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PROJECT L/R-3

ENERGY CONSERVATION

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INTRODUCTION

In the decade from 1960 to 1970, the consumption of energy in the United States grew at an annual rate of 4.3 percent, while the growth in domestic energy production lagged behind at a rate of 2.6 percent.[1] This discrepancy transformed the United States from a net energy exporter to a net energy importer. At present, this country cannot satisfy domestic demand with domestic production and must make up the difference through one or more of the following measures:

1. Increase importation of energy sources, especially petroleum and liquefied natural gas;

2. Increase the domestic supply of energy sources, especially coal and uranium, and, to a lesser extent, oil and natural gas;

3. Develop new energy sources, such as geothermal and solar energy; and,

4. Decrease wasteful energy consumption by improving the efficiency of energy systems and the component parts, reducing wasteful practices and shifting to less energy-intensive activities.[2]

In the late 1960's the United States pursued the first alternative, that of increasing imports, and held to that policy until the fall of 1973 when the Arab oil embargo made that position untenable. Now, the national security risk inherent in importation of oil has led to alternative policies. This report will focus on energy conservation.

Any attempt to conserve energy in Texas through the passage of legislation must deal with various economic, social, technological and legal constraints. This report will discuss measures for conserving energy and analyze the possible legal issues that would be involved with each alternative.

I. CONSUMER EDUCATION

Since energy demand is largely a function of consumer behavior, an important part of any conservation program is consumer education. It is an effective short-term measure which will also have mid- and long-term effects as consumer habits are changed. Consumer education is a necessary part of energy conservation in each of the four areas discussed in this report.

Increased energy costs and energy shortages have caused greater public interest in conserving energy in all areas. Given this interest, a public information campaign similar to the successful "Drive Friendly" automobile safety campaign conducted by the Governor's Office would serve two purposes. First, it would show key areas where conservation is immediately possible. Second, it would serve as a reminder that continued conservation is needed to prevent another crisis caused by continuing overdemand. There are no legal problems involved in the enactment and implementation of this program. Supplementary measures to give the public information on the efficiency of equipment and the cost of energy will be discussed below.

II. LEGAL ISSUES

The Constitutions of the United States and of Texas limit this state's authority to mandate the conservation of energy. This section of the report will discuss the validity, under the two constitutions, of energy conservation measures in general. Later sections will apply the same constitutional tests to particular conservation proposals.

A. Limitations Imposed by the United States Constitution

To conform to the United States Constitution - - the "supreme law of the land"[3] - - a state energy conservation measure must pass certain tests involving the Due Process, Taking, Supremacy, Commerce, and Equal Protection Clauses.

1. Police Power

Energy conservation legislation affecting private activities would constitute exercises of the state's "police power" - - that is, its inherent[4] authority to legislate for the public "good." Although the police power is one of the least limitable of governmental powers,[5] particular exercises of it must meet the requirements of the Due Process[6] and Taking[7] Clauses. Such statutes must (1) have a proper "object," (2) bear a reasonable relation to the attainment of the object, and (3) not be arbitrary or unreasonable.[8]

The proper "object" test determines whether the end to be achieved by the legislation is one sufficient to justify

governmental promotion. Valid objects include protection of the public health, safety, morals, and welfare. "Welfare" has been construed to encompass the peace, order, economic well-being, comfort, and security of the community.[9] Most objects of energy conservation would fall within one or more of these expansive categories.

Second, to constitute a valid exercise of the police power, the regulation imposed by the legislation must bear a reasonable relation to the attainment of the object.[10] The Legislature is given wide discretion in this determination to the extent that "debatable questions as to reasonableness are not for the courts but for the legislature."[11] The statute will pass constitutional muster if there is any reasonable basis upon which the legislature could have decided it was necessary or desirable for its intended purpose.[12]

Third, the exercise of power must not be arbitrary or unreasonable. Usually, reasonableness is determined by balancing the public "good" to be achieved against the burden to be placed upon the person whose activity or property is being regulated. As the United States Supreme Court has said:

> "To evaluate [the police-power measure's] reasonableness, we therefore need to know such things as the nature of the menace against which it will protect, the availability and effectiveness of other less drastic protective steps, and the loss which appellants will suffer from the imposition of the ordinance."[13]

It has been contended that in addition to passing the balancing test, the legislation must seek, not merely the attainment of a public good, but the elimination of some harm to the public.[14]

In applying the three tests, the Supreme Court has exhibited two important tendencies. In applying the balancing test, the Court has been less tolerant of state measures that restrict the use of property than of measures that interfere with certain personal activities.[15]

In considering property losses, some courts have added another limitation to the balancing test. The exercise will be unreasonable if it deprives the owner of virtually all profitable use of his property and thereby diminishes its value to practically nothing. This rule was stated in Pennsylvania Coal Co. v. Mahon:

> The general rule at least is that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a "taking."[16]

However, this test has been severely criticized[17] and has not always been applied in situations where the diminution in value would seem to invoke it.[18] The Supreme Court, in Goldblatt v. Town of Hempstead, stated that if the property was being used to inflict injury upon the community, a prohibition by the legislature of its use in that manner "cannot, in any just sense, be deemed a taking or appropriation of property for the public benefit. . ."[19]

Moreover, when evaluating the public good to be derived from the exercise of the police power, the courts frequently tip the scales in response to the type of "good" involved. When matters of public health or safety are directly involved, much weight is given to the public "good" and little to the burden placed on the regulated person.[20] But where the public "good" is merely a matter of comfort or convenience, the courts will take a more critical look at the necessity of achieving it.[21]

In the light of the emphasis placed on energy conservation by state and federal energy officials, such an object might well fall within the category heavily favored by the courts.

It should be noted that the above tests apply to exercises of the police power by the state or any of its subdivisions. An exercise by a political subdivision must also be pursuant to police powers delegated to it by the state.[22]

2. Commerce and Supremacy Clauses

Energy conservation legislation must also comply with the Commerce and Supremacy Clauses. Tests for both are cogently discussed in the report for Project L/R-4, "Legal and Regulatory Policy Aspects of Energy Allocation." That report will be referred to in analyzing the constitutionality of various proposed energy conservation measures, below.

