, service delivery systems, and lack of administrative resources. Also, there are insufficient funds to serve those requiring assistance. For example, the Low-Income Home Energy Assistance Program (LIHEAP), the largest energy assistance program in Arizona, provides federal funds to serve only 12% (31,000) of the 248,000 eligible households.

Recommendations: The Work Group reviewed the identified problem areas with the goal of assuring coordination of energy services. There was consensus that providing assistance with utility bills or weatherization should be coordinated with educating individuals on conservation efforts. The recommendations are:

- o Develop and implement a coordinated statewide energy assistance program for Arizona low-income households;
- o Appoint a Governor's Council to monitor the energy service delivery system;
- o Address affordable energy costs through coordinated efforts;
- o Identify sufficient funds to be made available to ensure that no low-income households in Arizona will go without utilities services.

The initial cost of addressing these recommendations is estimated at \$60,000. This funding would support the staff for the Council. The Council and staff would then assume the lead responsibility for follow-up on the report's recommendations.

Report to the State Legislature

STATEMENT OF PROBLEM

The number of families living in our state and country living at or below the poverty level (\$12,100 annual income for family of four) is escalating. In Arizona an estimated 477,300 individuals live in poverty. An estimated 14.2% or 67,865 of these individuals are elderly persons with fixed incomes. These numbers do not include the many households where two working parents whose income from minimum wage jobs places them slightly above the poverty guidelines. These families are making every effort to make ends meet, often foregoing other essential needs in order to avoid being displaced or becoming homeless. The problem of homeless people has received high visibility in Arizona and throughout the United States. The high cost of household energy is one of the factors contributing to this problem.

Low-income households in Arizona bear an incredible burden with respect to energy costs. Basic needs such as food and medical care are often ignored or reduced drastically in order to maintain minimum levels of energy usage. The average annual energy costs for a low-income household in Arizona is \$940 a year, representing 15.7% of its income, a higher percentage than all but fifteen states in the United States (NCLC Report). Arizona's average Low-Income Home Energy Assistance Program (LIHEAP) benefit is \$126, leaving a difference of \$814 between the average energy costs and assistance that may be available.

The level of federal funding available in Arizona is limited and has decreased for LIHEAP over the last 4 years by 36%. Arizona ranks close to the bottom of all states in its LIHEAP participation rate with only an estimated 12.5% or 31,000 of the 248,000 eligible households receiving benefits. The limited participation is directly related to lack of funds. This energy burden for low-income households is likely to increase in future years as major fuel prices increase.

In response to the energy crisis for low-income households in Arizona, various efforts (described in more detail in Attachment A) in addition to LIHEAP have been or are about to be launched:

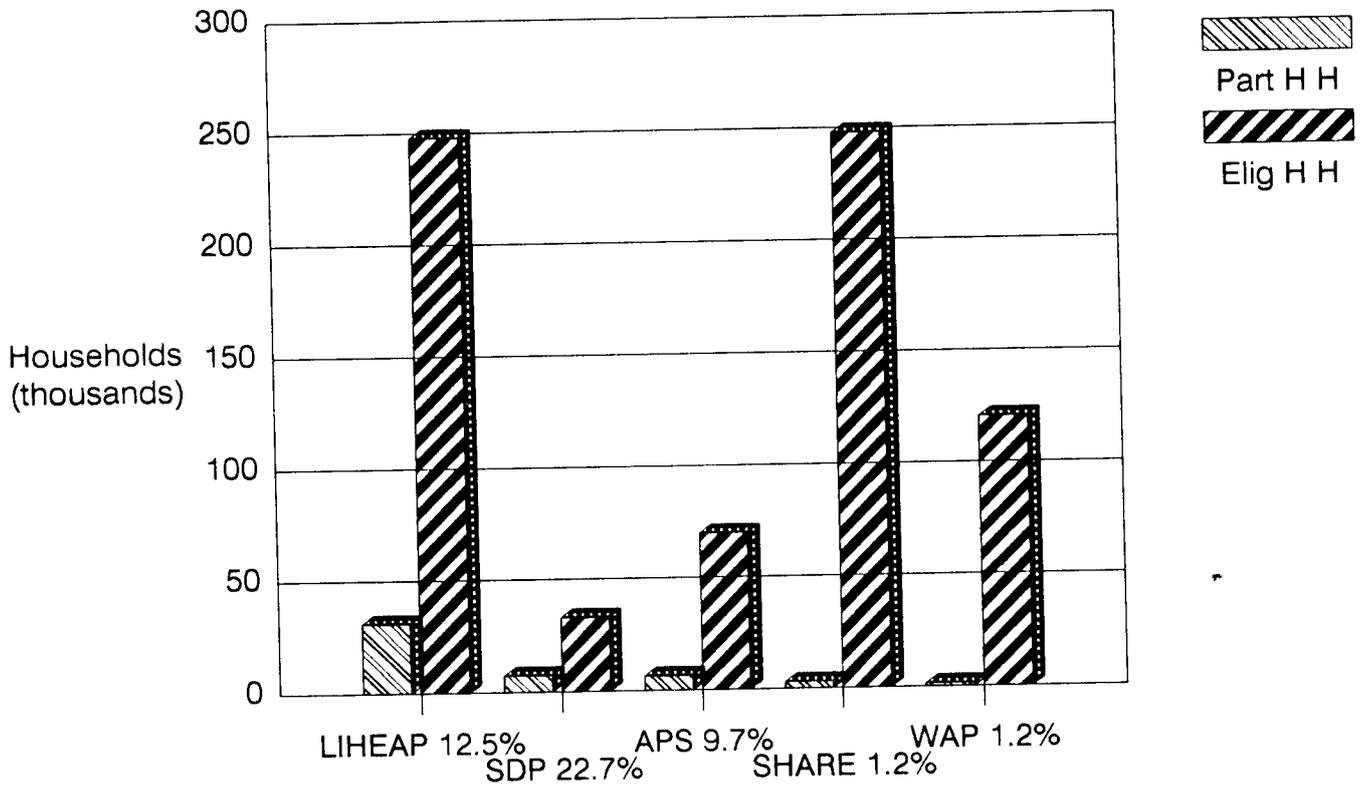
- o Senior Electric/Gas Discount Program (SDP)
- o Arizona Public Service Company's Energy Support Program (APS)
- o Tucson Electric Power Program
- o Service to Help Arizonans with Relief on Energy (SHARE)
- o Utility Repair and Deposit Assistance Program
- o Weatherization Assistance Program (WAP)

While the existence of these efforts is hopeful, serious problems exist in the coordination and delivery of these services which need to be addressed. These include:

- o No clear Arizona state energy policy and direction regarding low income energy issues
- o Lack of coordination in program design and development
- o Lack of communication about program operation between administrative agencies' staff and local service delivery staff
- o No coordinated standards in benefit/eligibility criteria
- o Fragmented systems which are confusing to clients and the general public
- o Increased demand for services
- o Decreased program funding
- o End of the Senior Electric Natural Gas Discount program on June 30, 1990
- o Limited administrative resources
- o Low participation rate in available programs due to lack of outreach
- o Confused public understanding of programs
- o Poor public image of utilities

A complete discussion of problem areas appears in the National Consumer Law Center's Evaluation Report (NCLC), available from the Departments of Commerce and Economic Security; a summary is included as Attachment B.

PARTICIPANTS IN ARIZONA LOW-INCOME ENERGY ASSISTANCE PROGRAMS 1989



NOTES:

- Specific program eligibility guidelines are included on Attachment A which also provides more details on each program.
- There are no eligibility figures for the S.H.A.R.E. Program. It is estimated that the number of eligible households would be approximately the same as for LIHEAP.
- The number of potentially eligible households for weatherization are also unknown, however, the State Data Center reports that 12.6% (120,562) of the total households in Arizona are low-income households eligible for weatherization services.

RECOMMENDATIONS

The objective of the interim study of energy assistance programs was to identify ways to improve the coordination and delivery of energy services. It is clear from the analysis that there is a need to relieve the energy burden borne by low-income households. Commerce and DES with input from the Work Group submit the following recommendations:

Recommendation #1. Establish a state policy on energy services for low-income households and a coordinated statewide program with uniform standards, procedures and benefits which includes:

- o Common eligibility requirements
- o Uniform application procedures
- o Common computer data base, programs and systems
- o One-stop shopping for assistance, education, weatherization and conservation services.

Recommendation #2. Establish a Governor's Council on Affordable Energy Services Coordination for low-income households with membership from utilities, relevant state agencies, program providers, advocacy groups and clients. The Council, with staff provided, would be responsible for identifying low-income energy issues, monitoring the existing service delivery system, and advocating affordable energy for low-income households. In addition, this Council, accountable to the Governor, would:

- o Assure existing programs were coordinated
- o Identify barriers to achieving the goals of coordination of services
- o Make recommendations through the Governor's Office for improvements in the delivery system.