In general, energy conservation legislation which affects commerce must be analyzed in accordance with the following general rules:

(1) If there is a need for nationally uniform regulations, no state may enforce its own regulations.

(2) If the state statute deals with a matter of local concern, it is more likely to be upheld.

(3) The state action may not unduly burden or discriminate against interstate commerce.

(4) If the state statute constitutes a traditional exercise of the police power, it stands a better chance of being upheld.[23]

The Supremacy Clause negatives all state legislation in subject areas pre-empted by federal legislation. In areas where Congress has been silent, a state is free to act.

Since relatively little federal energy conservation legislation has been enacted, most state conservation measures probably would not run afoul of the Supremacy Clause.

Later in this report the tests for federal pre-emption set out in the report for Project L/R-4 will be applied to the various conservation proposals presented.

3. Taxing

The primary constitutional limitation upon the state's taxing authority is the Commerce Clause. States may not enact taxes which discriminate against or place an undue burden

upon interstate commerce.[24]

Ad valorem property taxes may not be levied upon goods "in the course" of interstate commerce.[25] However, once goods have reached their destination in a state, that state may tax them.

Instrumentalities used to convey commodities interstate, such as airplanes, railroad cars, and trucks, are subject to a different test for ad valorem taxation. They must have acquired a "taxable situs" in the taxing state to satisfy due process requirements. Generally, the instrumentality will be deemed to have a taxable situs within a state if it receives benefits or protection from the taxing state.[26] If an instrumentality has more than one taxable situs, apportionment will be required to avoid double taxation. The method of apportioning the value of the instrumentalities will be upheld if it approximately reflects the extent of average physical presence within the taxing state.[27]

Generally, sales taxes are valid as long as they are imposed on any sale consummated <u>within</u> the state, even if the goods came into the state through interstate commerce. Such taxes are considered, not a direct burden on interstate commerce, but a reasonable method of reimbursing the state for the cost of governing the jurisdiction in which the sale takes place.[28] If, however, the sale actually takes place outside the state, the tax is invalid.[29]

The state also may levy use taxes on goods used in the state as long as the tax does not discriminate against goods brought in from out of state.[30]

Taxes on interstate carriers such as trucks may be imposed only to the extent they fairly compensate the state for the cost of providing roads and administering traffic regulations. In determining fairness the court will consider:

(1) the formula used to determine the tax,

(2) legislative and judicial determinations as to the purpose of the tax, and

(3) how the revenues are appropriated.[31]

B. Limitations Imposed by the Texas Constitution

Energy conservaton measures enacted by the legislature must also accord with the Constitution of the State of Texas.

Article I, the Bill of Rights limits the state's powers by prohibiting the state from, among other things, making any ex post facto law, retroactive law or any law impairing the obligation of contracts, §16; taking, damaging, or destroying private property for public use without just compensation, §17; making any irrevocable or uncontrollable grant of special privileges or immunities, §17; depriving any citizen of "life, liberty, property, privileges or immunities . . . except by the due course of the law of the land," §19; and allowing perpetuities or monopolies, §26. Article I, §28, vests in the legislature the sole power to suspend laws.

Allegations that these provisions were violated might well

form the basis of legal challenges of future state actions in the energy field--particularly of actions regulating or prohibiting private activity. It appears from Texas case law, however, that the courts will be hesitant, except in unusually oppressive circumstances, to strike down any legislative exercises of the police power. Such enactments generally enjoy a presumption of validity.[32] Moreover, to defend against claims that a particular governmental action violates either the contract clause, §16, or the due course clause, §19, the state need show only that the action was a reasonable measure providing for the health, safety, good order, comfort, or general welfare of the community.[33] Finally, even though a regulation results in diminution in value or complete loss of private property, it is not a "taking" under §17 and compensation of the private owner will not be required.[34]

III. ENERGY CONSERVATION IN THE RESIDENTIAL/ COMMERCIAL SECTOR

A. Introduction

The residential/commercial sector includes all homes, apartments, farms, fisheries, construction contractors, wholesale and retail trade, finance and insurance companies, real estate and law offices, hotels and restaurants, repair services, health services, recreational services, schools, museums and art galleries, and all governmental institutions. Conservation measures which apply to one of these categories are applicable in many of the others. For that reason, and because their use of energy is similar, the residential and commercial sectors are grouped together (hereinafter referred to as "r/c sector").

Currently, the r/c sector accounts for about 20% of the energy consumed in the United States. The greatest uses of energy are for space heating and cooling, water heating, refrigeration and cooking. In the residential sector, these four uses account for 88% of total energy consumption and in the commercial sector, 77%.[35]

While the use of energy in the r/c sector is projected to decline as a percentage of total United States energy demand, nevertheless, within that sector, demand is projected to increase 41% between 1971 and 1990 (See Figure 1). Figure 1 is taken as a base projection throughout this report. References to energy savings in any sector would reduce the projected United States energy demand given in Figure 1.

Figure 1

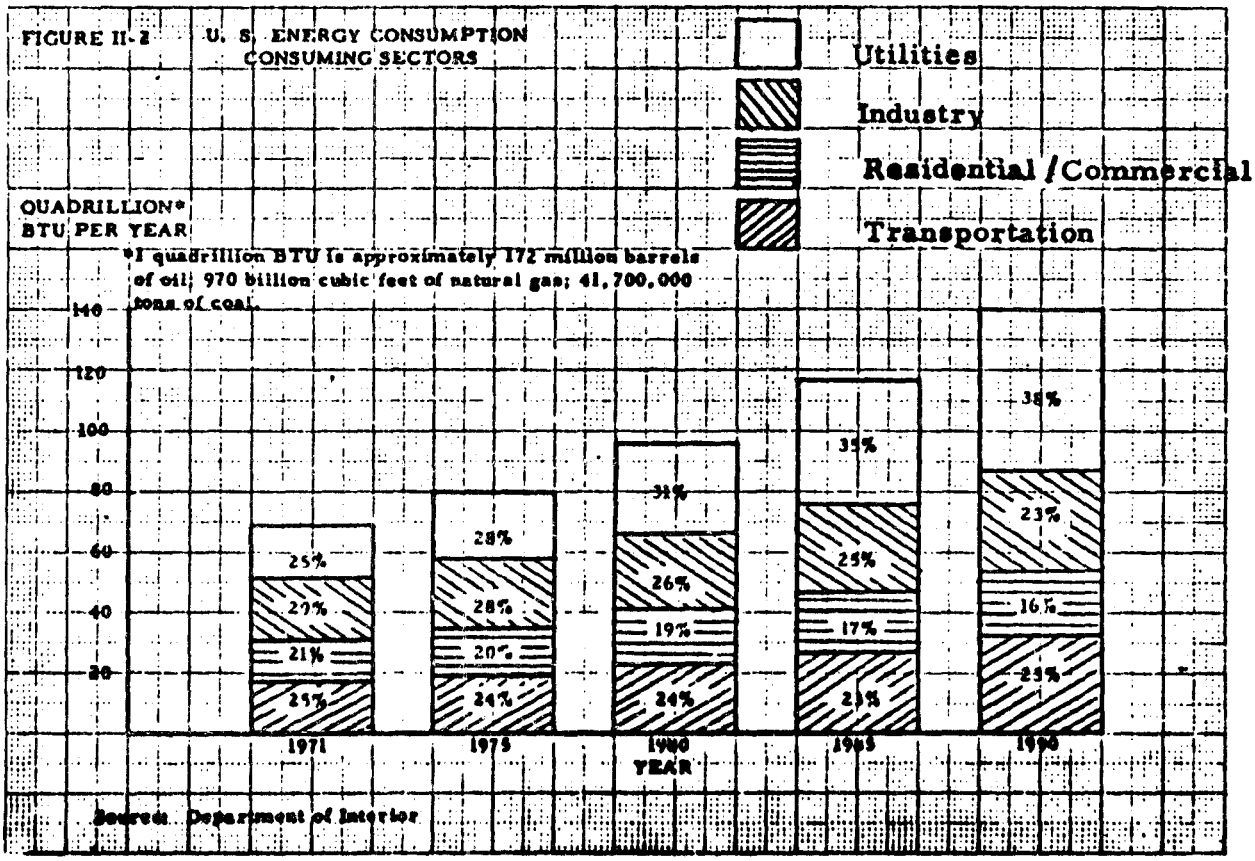


FIGURE II-2
U. S. ENERGY CONSUMPTION
CONSUMING SECTORS
Utilities
Industry
Residential / Commercial
Transportation
QUADRILLION* BTU PER YEAR
*1 quadrillion BTU is approximately 172 million barrels of oil; 970 billion cubic feet of natural gas; 41,700,000 tons of coal.
140
120
100
80
60
40
20
25%
29%
21%
25%
28%
28%
20%
24%
31%
26%
19%
24%
35%
25%
17%
23%
38%
23%
16%
23%
1971
1975
1980
1985
1990
YEAR
Source: Department of Interior

In the short term, little can be done to change the energy consuming systems, such as houses and office buildings, because their "birth" and "death" rate is so low (3% and 1% respectively).[36] Therefore, short-term energy conservation in this sector will have to come through system component changes and changes in the way consumers use energy in their homes and offices.

Without including modular integrated utility systems, solar power potential, or additional insulation for existing structures, the r/c sector conservation measures could result in a savings of 5,100 trillion BTUs within eight years.[37] This would be a 3.7% reduction in the total projected national consumption (See Figure 1 and Appendix A).

Table 1 shows a breakdown of r/c energy savings. It should be noted that these savings were to have been achieved by 1980, assuming that the conservation measures were initiated in 1972.

B. Building Codes

Building code standards provide many possibilities for energy conservation. According to numerous sources, the most significant savings in this area would come from improved insulation standards which would reduce the energy needed for space heating and cooling.[38] Mandatory storm windows, doors and weather stripping also would save energy. The actual amount of savings obtained by such legislation would depend upon the rate at which buildings subject to the new code replace buildings under the existing codes.

TABLE 1

Annual Energy Savings Possible in the Residential/Commercial Sector 1980

Residential	Savings Trillion of BTU/Year	Percent of Total Residential/Commercial Sector 1/	Percent of Total National Consumption All Sectors 2/
Space Heating and Cooling:			
(a) Existing homes	1,100	3.1	1.1
(b) New homes	1,100	3.1	1.1
Water Heating	250	.7	.3
Cooking	50	.1	.05
Refrigeration	100	.3	.1
Air Conditioning Equipment	500	1.4	.5
Other, including lighting, clothes drying, etc.	500	1.4	.5
Residential Total	3,600	10.1	3.7
Commercial			
All Commercial Uses	1,500	4.2	1.6
Total	5,100	14.3	5.3

This energy savings is equivalent to 2.4 million BPD of crude oil.

1/ Percentages calculated on basis of a denominator of 35.6 quadrillion BTU. This is the energy consumption of the residential/commercial sector including electrical energy, expected in 1980 as derived from Table A-1 (Appendix A).

2/ Percentages calculated on basis of a denominator of 96 quadrillion BTU which is the total national consumption for all sectors expected for 1980 as shown in Table A-1 (Appendix A).

Source: Office of Emergency Preparedness, The Potential for Energy Conservation, Oct. 1972.

Codes regulating interior and exterior lighting systems could also conserve energy. In particular, the use of flourescent, mercury vapor and high intensity discharge lighting rather than incandescent lighting would reduce energy demands and in addition provide longer lamp life.[39]

Equipment efficiency also could be a building code requirement. The energy efficiency of heating and cooling systems vary greatly. For example, in a variation of end-use controls the code could forbid the installation of relatively inefficient electric heating systems.

Legal Analysis.

Any regulation adopted to improve both commercial and residential structures would be subject to the police-power test discussed earlier. Because building codes are a traditional form of the exercise of police power, the reasonableness of the particular code would be the only issue.

Although the state almost certainly has the power to enact a state-wide building code to promote energy conservation, counties in Texas, with a minor exception, lack authority to establish building codes.[40] The only building code provisions in areas not within the county exception or the jurisdiction of a municipality are, therefore, the federally imposed regulations made in home financing programs. To the extent that these regulations would parallel state standards adopted to conserve energy, the federal regulations would supersede the state regulations. Conventionally financed suburban or rural homes and commercial buildings are exempt from the federal regulations.