Recommendation #3. Establish partnerships among utilities and providers which result in:

- o Advance planning and improved communications
- o Utility involvement in program financing
- o Increased fuel fund participation
- o Joint education and training events for consumers, providers and utilities

Recommendation #4. Identify sufficient funds from appropriate sources to ensure:

- o Basic utility service for all low-income households in Arizona
- o Affordable rate structures for low-income people
- o Protection from shut-offs year round due to extreme temperatures
- o Emergency assistance is available
- o Development of more energy efficient affordable housing

ACTION PLAN

ACTION ITEMS:	RESPONSIBLE	DUE DATE
1. Establish Governor's Council on Affordable Energy Services Coordination comprised of appropriate people with the authority to make recommendations through the Governor's Office.	Governor	07/01/90
2. Develop Statewide Policy on Energy Assistance For Low-Income Households	Governor's Council	10/01/90
3. Review existing and pending energy policies and advocate for inclusion of low-income households needs.	Governor's Council	ongoing
4. Establish long term goals and planning process including resources and budget needed.	Governor's Council	12/31/90
5. Develop and implement coordination standards to the extent possible given federal guidelines.	State Agencies Corporate Comm.	2/31/90
6. Obtain budget appropriation as needed to implement goals and standards.	DES/Commerce Legislature	01/31/91
7. Draft legislation to mandate coordination of energy services programs consistent with policy.	Governor's Council/ Legislature	01/22/91
8. Draft legislation to 1) require low-income housing landlords to weatherize, and 2) all new developments to meet increased conservation/weatherization standards.	Governor's Council/ Legislature	01/22/91
9. Determine ways to maximize existing funds (ex. oil overcharge funds to match Title IV-A Emergency Assistance; increase participation in S.H.A.R.E.)	Governor's Council/ Commerce/DES Utilities	07/01/91
10. Review and revise rate structures to establish discounted rate for low-income households.	Utilities/ AZ Corporation Commission	07/31/91
11. Determine and secure alternative funding sources, including utility contributions and private funds.	Commerce/DES Utilities/Legislature	07/31/91
12. Develop and implement education programs for Arizona Corporation Commission, Arizona State Legislature, consumers, utilities regarding energy assistance and conservation programs.	Governor's Council/Commerce /DES	ongoing

COST: The initial cost of the recommendations for the first year are estimated at \$60,000.00. This would provide staff for Council to address the recommendations.

BACKGROUND INFORMATION

During the first regular session of the thirty-ninth Legislature's Senate Bill 1099 was introduced and passed which established an interim study of energy assistance programs. Section 2 of the legislation, reads as follows:

"Interim study on energy assistance Before January 15, 1990, the Department of Commerce and the Department of Economic Security shall report the President of the Senate, the Speaker of the House of Representatives and the Governor the outcome of their review of federal and state energy assistance programs available to residents of this state and develop recommendations on ways to improve the coordination and delivery of energy assistance programs."

ENERGY SERVICES COORDINATION

In reviewing the area of energy services coordination, it is imperative to consider the total range of services to be coordinated. As the logo indicates a key element in the overall effectiveness of low-income energy services is to maximize the limited resources by creating systems which link the various assistance, conservation, weatherization, and education programs.

The details of such systems will have to be carefully developed, building upon individual program strengths. Some specific possibilities for consideration include:

- o As individuals receive a Low-Income Home Energy Assistance utility bill subsidy a referral is made to the Low-Income Weatherization Assistance Program which installs those energy conservation measures for which the dwelling is eligible and where appropriate does necessary retrofit. A limitation of funds available preclude this from occurring on an on-going basis.
- o As individuals apply for any of the low-income energy assistance services, regardless of the point of entry into the system, they are made fully aware of all other available services, the parameters of the services/programs and eligibility criteria.
- o Each recipient of low-income energy assistance services would be required to participate in counseling/education sessions to learn those positive energy conservation actions that are no cost, simple life style changes to reduce energy usage in the home without creating undue hardship.

The results of creating and implementing systems which provide low-income energy assistance services coordination will be to reduce the burden borne by low-income households while moving them to a mode of self-sufficiency where assistance may no longer be necessary.

IMPLEMENTATION PROCESS

National Consumer Law Center (NCLC) - The center conducted an analysis of energy assistance programs for low-income households in Arizona and in other states. The NCLC report provided detailed recommendations on how Arizona energy assistance programs could be better coordinated and modified to enhance service delivery. The report also discussed the merit of programs in other states and the feasibility of adapting them for Arizona's use.

Attachment B provides a summary of the report findings. The full report is available from Commerce or DES.

Work Group Composition and Activities - Commerce and DES determined it would be advantageous to appoint a Work Group to assist in the development of recommendations. The Work Group consisted of representatives from utilities, program providers and advocacy groups. (See Attachment C.)

The goal of the Work Group was to review existing energy programs, their target population served, eligibility criteria, service delivery methods and to develop recommendations for inclusion in the interim report to the legislature. Five meetings were held during which the group:

- o reviewed information from the NCLC analysis;
- o identified additional areas for review;
- o considered each major area using an extensive problem analysis model.

The major areas reviewed included:

- o Coordination of Programs, Standards, Procedures
- o Advisory Group to Address Low-Income Energy Issues
- o Program Funding
- o Existing Program Design Changes
- o Utility Involvement/Partnership Development
- o Research and Documentation

The results of this review and analysis provided a clearer identification of the problems associated with affordable energy. Specific recommended action plans were developed and are incorporated in this report.

ARIZONA LOW-INCOME ENERGY PROGRAMS

<u>Program</u>	<u>Target Population</u>	<u>Administering Agency</u>	<u>Benefit Criteria</u>	<u>Comments</u>
Low Income Home Energy Assistance Program (LIHEAP)	Elderly (60 years or over) or handicapped at 150% of poverty and below; other households at 125% of poverty and below. (30 day income eligibility)	Community Services Administration, Department of Economic Security; local administering agencies, mostly CAPs.	0-80 of poverty minimum of \$40-50 payment, depending on whether in Region I or Region II; maximum benefit of \$300-\$350, depending on region. Precise benefit depends on application of criteria developed by local agency and approved by state; supplemental, explicitly crisis payment of up to \$100 also available for emergencies. (\$450 absolute maximum payment)	FY 1989 Federal funding of \$5.23 million; supplemented by oil overcharge and carryover funds to \$6.23 million. Heavy crisis orientation, in addition to explicit crisis component. Partial exception is the elderly, who may not have to show urgent, crisis need in order to be served.
Senior Electric/Gas Discount Program	Elderly (65 years or over) and at or below 100% of poverty, who are heads of household and customers of participating electric or natural gas utilities. (30 day income eligibility)	Community Services Administration; Department of Economic Security; mail-in application (to CSA), so no local administering agencies, as such.	Steady 15% discount applied to gas and electric bills.	Funded from oil overcharge monies; due to sunset in June, 1990.

ARIZONA LOW-INCOME ENERGY PROGRAMS (Cont.)

Program	Target Population	Administering Agency	Benefit Criteria	Comments
Arizona Public Service Company's Energy Support Program (E-3)	APS customers who are at or below 150% of poverty.* (30 day income eligibility)	CSA, with local agencies distribution a mail-in self-declaration, form; form to be mailed by applicant to CSA for processing.	Varies, inversely with monthly usage - 0-400 kwh or less per month, 20% discount; 401-800 kwh, 10% discount 801-1200 kwh, 5% discount.**	Unique benefits, in that they <u>decline</u> with higher usage; are highest with limited usage. Actual benefit will vary each month, not only due to application of percentage but also due to shifts from usage category to usage category, as weather changes.
Tucson Electric Power Program	TEP customers who are at or below 150% of poverty.	Self-certification annually, TEP will administer.	Would vary inversely with monthly usage - 0-300 kwh or less per month, 20% discount. 301-600 kwh or greater, 15% discount. 601-1000 kwh, 10% discount.	Same
Service to Help Arizonans with Relief on Energy (SHARE)	Customers of APS, SRP, SWG and others; elderly and the handicapped, as others who are experiencing a hardship (no strict poverty guideline limits).	Salvation Army, in part operating through local delivery agencies.	Payments for heating, cooling or repair; maximum benefit of \$350; payments based on individual need.	Funding from APS & SRP at \$385,000 in 1988. Funds are a combination of customer donations matched by the utility companies.

*Recently changed from 100% of poverty.

**Effective January 1, these percentages will be changed to 30%, 20%, 10%, respectively.

ARIZONA LOW-INCOME ENERGY PROGRAMS (Cont.)