Implementation of a state-wide building code could take many forms. The legislature could enact a detailed set of standards or it could delegate the authority to do so to a state board. In general, under Texas law, the Legislature may delegate power to an administrative agency to perform fact-finding and quasi-legislative functions that it cannot efficiently perform itself.[41] Provided that the Legislature declares a policy and fixes a primary standard, it may authorize the agency to promulgate rules to carry the legislation into effect.[42] The Legislature may also empower an agency to enforce such rules and the underlying statute through the issuance of orders following evidentiary hearings.[43] Agency rules and orders would be subject to judicial review.[44] Delegation of authority to promulgate energy-conserving standards would have the virtue of allowing for continuous review and updating to reflect new technology. A third approach would be to delegate the powers necessary to enact a building code to Texas counties.

C. End Use of Fuel Controls

One method to obtain the most efficient use of energy resources is to limit or prohibit specific uses. In Texas, such limitations have existed only in the industrial area.[45]

Placing limits on uses found in the r/c sector presents several problems. Generally, such users are dependent on city-owned or franchised utilities for services. Alternative sources are not likely to be available. In a state as varied as Texas,

it would be exceedingly difficult to enact a statute allowing for regional variations in supply and demand for different energy sources. Enforcement of sweeping end-use controls on the millions of residences and small businesses in the state would be expensive and difficult.

Legal Analysis. Equity problems would arise if homeowners and small businesses were forced to install new heating or cooling equipment to comply with end-use controls. If the economic balancing test of Pennsylvania Coal Co. v. Mahon,[46] were applied, such retroactive regulations might be held a taking of private property (the net cost of complying with the new standards) for which the state would have to pay just compensation to the owners. On the other hand, some courts have upheld against constitutional attack new fire and health structural standards imposed, at considerable cost to the private owners, on existing commercial buildings.[47] The courts might similarly uphold energy-conserving structural standards, at least for small businesses. Nevertheless, a statute controlling end uses of energy sources would present fewer legal and equitable problems if it were applied only to new users. Needed flexibility could be provided through the delegation of standard-setting and enforcement authority to an administrative agency.

D. Regulation of the Sale of Goods

Reduced consumption of goods that require large amounts of energy to manufacture or to use is another popular conservation

suggestion. Such a reduction might be brought about through prohibition of the sale of certain goods or through warning purchasers of such goods, via labeling, of the goods' energy inefficiencies.

Prohibition of the Sale of Goods: Legal Analysis.

A statute prohibiting the sale of energy-inefficient goods might conflict with the Commerce Clause by placing a burden on interstate commerce. On the other hand, the prohibitory standards would not discriminate between goods manufactured in Texas and goods manufactured in other states; the standards would effectuate no economic protectionism motive.[48] Moreover, the purpose of any such statutory prohibition -- to prevent the serious threat to public health and the economy which a shortage of vital energy sources would produce -- would clearly be within the police power of the state.[49]

Indeed, if energy waste can be seen as just as serious a threat to the public health and welfare as impure food or deceptive practices, even inspection and rejection at the border could be supported.[50] It is not likely, however, that this public policy argument would succeed in supporting border rejection of inefficient goods unless Congress had enacted legislation which either clearly invited such state action, or did not by necessary implication prohibit it.[51]

Recent cases which specifically deal with the prohibition of the sale of products have generally upheld the state's

exercise of its police power against Commerce Clause arguments. Frequently, the holding is based on the fact that the legislation involved does not directly regulate an instrumentality of commerce.[52] Therefore, a single uniform national standard is not required in the absence of federal action.

In a key case, a New York law which prohibits the sale of goods made from the skins of crocodiles, alligators, and caimans was upheld against challenges based on the due process, commerce and supremacy clauses.[53] The New York law, which was passed to protect endangered species, had a more extensive list than the federal list of endangered species. The court dismissed the argument that the federal listing and protection of endangered species had preempted the area, even though the legislation prohibited the importation and sale of foreign goods. The court also held that the loss of profits was not a denial of due process.[54]

In a case involving the import and sale of avocados from Florida, a California statute which based its test for maturity of avacados on varieties grown in that state was upheld in its application to Florida avocados of a different variety. The Florida avocados had been certified as mature under federal regulations. The court held that the federal regulations did not conflict and avocados could be subjected to both tests.[55]

The Oregon Bottle Law prohibits the sale of beverages except in specified containers.[56] The Oregon court of Appeals

recently rejected a Commerce Clause challenge to the law on the ground that a state, in the absence of pre-emptive federal regulation, may control the sale of goods so long as the regulations do not discriminate against interstate commerce.[57]

The chief argument against state regulation in this area is that 51 different standards for goods which are mass-produced would be an undue burden on commerce and also would violate the concept of a national common market. Before such a wide disparity in regulations would occur, however, it is more likely that Congress would act or that manufacturers would comply with the strictest set of standards. Even if goods were specially manufactured for a particular state, it is the citizen of that state that would pay the additional cost. State legislative action would be a greater incentive for Congressional action than a mere request. The not insubstantial lobbying efforts of industry would probably be used to obtain federal legislation if varying state standards were burdensome and, especially, if the courts uphold those standards.[58]

Efficiency Labeling: Legal Analysis. An energy efficiency labeling statute presents fewer legal problems than a statute prohibiting the sale of goods. The only realistic legal argument that could be made would be that federal action has preempted the area. But thus far, no federal legislation requiring labeling for energy conservation purposes has been enacted.

The United States Department of Commerce has adopted a voluntary labeling program[59] and is currently supporting passage of a statute using energy efficiency ratios.[60] Opponents to this bill would prefer the use of operating costs which they claim will be easlier to understand for comparison purposes.[61] If labeling legislation is not enacted before the close of this session of Congress, it will have to be reintroduced. The probability of preemption in the near future is not great.

The Department of Commerce has developed specifications for the voluntary labeling of room air conditioners which became effective May 1, 1974.[62] Specifications are pending for central air conditioners, household refrigerators, home freezers, clothes washers, dishwashers, clothes dryers, kitchen ranges, kitchen ovens, water heaters and comfort heating equipment. The Department of Commerce program, therefore, will cover major appliance purchases.

A State statute which requires labeling of major appliances would probably be easier to administer if it incorporated the specifications issued by the Department of Commerce. If federal legislation is enacted directing a different labeling technique, a statute which incorporates the federal standard would not necessarily be preempted unless the federal legislation prohibits any state enforcement.[63]

E. Tax Incentives.

Tax incentives are an effective method of encouraging energy conservation. Some are already in use. For example, nonreturnable containers are taxed when sold with contents to the consumer, while returnable containers are exempt. Thus, fewer bottles produced means less energy wasted.

Other energy conscious tax exemptions could encourage the installation of additional insulation, storm windows and doors in buildings. Since cities which levy the sale tax under the Local Sales and Use Tax Act cannot themselves create such an exemption,[64] the Legislature would have to act. It could create a new energy conservation classification which would exempt such items as a class from the Limited Sales, Excise and Use Tax statute.[65]

Other incentives such as a property tax exemption for the value of energy conservation improvements and an exemption for experimental projects in the use of solar energy and modular integrated utility systems in the residential and commercial sector could only be enacted by a constitutional amendment. Article VIII, Section 2 of the Texas Constitution voids any exemption not specifically authorized.

IV. ENERGY CONSERVATION IN THE TRANSPORTATION SECTOR

A. Introduction

The transportation sector accounts for 25% of the energy consumed in the United States, and is projected to stay at approximately that percentage of total energy demand[66] (See Figure 1). Within the transportation sector, the breakdown of energy use is:[67]

- -- Automobiles - 55%
- -- Trucks - 21%
- -- Aircraft - 7.5%
- -- Railroads - 3.5%
- -- Buses, waterways (freight), pipelines - 3%
- -- Passenger travel by boat, pleasure boating, non-bus mass transit - 10.4%

The transportation sector is 96%-dependent on petroleum for fuel, and most of that fuel is gasoline.

Measures to conserve energy in the transportation sector fall into four categories:

-- Reduction in demand for transportation services

-- Shift of transportation demand to more efficient modes

-- Technological changes to improve efficiency of petroleum-dependent transportation

-- Technological changes to allow greater use of non-petroleum-dependent transportation.[68]

State government can make the greatest impact in the first two areas, demand reduction and transportation mode shift. As in the residential/commercial sector, short-term conservation in the transportation sector must focus on reducing demand by changing consumer's attitudes about energy consumption. Consumer education and tax incentives will prove useful in this regard.

In order to effect large-scale shifts in use of transportation modes and to develop new technologies, however, long-range planning becomes essential. The modal changes that will yield greater effeciency are:

-- Shift urban passengers from automobile to mass transit

-- Shift inter-city passengers from air to ground travel

-- Shift inter-city freight from highway to rail (See Table 2)

-- Consolidate urban freight movement.

Figure 2 and Table 2 show the historical energy efficiency of several modes of passenger and freight transportation, and emphasizes the energy conservation potential which appropriate shifts in mode of transportation can bring.