Program	Target Population	Administering Agency	Benefit Criteria	Comments
Utility Repair and Deposit Assistance Program	<p>Elderly (60 yrs. or over) or handicapped at 150% of poverty and below; other households at 125% of poverty and below.</p> <p>Applicant must also be in crisis situation, requiring deposit or repair assistance. (30 day income eligibility)</p>	<p>Community Services Administration, Department of Economic Security; local administering agencies, mostly CAPs.</p>	<p>To cover deposits and repairs to utility related appliances and systems, owned by recipient, with a maximum benefit of \$450.</p> <p>Showing of crisis relating to required deposit or repair assistance must be made.</p>	<p>Start-up on July 1, 1990. Funds, drawn from unclaimed utility deposits, estimated to fall between \$400,000-\$600,000, including those covering telephone and water/sewer use.</p>
Weatherization Assistance Program	<p>Same eligibility as LIHEAP; 150% of poverty and below priority given to high consumption households who are elderly or handicapped. (12 month income eligibility)</p>	<p>Department of Commerce, and local administering agencies.</p>	<p>Average expenditure per unit, \$1,000.</p>	<p>Allocation from U.S. Department of Energy of \$535,000 in FY 1989. Supplemented by \$650,000 in LIHEAP funds and \$1,083,000 in oil overcharge funds, for a budget of \$2,268,000.</p>

SUMMARY OF THE NATIONAL CONSUMER LAW CENTER EVALUATION

I. INTRODUCTION

The evaluation provides:

- o A description of the existing Arizona low income energy assistance programs.
- o The identification of possible problem areas in the various programs.
- o A discussion of steps which might be taken to address those problem areas.
- o A description of special approaches adopted in other states. (Pages 1-2 of the full NCLC evaluation report)

II. THE BACKDROP - ENERGY COSTS AND THE BURDEN BORNE BY LOW-INCOME ARIZONA

- o Arizona's average low-income home energy costs are at approximately \$940 a year. (Page 2)
- o Energy costs borne by low income Arizona households are likely to increase at a rate faster than the national average. (Page 2)
- o Sixty-six percent of LIHEAP participants have income below \$6,000/yr. (Page 3)
- o This group expends 15.7% of their income on home energy. (Page 3)
- o Thirty-nine percent cut in federal funds for LIHEAP since 1985. (Pages 4-5)
- o Oil overcharge funds while not totally depleted will be drastically reduced. (Page 6)
- o Arizona strengths include improvements that have been made to the program; active community participation in addressing concerns of low-income people; and the variety of programs available to assist low income individuals. (Page 7)

III. EXISTING ARIZONA PROGRAMS (Pages 10-12)

Discussion of each program is as follows:

- o Low Income Home Energy Assistance Program (LIHEAP) - (Pages 8-9, 13-14)
- o Senior Electric/Gas Discount Program - (Page 14)
- o Arizona Public Service Energy Support Program - (Page 15)
- o Project Share - (Page 16)
- o Tucson Electric Power Program - (Page 16)
- o Utility Repair and Deposit Assistance Program - (Pages 16-17)
- o Department of Commerce Weatherization Program - (Pages 17-18)

IV. PROBLEM AREAS

- o Communication - There is a lack of coordination in program designs. There needs to be better communication between administrative agency staff and local service delivery staff. (Pages 18-19)
- o Program Coordination - The energy assistance programs have varied eligibility criteria for income and age and benefits vary. Due to this variety, there is a need to provide ample information and explanation to clientele on program variations. The application process should be consolidated. The lack of administrative funds contributes to the lack of coordination at all levels. (Pages 19-22)
- o Participation and Outreach - The LIHEAP participation rate is low and limited to crisis situations and households that are already aware of the program. There are insufficient funds available under LIHEAP to serve all eligible households. There are inadequate intake procedures for APS E-3, and the Senior Discount Program. (Pages 22-24)
- o Crisis Orientation of LIHEAP - The evaluation raises legal and policy issues concerning whether Arizona's program meets the federal requirement of providing assistance to "those households which have the lowest income and the highest energy costs in relation to income, taking into account family size...". The crisis orientation may adequately meet Arizona's needs, however only households in payment difficulty get LIHEAP benefits. There is a problem with the program's year-round format and contributes to problems with administrative costs. A benefit of the current program is that intake workers take a total look at the other problems experienced by applicants. (Pages 24-28)
- o Conservation Tilt of Commission-ordered Programs - Currently, customers with low usage receive greater percentage reductions under the APS program. The program clearly encourages conservation, but questions were raised whether applicants/participants understand the conservation aspects of the program. The evaluation questions whether the basic conservation premise is realistic or fair. There are no administrative costs for local agencies to expend more time explaining the conservation component. The reward of a higher discount may be to a household who simply has been fortunate to receive weatherization or live in an airtight home. There is a need to scrutinize and reassess the program design, and evaluate the operation based on hard data. (Pages 28-29)
- o Administrative costs - Arizona is suffering like other states, due to the 10% limit on administrative costs on the LIHEAP. This is accentuated by operat-

ing a year-round program and the crisis orientation of Arizona's LIHEAP. There are various related programs without administrative costs. Local agencies have not been asked to undertake various essential steps in outreach and intake needed in the early stages of a new program due to the lack of administrative funds. (Pages 29-32)

- o Adequacy of Funds Available and Their Targeting - There are inadequate funds to meet the need for energy assistance in Arizona. The current level of assistance is only reaching a limited number of those eligible. The Senior Discount Program is slated to end in less than a year. Households with high energy needs receive marginal assistance under the weatherization program. (Pages 32-35)
- o Limited Data on the Energy Situation and the Affected Population - It was difficult to debate design issues without adequate data. There is a general lack of evaluation materials at the state level. There is a need to obtain data on actual individual households income, consumption, debt and other critical factors. There is a need for data on households being served. (Pages 35-36)
- o Assistance to Users of Unregulated Fuels - Arizona is oriented toward customers of regulated vendors. (Pages 36)
- o Diminishing Level of Conservation Assistance - There is a need to obtain additional funding to support the weatherization program in Arizona. (Page 37)

V. SUGGESTIONS FOR CONSIDERATION

- o Area of Communication - The evaluation recommends for consideration the establishment of an Advisory Committee, consisting of government officials, vendor representatives and low income community representatives. These types of committees are established in other states. The value of the committee depends on the role and responsibility assigned to it by the Governor. (Page 38)
- o Program Coordination - It was recommended that consolidation of the programs would be ideal. It was also suggested that automatic eligibility for certain programs be considered. Eligibility would be based upon an approved application from any one program. Complete consolidation may not be possible due to the unique fund sources. It was also noted that weatherization coordination with bill paying assistance could be more formalized. (Page 39-41)
- o Administrative Costs Savings - Better coordination in program design and implementation could assist with these costs. There is a need for increased local function involving outreach responsibilities, information and intake for all

- the programs. Consideration should be given to reestablishing categorical eligibility. Greater involvement of vendors could be encouraged, including taking of applications. It was recommended that state revenues be requested and additional assistance from fuel vendors by possibly imposing a surcharge on fuel. It is also recommended that all other alternatives be explored prior to considering transferring energy block grant funds into the Community Services Block Grant Program. (Pages 41-45)
- o Consideration of the Benefit Allocation System - The report recommends that the state consider the legality of operating a crisis oriented program and that the consumption of energy by household should be considered. Some states pay a percentage of the household's total energy use. LIHEAP could be recast to have some sensitivity to variations in consumption and the energy burden of the household. The report recommends a study of actual LIHEAP participants. (pages 45-51)
 - o Program Funding - It was recommended that the State continue to extend reduced rates to low-income households, apply for Title IV-A funds - Emergency Assistance Program and tap additional Oil Overcharge Funds. Arizona has fallen below the national average for its usage of oil overcharge funds for low income programs. These funds could be used to bridge into other permanent funding. Public funding could be requested for administrative costs. Contributions from the private sector for energy and weatherization benefits should be pursued. Utility financed conservation efforts are common in other states. Landlord contributions to weatherization efforts should be encouraged as they benefit from the improvements. Credit balances on LIHEAP vendor payments should be reviewed to see whether there are sufficient funds to draw interest. (Pages 51-62)
 - o Regulation of Utility Termination Practices - The report recommends for consideration special protections for low income households against loss of utility service when certain circumstances occur. Hot and cold weather needs of the vulnerable low income population should be considered. (Pages 62-63)
 - o Customers of Unregulated Vendors - There should be consideration for procedural protection designed to assist the consumer overcome fraud or overreaching by an independent fuel vendor. (Pages 63-64)
 - o A system of Proactive Protections on Identification of Household in Difficulty - Utility companies could identify households having payment difficulties and refer them to service providers. (Page 64)

- o Study of the Impact of Current Programs Upon Affected Population - The report recommends a study be conducted to develop a data base that is drawn from actual income and consumption figures. It would enable concerned individuals to dramatize the need and better argue for application of appropriate resources. (Page 65)
- o Program Evaluations - Periodic evaluations would enable the state to assess the particular program's goals and strategies. (Page 66)

VI. THE EFFORTS OF OTHER STATES TO ENHANCE OR BETTER UTILIZE RESOURCES

A. ADDITIONAL ENERGY ASSISTANCE FUNDING

- o Emergency Assistance Program (Title IV-A) - This is a grant program which provides funds to households with children. Eleven states have applied for this and use LIHEAP funds as a match. (Page 67)
- o Oil Overcharge Funds - While the majority of funds have been distributed, some will continue to be available. (Page 68)
- o Contributions - All efforts should be made to expand individual and corporate contributions for low income energy assistance programs. (Page 68)
- o Interest on LIHEAP Credit Balances - Interest can be accrued on balances carried on customer accounts. (Page 69)
- o State Contributions - The report recommends that the State obtain state appropriated funds. (Page 69)
- o Federal Emergency Management Agency Funds (FEMA) - (Page 69-70)

B. LOWER COSTS

- o Special Utility Rates or Discounts - California has established an across the board discount for all low-income households. (Page 70-71)
- o Exemption from Taxes on Utility Services - Some states have provided a state tax credit to low-income individuals for energy use. Arkansas has operated this credit since 1987. (Page 71-72)
- o Tapping "Spot Market Gas" - It was recommended that the State work with utility companies to obtain short-term supply of gas. (Page 72-73)
- o Special Discounts from Unregulated Fuel Vendors - A bidding process by which utilities establish a price for LIHEAP participants and in Maryland has led to lowering of prices. (Page 73)
- o Bulk Purchase Arrangements - Some states have used bulk purchasing to obtain fuel supplies for program participants at lower prices. (Page 74)

C. USAGE REDUCTION

- o Utility-Financial Conservation Efforts - There are many commission-ordered weatherization projects in other states. (Page 75)
- o State-funded Weatherization - State contributions to program were recommended. (Page 75)
- o Landlord Contribution - Landlords are being required to contribute to the weatherization efforts. (Page 75)

D. MEANS OF BETTER TARGETING LIHEAP RESOURCES - (Page 75)

E. PROCEDURES RESTRICTING OR CHANNELING UTILITY DETERMINATION ACTIVITY
Most states have regulations established by statutes or issued by commissions restricting termination of utility services. Warm weather states (Texas) set a high temperature range where shutoffs are restricted. (Page 76)

F. SPECIAL EFFORTS TO IDENTIFY AND ASSIST HOUSEHOLDS IN PAYMENT

DIFFICULTY In some states the utility companies identify problem customers with high utility bills and these households are targeted for weatherization or other payment benefits. (Page 76)

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Arizona Comm. Action Assn
Tucson, AZ Phoenix, AZ
- 11. **Luz Sarmina-Guiterrez**
Southwest Gas Corporation
Phoenix, AZ
- 12. **Norm Shipp**
Tucson Electric Power
Tucson, AZ
- 13. **Marty Sonnenberg**
Customer Service
Salt River Project
Phoenix, AZ
- 14. **Bob Stevens**
Coconino County Comm. Svcs.
Flagstaff, AZ
- 15. **Woody Sunderman**
Southern Union Natural Gas
Flagstaff, AZ
- 16. **Craig Thomas**
Intertribal Council of Arizona
Phoenix, AZ

Work Group Facilitator:
B. Jeanne Peters
Phoenix Associates, Inc.
Scottsdale, AZ

Work Group Staff:
Juanita Garcia, Community
Services Administration, DES
Barbara DesMarteau, Community
Services Administration, DES

Appendix D - Arizona Corporation Commission Response to the National Consumer Law Center



MARCIA WEEKS
CHAIRMAN

RENZ D. JENNINGS
COMMISSIONER

DALE H. MORGAN
COMMISSIONER



JAMES MATTHEWS
EXECUTIVE SECRETARY

ARIZONA CORPORATION COMMISSION

July 5, 1990

Charles E. Hill
National Consumer Law Center
Eleven Beacon Street
Boston, Ma 02108

Dear Mr. Hill:

I recently read your report to the Arizona State Legislature, Executive Summary on Energy Services Coordination, as required by SB 1099. On page 12 of the summary, you state:

"Conservation Tilt of Commission-ordered Program-Currently, customers with low usage receive greater percentage reductions under the APS program. The program clearly encourages conservation, but questions were raised whether applicants/participants understand the conservation aspects of the program. The evaluation questions whether the basic conservation premise is realistic or fair. There are no administrative costs for local agencies to expend more time explaining the conservation component. The reward of a higher discount may be to a household who simply has been fortunate to receive weatherization or live in an airtight home. There is a need to scrutinize and reassess the program design, and evaluate the operation based on hard data."

The following chart may illuminate some of your concerns.

Monthly Usage	APS E-10 Ann. Bill	APS E-10/ E-3 Bill	Discount %	Discount amount (15% annually)	Discount amount (15% Disc)
100 kwh	\$186.29	\$130.40	30%	\$55.89	\$27.95
250	\$330.73	\$231.51	30%	\$99.22	\$49.61
400	\$475.18	\$332.63	30%	\$142.55	\$71.28
500	\$585.57	\$468.45	20%	\$117.12	\$87.84
750	\$861.55	\$689.24	20%	\$172.31	\$129.24
800	\$916.76	\$733.41	20%	\$183.36	\$137.52
1000	\$1140.36	\$1026.32	10%	\$114.04	\$171.06
1200	\$1363.99	\$1227.59	10%	\$136.40	\$204.60
(2000)	\$2258.43	\$2258.59	0%	0	\$338.76

(comparison purposes)

The chart shows that a higher discount percentage doesn't mean a higher discount amount--in fact, it is often much smaller in total. Your comments should probably read ". . . The reward of a higher discount 'percentage' may be to a household who has 'evaporative cooling' and 'heats with gas'. . ." The weatherized all-electric new homes with high efficiency heat pumps often have

bills that are higher than the existing housing stock. (Climate Crafted home--\$1360/year, average 12000 kwh/year home--\$1006/year --(Salt River Project)). Low-income people tend to live in older neighborhoods, and are more likely to have evaporative cooling and gas.

A recent letter to the Arizona Corporation Commission stated: "Median income in Yuma is \$17,000 annually, compared to \$27,000 in Maricopa County . . . that summer electric bills of \$380 for a three bedroom house and \$170 for a two bedroom apartment are not uncommon . . . Yuma has an 'ability to pay' situation that needs addressing." My response included that it must be admitted that Arizona has "the most hellish summer climate this continent offers" and that "low-income people cannot afford high energy sealed-off air conditioning, as it is presently engineered, to tame it. With desert-compatible evaporative cooling those \$170-\$380 bills should be lowered to a more manageable \$30-\$100 range." If low-income people still have trouble with those kind of bills, they should be assisted. However, short of a medical emergency, it is questionable whether assistance should be provided for the kind of bills that air conditioning runs up. No politically feasible program can assist on a long term basis ratepayers with bills in the \$170 to \$380 range. It would be better to give an evaporative cooler to that low-income person, unless there is some medical reason to prohibit it. It should be pointed out that about 25% of APS' customers have evaporative cooling only, as do about 60% of Tucson Electric's customers. Luckily, the harsh desert summers can be made tolerable with low-energy use evaporative cooling, which is also less costly for Arizona utilities to serve because of its low demand coincident with the utilities' summer peak. That is a major reason why APS' E-10 and E-12 rates are both inclining block rates in the summer.

I've never quite understood why someone who uses four times as much energy as someone else, should get 4X the discount amount, especially when the person who uses less energy probably has evaporative cooling instead of air conditioning, the symbol of "energy profligacy, . . . destruction of the ozone layer . . . and substantial contributor to the greenhouse effect," according to a recent issue of Newsweek. (6/18/90, p. 51)

I believe that most people understand basic percentage arithmetic--such as, a large percentage (30%) of a small number will give you an even smaller number. The program was designed so that there wouldn't be such a wide variation in discount amounts for normal usage (\$8 to \$15 per month as opposed to \$3 to \$25 and up under a flat discount percentage with no cap). It was also designed to give a conservation incentive, especially to

those who normally use just above the breakpoints in the schedule--401-500kwhs, 801 to 900 kwhs, and 1201 to 1300 kwhs.

The program was designed based on utility usage profiles and from my own experience in owning and managing 16 two bedroom master-metered/submetered apartments, in which about 50 people live. The year around average use there is about 350 kwhs per month per apartment--the summer average is about 450 kwhs/month. The lowest use apartment with two residents (one an elderly man who is there all the time) uses under 100 kwhs/month for 7 or 8 months; summer usage is 150 to 250 kwhs. The highest use apartment generally uses about 3 to 4 times that amount. The apartments are evaporatively cooled and have gas for everything that gas can be used for. The apartments are always full with low and moderate income people, including myself. I've been there since 1972.