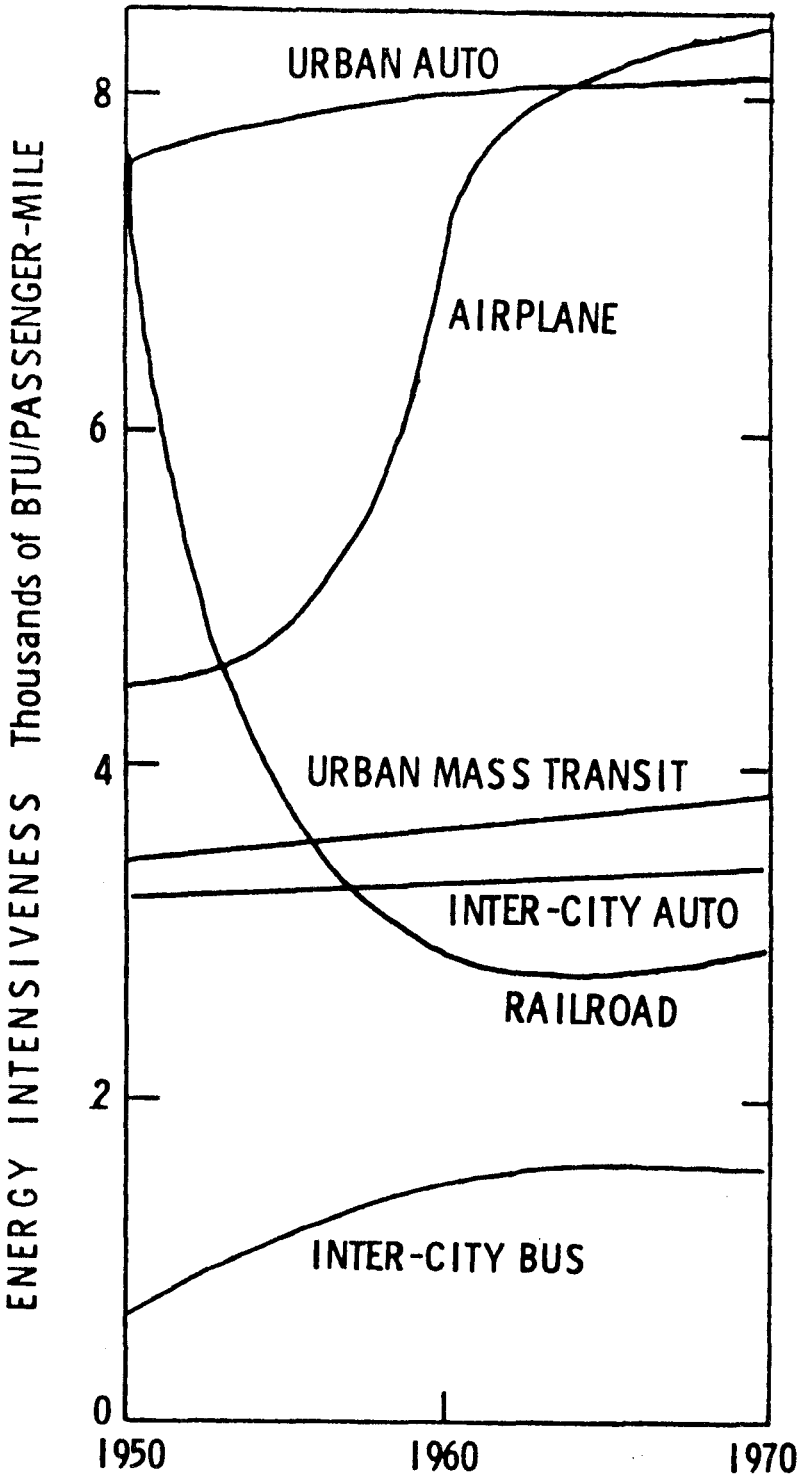


FIGURE 2

HISTORICAL VARIATION IN ENERGY-INTENSIVENESS OF PASSENGER MODES

Source: Hirst, E. and Moyers, J., **Potential for Energy Conservation, 1973**

TABLE 2

ENERGY-INTENSIVENESS FOR FREIGHT TRAFFIC

Mode	EI, BTU/TM[1]
Aircraft	42,000
Trucks	2,800
Intercity, Average	1,100
Waterway	700
Rail	650
Pipeline	450
Supertanker	150

[1] Assuming 136,000 BTU/gal.

Source: E. Hirst and J. C. Moyers, "Potential for Energy Conservation," March 1973 (6).

B. Regulatory Policy

Transportation controls are well accepted as an exercise of the state's police power. Commercial passenger and freight transportation are regulated by both the federal and state governments. In these areas, a coordination and reconciling of policies by all the regulatory bodies could insure that governmental policies do not cause inefficient use of energy for transportation. The failure to set the rates of carriers at all times by the cost of carriage has often led to inefficient use. In Texas, transportation policy is formulated and enacted by a number of independent agencies.[69] Informal coordination is obtained through the Governor's Inter-Agency Transportation Council. One alternative is a single transportation agency that could coordinate the use of all types of transportation in Texas.

C. Automobiles

Because automobiles consume over one-half of the energy used in transportation, a major effort has already begun to conserve the fuel they use. The required 55 mile-per-hour speed limit and FEO allocations are federal efforts to reduce the use of fuel by automobiles.[70] State efforts are also possible.

1. Vehicle Equipment

Motor vehicle efficiency varies by the types of equipment used. The equipment requirements in Texas are specifically enumerated by statute.[71] Radial tires, for example, help obtain better

mileage per gallon of fuel. The inspection statute could be amended to require their use.

2. Taxation

Taxation of equipment such as air conditioners which lowers the efficiency of a vehicle has been suggested as an incentive to eliminate or reduce their use. As a practical matter, the usefulness of such taxation for energy conservation is doubtful. The optional equipment involved, such as air conditioners, power steering, and automatic transmissions, already are expensive additions to the basic vehicle cost. Texas also levies a 4% sales tax on automobiles, thereby taxing all options at 4%.[72] Because of the hot Texas summers, Texans have an additional incentive to purchase automobile air conditioners.

If it were determined that higher cost would reduce substantially the purchase of energy-consuming options, the formulation of the tax would present several difficulties. For example, would it be fair to levy a flat rate tax on the purchase of an air conditioner that would be the same whether the air conditioner is installed in a Honda Civic or a Chevrolet Impala? The only way to measure the energy conservation benefits of reducing the purchases of an option would be the reduced efficiency of each vehicle resulting from installation. The levy of the option tax, if it truly were to have conservation benefits, would require the determination of a complex set of factors for each make and model of

automobile equipped with various options. If the tax were not formulated in this manner, incentives to obtain the most efficient vehicle would be lost.

A tax levied according to the horsepower of the engine also would be an incentive to use the most efficient vehicle. This tax would be much simplier to apply. A factor in the tax should be the type of carburetor system used because, for example, a four barrel carburetor uses more fuel than a two barrel carburetor. An additional factor might also be the type of transmission because standard transmissions use less fuel. This tax could take the form of a sales tax or a yearly tax in addition to license fees already charged. These three factors also change the weight of the vehicle.

A study of the United States Environmental Protection Agency tests for the miles per gallon obtained by various automobiles reveals two things: First, efficiency is not a direct correlate to the size of the engine; and, second, efficiency is a direct correlate to the weight of the vehicle.[73] Therefore, a motor vehicle license fee graduated by weight could offer direct conservation benefits. Because major energy-consuming options add to the weight of the vehicle, they would be included in the yearly license fee. The Environmental Protection Agency (EPA) report indicates that efficiency is greatest for vehicles weighing 2,000 pounds or less. Under the current Texas motor vehicle fee structure, the owner of a 2,000-pound vehicle pays a fee of 60 cents cwt, while the owner of a 6,000-pound vehicle pays 50 cents cwt.[74] A revision of the

motor vehicle fee statute could be made to provide a greater differential between the vehicles according to weight and structured to recognize the greater efficiency of vehicles weighing 2,000 pounds or less.

3. Efficiency Labeling

Automobile manufacturers and dealers are currently using a large and confusing variety of mileage test results in their advertising programs. Many dealers place stickers giving EPA results for the vehicle weight classification next to the window price sticker on new automobiles. All dealers could be required by state statute to use window stickers for new motor vehicles giving the EPA mileage results both for the weight classification and the particular model equipped with the same type of transmission. Consideration might also be given to requiring the posting of average operating costs. Some dealers currently use window stickers which include average operating cost information. The United States Department of Transportation has embarked upon a two-part automotive energy efficiency program. Data developed by the Department will furnish a more definitive basis to determine labeling requirements.[75]

4. Mandatory Efficiency Requirements: Legal Analysis

The constitutionality of prohibiting the sale of vehicles which do not meet efficiency standards is more doubtful than in the area of goods. The commerce clause has as its basic thesis the maintenance of a national common market without local protectionist barriers. The regulation of goods can be upheld as a

valid exercise of the police power against commerce clause arguments where the regulations are nondiscriminatory and do not have an economic protectionism motive. Motor vehicles are more than goods involved in commerce. Automobiles are also a mode of transportation and therefore might be treated as a mode of interstate commerce. In commerce clause cases, state actions are held invalid which unduly burden a mode of interstate commerce.[76] An additional policy argument may be made that due to the mobility of the United Stated population, a uniform national system is required.[77] In view of the constitutional problems and the fact that manufacturers already are attempting to meet the demand for more efficient vehicles, fewer legal problems would result if state action is limited to efficiency labeling of vehicles and taxation policies designed to encourage the use of the most efficient vehicles.