Sincerely,

Roland James
Assistant to Commissioner Jennings



Committee Appointments

One representative of private industry involved with renewable energy to be appointed by the President of the Senate:

Liná Gormley, Arbor International, 6625 N. 14th Street, Phoenix, AZ 85014; 265-0665

One representative of a public service corporation (gas) to be appointed by the President of the Senate:

Wally Kolberg, Southwest Gas Corporation, 5241 Spring Mountain Road, Las Vegas, NV 89102; 702-876-7367

One representative of commercial users to be appointed by the President of the Senate:

Daniel Hunter, President, S.M.A. Company, Inc., 2211 E. Highland, Suite 240, Phoenix, AZ 85016; 956-0076

One representative of the petroleum industry to be appointed by the President of the Senate:

Guy Yates, VP of Marketing, Giant Industries, Inc., 23733 N. Scottsdale Road, Scottsdale, AZ 85255; 585-8888

replaced by:

George A. Ross, Director, State & Local Government Relations, ARCO, 515 South Flower Street, Los Angeles, CA 90071; 213-486-2626

One representative of persons living on an Indian Reservation to be appointed by the President of the Senate:

Bob Preston, Navajo Technologies, Inc., Navajo Nation, Box 100, Leupp, AZ 86035; 863-0587

One representative of agricultural producers to be appointed by the President of the Senate:

Ron Rayner, Chairman, Electric District 8, P.O. Box 1509, Goodyear, AZ 85338; 932-1834

One low income energy users advocate to be appointed by the Speaker of the House:

Barbara Norton, 6334 E. Rose Circle, Scottsdale, AZ 85251; 945-7489

One consumer in a county with a population less than 400,000 people to be appointed by the Speaker of the House:

J.R. Ramirez, Executive Director, Southeastern Arizona Human Resources Council (SEAHRC), 921 Thatcher Boulevard, Safford, AZ 85546; 428-4653

One representative of private industry involved in renewable energy to be appointed by the Speaker of the House:

Richard Bingmann, General Manager, Ramada Energy Systems, Inc., 1421 S. McClintock, Tempe, AZ 85281; 829-0009

replaced by:

William J. Murphy, President, Murphy Engineering, 5151 N. 16th Street, Phoenix, AZ 85016; 234-3781

One representative of a public/municipal power entity to be selected by the Speaker of the House:

Arnie Schwalb, Director, Corporate Planning, Salt River Project, P.O. Box 52025, Phoenix, AZ 85072-2025; 236-5900

One representative of a public service corporation (electrical) to be appointed by the Speaker of the House:

Martin Shultz, Arizona Public Service Company, P.O.Box 53999, Phoenix, AZ 85072-3999; 250-2866

RUCO Director

Douglas Brooks, RUCO, 34 West Monroe, Suite 512, Phoenix, AZ 85003; 255-1431

Corporation Commissioner

Renz Jennings, Arizona Corporation Commission, 1200 W. Washington, Phoenix, AZ 85007; 542-3935

Commerce Director

Mark Ginsberg, Arizona Energy Office, 3800 N. Central, Phoenix, AZ 85012; 280-1420

University of Arizona Faculty

Robert Seale, Ph.D., Nuclear and Energy Engineering, Engineering Building #106, University of Arizona, Tucson, AZ 85721; 621-2311

replaced by:

Rocco Fazzolari, Ph.D., Nuclear and Energy Engineering, Engineering Building #106, University of Arizona, Tucson, AZ 85721; 621-2487

Arizona State University Faculty

Byard Wood, Ph.D., Center for Energy Studies, College of Engineering and Applied Sciences, Arizona State University, Tempe, Arizona 86281; 965-7298

Northern Arizona University Faculty

Clyde N. Holland, Ph.D., College of Engineering and Technology, Northern Arizona University, Flagstaff, AZ 86001; 523-2880

Oil and Gas Conservation Commission Director

Daniel J. Brennan, Executive Director, Oil and Gas Conservation Commission, 5150 N. 16th Street, Suite B-141, Phoenix, AZ 85016; 255-5161

Appendix F - Minority Reports



SOUTHWEST GAS CORPORATION

December 12, 1990

Joint Legislative Task Force
on Energy Policy and Planning
of the Arizona Legislature
c/o Arizona Energy Office
3800 N. Central, Suite 1400
Phoenix, AZ 85012

RE: Arizona Energy Policy - Minority Report

Gentlemen:

In many ways, the attached Energy Policy is a remarkable document. Not in the great/extraordinary definition of the word, but in the sense of being notable that the document now exists. It's the end result of almost two years of work by the voluntary Advisory Committee and excellent support and assistance from the Arizona Energy Office's Director and staff.

It's a consensus document - in that the majority ruled. If the quorum present voted for or against a suggestion, it passed or failed based on the majority. As a result, not everyone agrees with every item that's been included in the Policy. In that regard, Southwest Gas is no exception.

Regarding some recommendations, Southwest did not support the thesis of the statement as drafted. In a few others, while we supported the underlying thrust and purpose of the recommendation, we did not agree with the means to reach the end. However, we do support the general body of this work and the recommendations produced.

Southwest strongly supports the need for a constructive energy policy in Arizona and believes that this document, while not an end itself, is a beginning moving in the right direction. Clearly, specific implementation plans need to follow, taking recommendations from this Policy and putting them into practice.



Joint Legislative Task Force
Page 2
December 12, 1990

In the next legislative session and in other forums these recommendations will be discussed at length. Southwest believes it would be most productive to state its views for or against specific proposals when they are presented in the future. Accordingly, we reserve our right to do so at a later date.

Yours truly,

Wallace C. Kolberg
Manager/Marketing
Conservation & Resource Plans

lb



SALT RIVER PROJECT

POST OFFICE BOX 52025
PHOENIX, ARIZONA
85072-2025
(602) 236-5900

December 12, 1990

Mr. Bill Murphy, Chairman
Advisory Committee on Energy Policy and Planning
Arizona Energy Office
3800 N Central Avenue, Suite 1400
Phoenix, AZ 85012

Dear Bill:

This letter represents my minority report regarding the results of the Committee's efforts. I request that it be published and distributed as agreed by the Committee.

The Committee has spent many hours and a good deal of energy in crafting the proposed energy policy for the State of Arizona. Many creative ideas and valid viewpoints have emerged during the process. As such, I think that the document will be a good starting point in focusing Arizona's energy future. I think it is especially commendable that a group with such diverse backgrounds and interests could work together as well as we have and arrive at some strong consensus positions regarding energy policy.

As I have said before, I fully support the goals of assuring our energy supplies are sustainable, affordable, and environmentally compatible. While I believe that the six "priority actions" contained in the Committee's report and "Executive Summary" will move the state in that direction, I have concerns about a number of the "possible" legislative, state and local government and private sector actions listed under the "priority actions." These action items were developed by the Committee in an extremely short brainstorming/screening process. That is why they are specified in the report as "possible" actions. They all require significant additional evaluation. It is important that readers of the report recognize this caveat. I do believe it is appropriate for an "Energy Policy Implementation Advisory Council" to be established and for that council, in consultation with state and local government and private sector experts to determine what specific actions are appropriate. I would briefly like to address specifically a few of these "possible" actions with which I have concerns:

1. **"Priority Action One-Solar & Renewable Energy** - Establish a consumption based fee through energy utilities to be used for solar projects and education." (This is also in the report as Recommendation 2 in Section V)

A surcharge on utility bills should not be imposed without detailed analysis of its impact and accountability established for its use. Utilities are already faced with customer concerns about rate levels. "Hidden taxes" like this are an inappropriate method too often proposed to meet perceived needs.

2. **"Priority Action Four--Energy Environmental Protection -**
Begin installation of best available scrubber technology."

Recommending that the private sector install "best available scrubber technology" without consideration of what is already being done to comply with environmental regulations, as well as to balance the benefits with the cost of the scrubbers, is inappropriate.

3. **"Priority Action Six--Planning & Policy -** Arizona Corporation Commission expand breadth of Integrated Resource Plan by including municipal and wholesale energy providers."

It is my opinion that the Arizona Corporation Commission does not have the legal authority to expand the integrated resource plan as suggested by this action item. I also believe it is inappropriate for this Committee to recommend such an expansion of power for the ACC.

The recommendations in the Committee's report were arrived at in a group process. While a few were unanimous selections, most had at least one detractor. I believe every member is uncomfortable with some part of the document. I am no exception. In addition to my previous comments on the "possible" actions, I submit the following general observations:

1. While the 60+ recommendations were developed by the Committee members in an iterative process over a significant period of time, the descriptive text was developed primarily by the Arizona Energy Office staff fairly late in the Committee's process. Although the text was reviewed and, in some instances, revised by the Committee, it did not receive the level of attention received by the recommendations. Additionally, decisions as to what remained in the text often was based on the opinions of Committee members rather than determinations of fact. Thus there are portions of the text with which I do not agree. Readers of the document should recognize these points and not consider the text to be either totally factual or necessarily representative of a consensus of the Committee.
2. There are several recommendations which call for increasing taxes and/or increasing regulatory burdens in various ways. While these recommendations received enough support within the Committee for them to appear in the document, I am personally opposed to their implementation and may take

exception to their implementation at the appropriate time and place.

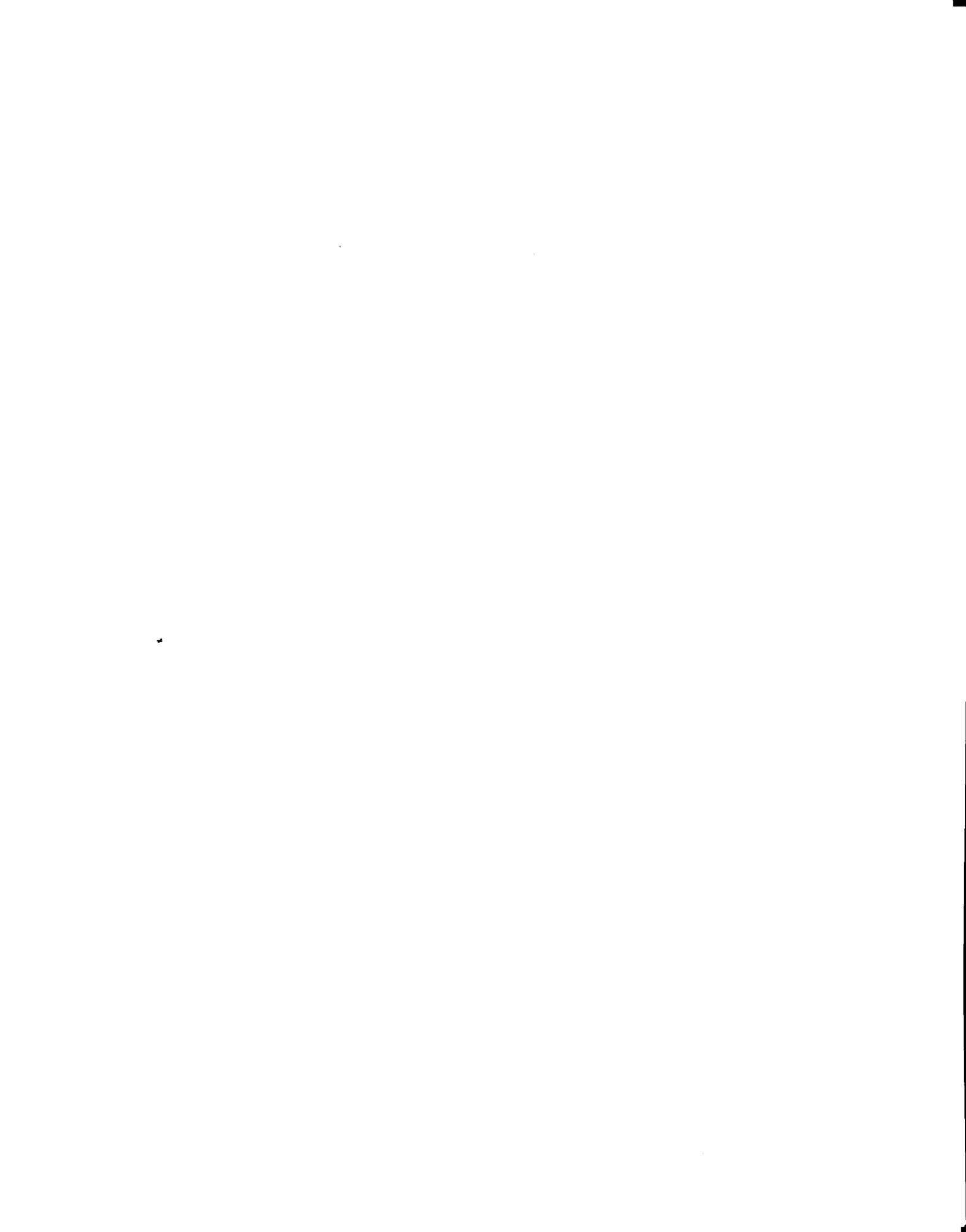
It is important that the reader recognize that the Committee's report is an assembly of concepts which have not been rigorously evaluated for their technical and economic merit. This is not a criticism of the Committee, since funds were not available for the Committee to conduct comprehensive analyses concerning the impacts of energy policy recommendations.

Sincerely,

A handwritten signature in cursive script, appearing to read "A. L. Schwalb".

A. L. Schwalb, Director
Engineering Services

bgl



Arizona Public Service Company

P.O. BOX 53999 • PHOENIX, ARIZONA 85072-3999

December 12, 1990

Mr. Bill Murphy, Chairman
Arizona's Advisory Committee on
Energy Policy and Planning
Arizona Energy Office
3800 North Central Avenue, Suite 1400
Phoenix, Arizona 85012

RE: Additional Comments on the Advisory Committee Report;
Energy Policy in Arizona: A Plan for Sustainable Development

My compliments to the Arizona Legislature for having the foresight to create the Advisory Committee on Energy Policy and Planning. The members of the Committee, by design, represent a diversity of interests in Arizona but share a common concern about the need for development of public policies, programs and private sector projects that will assure Arizona a "successful energy future."

I am encouraged that the Committee concluded that any effective, modern "plan for sustainable development" must consider the economic requirements as well as the environmental constraints.

While much Committee effort went into attempting to balance the fundamental economic questions and environmental requirements of energy policy, I am somewhat disappointed the Committee did not spend more time and place more attention on the economic impacts, the economic development consequences, and the implications for jobs for a strong Arizona economy, resulting from the State's energy policy. I am confident however, and will encourage future considerations of the Committee recommendations including a comprehensive analysis of the economic impacts and consequences.

Having been actively involved in this Committee's work for the past two years developing this Energy Policy, I would like to commend the Committee members and staff for their efforts in forging this document and for their spirit of cooperation and compromise which were essential in its development. I would also like to acknowledge the very professional support I received from Dennis Beals of APS and many APS officers, managers and employees for their continued interest, support and comment as this project developed. At Arizona Public Service, we believe that debate and dialogue on issues contained in the report is fundamental to insuring a reliable supply of energy for all Arizonans.

December 12, 1990

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During our Committee work, we agreed that where possible, our recommendations should reflect Committee consensus. In large measure, the bulk of the recommendations do reflect consensus. However, there are several areas of concern to APS discussed below.

- I. The Committee members spent the majority of their time developing and refining the recommendations contained in the report. The accompanying descriptive text was, however, developed primarily by the Arizona Energy Office staff and did not receive the same amount of review by the Committee. As a result, it is APS' belief that the actual report pays more attention to environmental concerns than economic concerns. Further, it should be realized by readers of the report that this "environmental bias" may not be shared by the Committee as a whole.
- II. There are two recommendations to which APS takes strong exception to:
 - A. **ENVIRONMENTAL QUALITY - RECOMMENDATION #4** (Imposition of an Emissions Tax). The Legislature should develop and implement an emissions tax for all stationary and mobile sources of particulates, NOX CO, CO2, and SOX pollution throughout the state based on quantity and quality of emissions with all revenue dedicated to energy conservation and energy pollution abatement. If adopted, this recommendation would:
 1. Penalize unnecessarily, those entities in Arizona that have already placed high cost effective pollution control equipment on their facilities in order to reduce pollution emission below applicable limitations. In effect, the recommendation would make companies and customers pay twice for pollution controls.
 2. Increase the cost of doing business in Arizona. Since this policy recommendation would only apply in Arizona, it would create a severe constraint to Arizona business' ability to compete in the marketplace. Such a proposal, if adopted, would have adverse impacts on the state's economy.
 3. Increase the cost of transportation and electrical power usage impacting disproportionately, persons with limited disposable income especially those in low income brackets, least able to afford such necessary services.
 4. Not contribute to solving air pollution problems. As examples, the tax would not be applied directly to capital improvements in pollution control, and would be ineffectual in solving global or large regional air pollution problems.

APS opposes this recommendation since there are other, more direct and effective solutions to solving Arizona's air pollution related problems.