D. Mass Transit

The increased use of alternative transportation modes is the most frequently suggested method to reduce the amount of fuel consumed by automobiles. According to studies done for the Texas Mass Transportation Commission, the bus is the best mass transit mode for Texas.[78] This is because no Texas city currently has the population density required for the installation of new fixed rail systems.

Federal aid for the development of mass transit systems is currently limited to capital expenditures.[79] However, the greatest costs for bus systems are operating costs. Fare box revenue has not been adequate to cover these costs and subsidies are required.

Since many of the mass transit systems in Texas are publicly owned, subsidies must come from other public revenue sources. Cities have strict limitations on possible revenue sources for transit subsidies.[80] The state could alter this by authorizing additional tax levies. The state currently levies two excise taxes on transit system fuel.[81] An exemption from these fuel taxes would be an administratively simple subsidy method because it does not require collecting taxes and then dispersing funds. Consideration might also be given to the implementation of a direct subsidy program by the state.

An added difficulty for publicly-owned transit companies is that counties are unable to own, operate or contribute to the operation of transit systems, even though the system may operate outside the city limits. The Metropolitan Rapid Transit Authorities Act[82] was designed to create a new district for this purpose. Houston is the only area which currently meets the specifications. A broader statute could be enacted to authorize the cooperation of cities and counties in operating and funding transit systems. As in the building code and zoning areas, if counties possessed broader powers, a major barrier to implementing energy conservation measures would be removed.

E. Increased Cost of Fuel

It has been suggested that fuel costs should be increased by

taxation to lower demand. Texas currently levies two excise taxes on motor vehicle fuel.[83] Diesel fuel, while more efficient in vehicle use, is taxed at a higher rate. Consideration might be given to taxing diesel fuel at a lower rate than gasoline.

Raising the cost of fuel by taxation would raise equity questions. Already hurt by dramatically increased fuel costs, low and middle income individuals would be forced to spend a greater amount of their incomes on fuel. If adequate mass transit systems were available, the equity problem would be less for metropolitan area residents than for the large number of Texans who reside in small towns and rural areas without any mass transit system. Another problem with this method is that the conservation effect of the increased cost is unknown.

F. Limit or Prohibit the Use of Automobiles in Specified Areas

1. Restrictions on Use

The use of alternative transit modes would be encouraged by restricting the use of automobiles in specific areas such as central business districts. Such restrictions also would have environmental benefits by reducing automobile emissions in congested areas.

For a restriction on automobiles in a downtown area to be reasonable, adequate alternate transportation must be available. Taxis could be allowed to operate in the restricted area, as well as buses or other forms of mass transit. Adequate access for service and delivery vehicles must also be provided. The most workable restriction on motor vehicle traffic might be a prohibition of automobiles with access allowed for taxis, mass transit

modes, service and delivery vehicles. Pedestrians and bicycle riders would also have access.

Legal Analysis. The United States Supreme Court has long recognized that the use of streets and highways is a privilege subject to reasonable restraints and conditions.[84] Texas cities have been specifically granted authority by the legislature to control the use of their streets.[85]

The legal issues involved in limiting the use of automobiles in specified areas revolve around the right of access possessed by property owners abutting the streets and the easement of use possessed by the public. The equitable issue is what happens to individuals who reside in those areas.

The public need for imposing these regulations under the police power arises out of new conditions. The public welfare would be aided in several key areas by the reduction of the number of motor vehicles in congested areas. Regulations to protect and promote the economic welfare of the people have been recognized as a valid exercise of the police power.[86] The crisis of the winter of 1973-1974 has shown the severe economic consequences of energy shortages. Regulations to protect the public health are traditional exercises of the police power. The elimination of air pollutants is a national policy, and transportation controls are a major part of the plans to reduce pollutants.[87] Finally, pedestrian and bicycle safety would be aided by reducing the number of motor vehicles in congested areas.

It is well-settled law in Texas that an abutting property owner possesses an easement of access.[88] The Texas Constitution

gives the property owner the right to be compensated for damages caused by the loss of access.[89] An owner or lesseee of property abutting a street or alley also has statutory authority to enjoin the vacating or closing of a street or alley if he has not released his claims for damages or recovered them in a condemnation proceeding.[90] This right of recovery is limited to occasions where the exercise of eminent domain has caused the loss of access, while damages to access in not compensated where police power regulation has caused the loss. The owner of a parking garage cannot recover damages for loss of access when a permit to cut an additional entry across a sidewalk is denied.[91] The right to recover is also limited by the rule that if reasonable access remains, no compensable injury has occurred. Therefore, one of two public streets may be closed without compensation if the remaining street furnishes reasonable access.[92]

An abutting owner does not have the right to be compensated for losses caused by the rerouting of traffic.[93] There is no right to continue having traffic pass in front of a place of business. Therefore, the loss of automobile traffic to the area because of transportation controls would not be a compensable injury for businessmen.

The issue then becomes the extent to which the access of abutting property owners can be restricted. The cases have never considered whether an abutting owner has the absolute right to use an automobile for access, primarily because generally all individuals have the right to use automobiles on public streets.[94] It would appear, however, that there is not such a right. Since the closing

of a street is not compensable where reasonable access is otherwise provided, reasonable limitations on the type of traffic permitted on an open street should not give rise to a right to be compensated. In this instance, access would be available but the means of access restricted. This is the same policy which supports exclusive bus lanes and bicycle lanes currently in use across the United States. A legislative finding that the use of automobiles in specific areas should be restricted because their use is hazardous and and detrimental to the public welfare should support such regulations unless it can be shown by a challenger that such a finding was arbitrary and capricious.[95]

2. Economic Incentives to Limit Use: Legal Analysis

Increasing the cost of automobile use in central business districts is an alternative to complete prohibition. In theory increased cost would encourage the use of mass transit systems. The cost could be increased directly by parking taxes and tolls and relatively by employee encentives.