With regard to the control of the emissions, for which the tax is proposed, there are already several Federal and State air pollution control programs that address these emissions. Therefore, we view the proposed tax on emissions as unnecessary and of little direct benefit to either Arizona's economy or environment. In addition, such a tax could well become a diversion of funds from pollution reduction programs to other general fund requirements not related to the reduction of emissions.

- B. **BUILDINGS - RECOMMENDATION #8** (Promote access to all energy types.) The State, in concert with the utility, construction, and real estate development industries, should promote access to all energy types. Through the assurance of consumer choice in energy type selection, the lowest cost energy alternative can be implemented by the consumer.

As a practical matter, this recommendation has been interpreted to mean the extension of utility services where it may not be economic to do so, requiring a builder to spend money providing facilities that a homeowner or building owner does not desire. We encourage that the choice of energy type be left to the "marketplace." This is an arena in which strict legislation or regulation will not produce significant public benefit and is likely to produce substantial distortions in the marketplace.

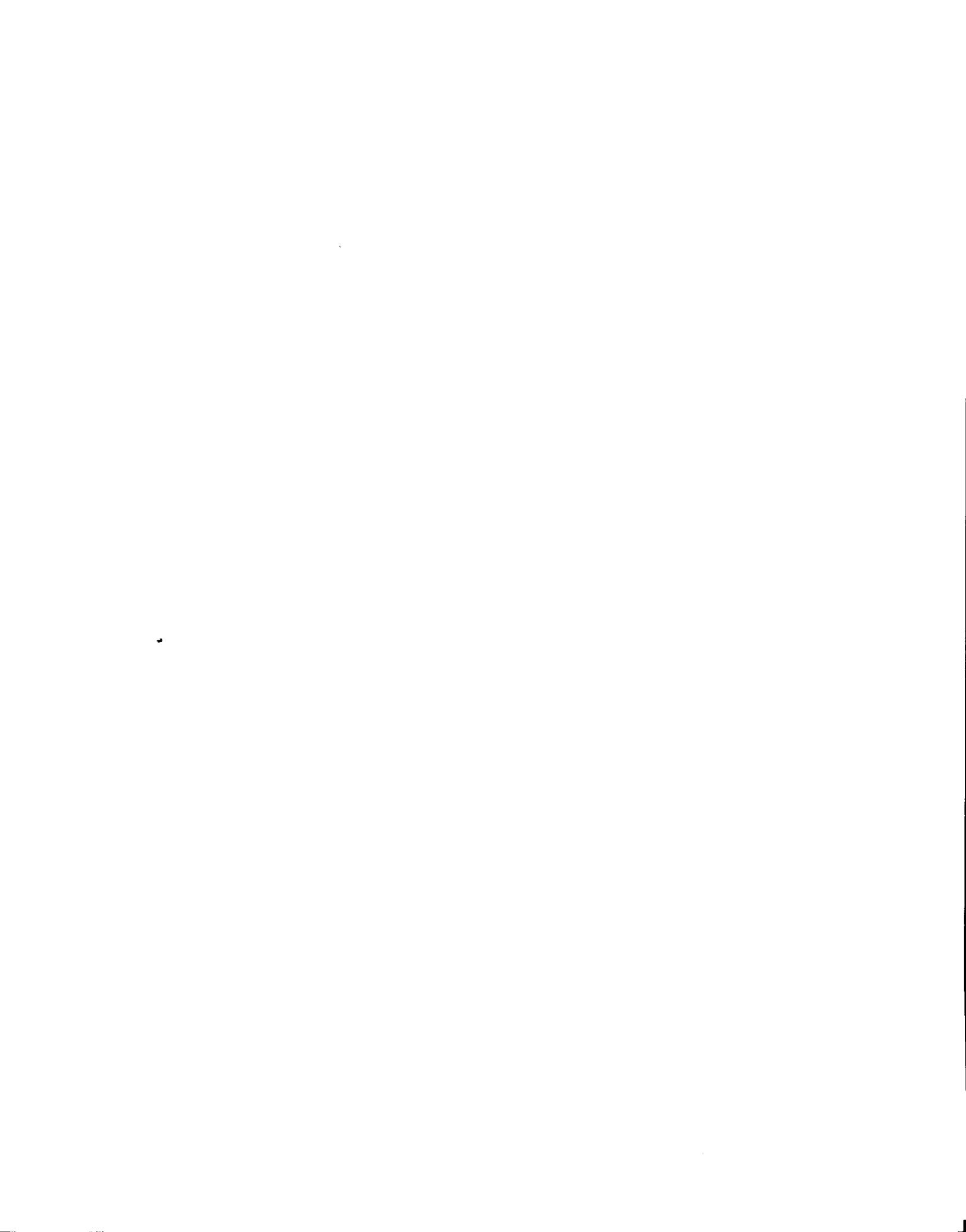
Finally, the reader should also recognize that many of the Committee's recommendations were not rigorously evaluated as to their economic or technical feasibility and, therefore, may only represent a starting point for further action.

On balance, APS fully supports the basic goals and objectives of this Energy Policy which are to assure an adequate and sustainable energy supply which is affordable and environmentally compatible. We appreciate the opportunity to participate on behalf of the Arizona electric industry and will look forward to efforts to implement recommendations which will further support the goals and objectives of this Energy Policy.

Sincerely,



Martin L. Shultz
Arizona Public Service Company
Member of the Advisory Committee on
Energy Policy and Planning





515 South Flower Street
Mailing Address: Box 2679 - T.A.
Los Angeles, California 90051
Telephone 213 486 2626

George A. Ross
Director
State & Local
Government Relations

December 13, 1990

Ms. Maureen Bureson
Energy Policy Analyst
Arizona Energy Office
Arizona Department of Commerce
3800 N. Central, Suite 1200
Phoenix, AZ 85012

Dear Maureen:

Attached is my minority report for inclusion in the final report of the Advisory Committee on Energy Policy and Planning.

Thank you.

Sincerely,


George A. Ross



MINORITY REPORT

THE ROLE OF GOVERNMENT IN THE PETROLEUM INDUSTRY

Led by its dedicated Chairman, Bill Murphy, the Advisory Committee on Energy Policy and Planning has thoroughly and conscientiously examined the complex issues associated with energy policy and has cogently assessed Arizona's particular problems and opportunities in this area. As in any committee, its members typically feel more or less strongly about the different issues addressed; it is a tribute to Bill Murphy that such a diverse a group of people as is represented on the committee were able to arrive at a set of coherent and meaningful recommendations. Thus, our submittal of this minority report is not meant in any way to demean the committee's efforts.

We do feel compelled to comment on the strong implication contained in the report's discussions of the Fundamental Suppositions and of the Planning Process that the existence of the Organization of Petroleum Exporting Countries (OPEC) in the words of the report "requires that appropriate levels of government have a role in the efficient operation of the energy market."

In its present form, the petroleum market in Arizona is highly competitive at both the retail and wholesale levels. This conclusion rests not only on an analysis of the number of firms selling petroleum products at wholesale and at retail in Arizona, but also on a comparison of prices consumers pay here with those paid elsewhere.

Various government agencies and academic economists have examined gasoline marketing during the federal regulatory period 1973-1981 and since that time. The consensus opinion is that the industry operates competitively, and that past regulation in fact resulted in curtailed domestic production of oil, higher prices (in money and time) to consumers, and was "extremely deleterious" to the economy as a whole. Since deregulation, the unconcentrated, highly competitive nature of the petroleum industry has not warranted either federal or state price regulation or other regulation beyond what is already in force through long-established legislation. A 1984 Department of Energy study, Deregulated Gasoline Marketing, clearly stated this position.

Estimates of the cost of federal regulation of oil prices

from 1973-81 are staggering. For example, it has been estimated that the cost to firms of reporting alone was \$80 million per year. It was determined that the expense of public and private accounting, record keeping, and legal resources amounted to between \$0.6 billion and \$2 billion per year in 1982 dollars. These estimates should make anyone concerned with government expenditures think twice about imposing regulation -- even if there were other legitimate arguments in favor of the proposed regulation.

It is important to remember the relationship among price, supply, and demand in a competitive market. The shortages and dislocations of the two energy crises of the 1970's occurred not because of an actual shortage of product, but rather because price and allocation controls prevented the price mechanism from attracting product from regions with surpluses to regions where supply was tight. The present petroleum industry structure results from extremely competitive conditions in the marketplace, and therefore represents an efficient response to market conditions; increased government intervention would represent a less efficient and therefore more costly way of doing business. Because of the importance of petroleum products to both consumers and businesses in Arizona, any increase in prices resulting from inefficient regulations would have a significant and far-reaching impact on all aspects of the economy.

George Ross
ARCO



ARIZONA DEPARTMENT OF COMMERCE

3800 NORTH CENTRAL AVENUE, SUITE 1400

PHOENIX, ARIZONA 85012

(602) 280-1300

FAX: (602) 280-1305

ROSE MOFFORD

GOVERNOR

DONALD E. CLINE

DIRECTOR

December 12, 1990

Mr. Bill Murphy, Chairman
Arizona Advisory Committee on Energy
Policy & Planning
Arizona Energy Office
3800 N. Central Avenue, Suite 1200
Phoenix, Arizona 85012

Subject: Minority Report of the Arizona Energy Office

Dear Mr. Murphy:

The Arizona Energy Office recognizes the hard work and dedication of time given by the Advisory Committee on Energy Planning and Policy over the last two years. Arizona's energy situation presents complex issues and difficult choices for those trying to address it. Since energy is embedded in the entire social fabric of our communities and the state, virtually any action or even inaction can have consequences throughout the economy or environment.

Too often public policy is shaped by inactions. Public policy can be very subtle or blatant. We often forget that it was public policy, whether intended or accidental, that got us where we are.

For energy, 1990 has been a watershed year. It is the year energy met the economy, the environment and volatile world politics all together. It is a time that requires a pro-active, thoughtful state energy policy to address current problems and build a strong foundation for the future.

With the passage of legislation in 1987, the way was paved to update and implement an effective energy policy. That a 19-member committee persevered and came to such remarkable consensus is testimony to the importance of energy for Arizona. Not everyone got everything he or she wanted, yet the committee proceeded with respect and appreciation for a full range of views from other members, witnesses and the public.

It was hard for the committee to come to grips with the myriad issues related to energy. However, from the start, the committee acknowledged the impact of energy on the environment, the importance of energy for our economy and lifestyle. The process had open discussion, thorough review and, where there was controversy, time for reflection and, when needed, informal meeting.



Mr. Bill Murphy
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It is clear none of us knows the truth of the future. But, collectively, the committee has developed a list of recommendations and set of priorities that address the institutional, regulatory, economic and social issues related to energy. It now goes to the political arena for implementation.

The committee is very understanding of the degree of difficulty in implementing all the measures in this plan. It is hard to convey two years of education, discussion, debate, disagreement and ultimate agreement in a report or presentation. One hopes the committee's considerable work is respected for its sincerity and thoughtfulness, and that those reading it will understand that they must either accept the committee's work or be sentenced to reinventing the wheel with their own original work.

The committee has made it considerably easier for public policy makers to focus on significant energy issues critical for our state's economic and environmental health. As technology and circumstances change, this policy will have to change. If the draft document is to become a useful blueprint for action, it must establish a mechanism to seek the best methods to implement the recommendations it contains. Full economic and environmental assessment, and much detailed planning is required before implementation of many of the recommendations. A permanent lead agency should be established that will take ownership of the mission to fully implement the policy and its recommendations. This agency should be committed to a leadership role, a coordinating role. This agency should be committed to working with everyone affected by a particular recommendation. This agency should be committed to an open process that will produce innovative solutions to energy problems by the state, local government and the private sector. Collaborative, cooperative and participatory process should be emphasized. Perhaps the most important priority is an ongoing energy policy process. The Energy Office has been an assertive advocate for such a process, and an aggressive and comprehensive implementation plan.

The Energy Office endorses the recommendations and action plans made by the committee. As do other members, we may not be as enthusiastic about some as others and we may not embrace every word of narrative. However, on the whole, the Energy Office has been proud to be a participant in the process that has come this far.

This final opportunity to comment cannot go without several important areas of disappointment. Perhaps these could be called lost opportunities or possibilities for the future. Although the Energy Office acknowledges the committee could only advance so far, it would be remiss if it did not lay out other options for policy makers to be aware of.

A main shortcoming of the draft policy document is its failure to view the future with any bold vision. It mostly reflects incremental change from the status quo, and could fail to prepare the state and its people for the changes in energy sources, technologies and

Mr. Bill Murphy
Page Three
December 12, 1990

individual utilization that will come as a result of environmental, security, and economic realities. Urban air pollution, a bankrupt reliance on imported oil, and the very real threat of global climate change dictate a transition to an energy resource base that is domestic, clean and affordable.

Solar energy should be a strong priority for Arizona, and requires an investment of state funding. While the committee did not recommend a specific funding mechanism, a 2 mil per kilowatt-hour fee would produce a Solar Projects Fund that would help integrate solar into Arizona's homes, businesses, communities and transportation systems. State funding of solar initiatives was enthusiastically supported by a significant volume of public comment, both written and oral. As our most abundant energy resource, we should harness the sun to our economic and environmental advantage.

Serious attention to goal setting, based on overall benefits to society is essential. In order to make the transition to new clean and safe energy resources, a concerted effort to become more energy efficient is required. This requirement is necessary in order to minimize the enormous investment that would be necessary if new energy production facilities and delivery infrastructure were needed. Whether we establish a goal of using X percent less energy in the year 2000 than in 1990, or an incremental goal of some percentage increase in efficiency per year, a target needs to be set. The policy needs to give the state and its citizens something to shoot for, and it is best to set a challenging goal. In itself, that should spawn new jobs, exports and sales from a thriving renewable and efficient energy technology industry.

Particular areas that should be aggressively pursued include:

- o building and community energy efficiency through better urban design and planning, as well as adoption and enforcement of local energy efficiency building codes, (e.g., ICBO, ASHRAE, California Title 24).
- o promoting increased building efficiency through competition in the marketplace utilizing residential and commercial building energy rating systems to inform potential owners and renters of their choices.
- o state building efficiency and renewable energy utilization through new building design and existing building retrofits.

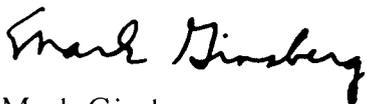
Mr. Bill Murphy
Page Four
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- o alternative fuels, particularly electric and solar/electric vehicles, through conversion of government fleets, and eventually all centrally-fueled fleets.
- o a technology-based economic development strategy with energy technologies as a cornerstone.

The Energy Office took a strong position from the start that any state energy policy must be sensitive to those in need. Energy is an essential commodity for economic activity, and a necessity for maintenance of life in our climate. Low-income individuals have difficulty in finding the resources to cope with energy costs, and need special consideration in energy policy. The federal government has been backing away from its commitment to low-income consumers by cutting budgets for emergency utility bill payments and weatherization programs. A dedicated state funding source to supplement shrinking federal dollars should be established.

In conclusion, the Arizona Energy Office marks the completion of this document as only the beginning of the effort to pro-actively plan for a clean, safe and affordable energy future for Arizona's citizens and businesses. The Arizona Energy Office of the Department of Commerce stands ready to assist in the many difficult and complex tasks that must be undertaken to prepare for that future.

Sincerely,



Mark Ginsberg
Energy Director
Arizona Energy Office

MG:bn

Glossary

abolish	To do away with wholly; to annul; to repeal; to rescind; to abrogate; to dispense with. Put an end to.
adequate	Sufficient; commensurate; equally efficient; equal to what is required; satisfactory.
apply	To put, use, or refer, as suitable or relative; to coordinate language with a particular subject matter; as to apply the words of a statute to a particular set of facts.
assure	To make certain and put beyond doubt. To declare, aver, avouch, assert, or ensure positively.
avoid	To annul; cancel; make void; to destroy the efficacy of anything.
conserve	To save and protect from loss or damage.
continuous	Uninterrupted; unbroken; not intermittent or occasional.
defend	To oppose, repeal, or resist. To protect, to shield, to make a stand for, or uphold by force or argument. To vindicate, to maintain or keep secure, to guaranty, to agree to indemnify.
efficient market	A market system that acknowledges total production and distribution costs.
encourage	To instigate; to incite to action; to give courage; to inspire; to embolden; to help and advise.
environment	The totality of the physical, economic, cultural, aesthetic, and social factors which surround and effect the quality of individual's lives.
establish	To settle, make, or fix firmly, place on permanent footing; put beyond doubt. To bring about or into existence.
excess capacity	Electric generation infrastructure in excess of community needs at peak demand for energy.
indigenous	Occurring naturally in a particular region or environment.
key	Of basic importance.
life-cycle cost	The total cost (economic, social, and environmental) of a commodity, product, or service over its full life.
promote	To contribute to growth, enlargement, or prosperity of; to forward; to afford; to contribute.

resources	Any tangible material in its native state which has economic or social value. Forests, mineral deposits, panoramas, air, water, and land. The term may include intangibles which supply a human need and contributes to the well-being of the community.
solar energy source	Any energy source from solar energy striking the planet, including but not limited to: solar thermal, photovoltaic, wind, hydro, and biomass.
technology transfer	The process of market penetration by new technologies and products.
total social cost	The total cost (economic, social, and environmental) of a commodity, product, or service.
transaction cost	The economic (dollar) cost of a commodity, product, or service at the time of purchase.

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