An increase in the cost of parking in the central business district, for example, would be an incentive to switch to mass transit. The United States Supreme Court has recently upheld a City of Pittburgh ordinance that levied a 20% gross receipts tax on parking garages against the attack that the tax was so high it was taking of property, especially since Pittsburgh operated parking garages.[96]

Texas cities do not have statutory authority to levy a gross receipts or occupation tax on the operators of parking facilities or a surcharge on the users of them. Under Texas law, cities must be specifically given the authority to levy a tax for revenue.[97] Cities may charge license fees to cover the cost of administering the licensing statute, but a fee substantial enough to serve as a cost deterrent to using automobiles in central business districts would be subject to attack as a revenue measure. The legislature can remove these difficulties by enacting a statute allowing cities to tax the operators or users of parking garages or lots. Alternatively, the state could levy the tax, or perhaps a joint tax such as the Sales Tax could be levied.

Another economic incentive to use mass transit would be to charge a toll for using the streets in specified areas. Texas cities do not have statutory authority to levy a toll. Again, the legislature could provide that the toll be levied by the cities or levy a joint toll which the city and state would share.

The primary difficulty with implementing a transportation controls program would be the lack of sufficient mass transit facilities to meet the sudden increase in demand. Because the reasonableness of the traffic controls probably will be the key issue in any litigation, an adequate transportation alternative to the automobile must be available. The prohibition of the use of automobiles in specified areas would have to be coordinated with the development or expansion of a mass transit system and

implemented in phases using other transportation controls such as taxes or tolls. While cities do possess general police powers to regulate the use of their streets and could enact regulations using these powers, specific statutory authority to enact transportation controls would furnish additional support because legislative findings have a presumption of reasonableness.[98]

Employers may encourage employees to car pool or use transit systems with a number of incentives, ranging from a $1 token for lunch in the company cafeteria to lower or no parking fees for vehicles used in car pooling. The possible legal issue for private employers with unionized members is the prohibition against unilaterally changing employee wages and benefits.[99] In such cases, the employer would probably have to negotiate the incentive proposals with the union.

G. The Relationship of Transportation to Land-Use Planning

A major change in transportation modes could cause changes in land use. For example, prohibiting automobiles in one area may cause a movement of business to areas not controlled. Thus, the availability of mass transportation may become as important in land-use decisions as the availability of water and sewer service. Transportation controls could be envisioned and handled in much the same way as zoning. One way to conserve energy might be to switch land-use planning decisions from requiring the adequate parking be provided to requiring that mass transportation be available.

Legal Analysis. Here again, the reasonableness of such a

requirement will depend on whether adequate mass transportation is actually available. An additional factor would be the amount of traffic connected to the business.

In zoning cases where building permits have been limited due to the lack of capacity of water and sewerage systems, the restrictions have generally been upheld where the city or county was making an effort to expand those systems based of the projected growth of the area instead of on a predetermined self-limitation on growth.[100] Transportation controls used as a factor in determining land use and the issuance of building permits must therefore be made pursuant to an overall plan which is designed to meet the transportation needs of the community. As a concrete example, Community A as a part of its Master Plan projects that an extension of its mass transit routes to Point A will be needed in two years due to community growth. Community A makes the capital cost of such an extension part of a capital improvements bond issue. Pursuant to this plan, Community A may deny Beta Corporation's application for a building permit to construct at Point Z a plant employing 1,000 people until the transit route has been extended.

Even with the use of a master plan, zoning and building controls, the movement of business to uncontrolled areas cannot be completely halted by cities or counties because of the lack of adequate land-use powers. The need for transportation and land-use coordination furnishes further support for the enactment of land-use planning legislation which gives this authority to some governmental body.

V. ENERGY CONSERVATION IN THE INDUSTRIAL SECTOR

A. Introduction

Texas industrial energy consumption accounts for more than 56.3% of the total Texas energy use.[101] This is very different from the national industrial consumption figure of 29% (See Figure 1). Therefore, the projected 5 to 10% reduction in the United States demand[102] resulting from the suggested conservation measures could have a substantial impact on the total energy demand in Texas.

The industries within the industrial sector may be grouped into the following categories: Primary Metal Industries; Chemicals and Allied Products; Petroleum Refining and Related Industries; Food and Kindred Products; Paper and Allied Products; and Stone, Clay, Glass and Concrete Products. Table 3 lists national statistics for the energy each group uses. It is encouraging that the general trend within the industrial sector is toward greater efficiency. Tables 4 and 5 show that only four industries in the industrial sector have experienced an increase in their ratio of energy used to value added (Tobacco Manufactures - no. 21; Apparel and Other Finished Fabric Products - no. 23; Lumber and Wood Products - no. 24; Printing, Publishing and Allied Industries - no. 27).[103] However, these four industries are responsible for only two percent of industrial sector energy demand. The only other industry showing a decreased energy efficiency is Textile Mill Products (no. 22), with an increased ratio of energy consumed to value added which is insignificant.

TABLE 3

Industrial Fuel Consumption by Major Users

Industry Group	Coal	Natural Gas	Petroleum Products	Electricity	Total Energy
Primary metal industries	2,838	863	306	1,291	5,298
Chemicals and allied products	666	1,219	1,426	1,626	4,937
Petroleum refining and related industries	*	1,012	1,589	225	2,826
Food and kindred products	263	593	134	338	1,328
Paper and allied products	467	341	211	280	1,299
Stone, clay, glass, and concrete products	406	449	87	280	1,222
Subtotal	4,640	4,477	3,753	4,040	16,910
All other industries	976	4,781	721	1,572	8,050
Total	5,616	9,258	4,474	5,612*	24,960

*Input basis.

Source: U. S. Department of Interior, Bureau of Mines, **Minerals Yearbook 1968.**

TABLE 4

COMPARISON OF VALUE ADDED IN MANUFACTURING WITH POWER AND FUEL CONSUMPTION
IN THE INDUSTRIAL SECTOR
(Feedstocks not Included)

Standard Industrial Classification	Ratio of Value Added in 1967 to Value Added in 1962*	Ratio of Energy Used in 1967 to Energy Used in 1962	Ratio of Increase in Energy Used to Increase in Value Added	Rate of Growth in Value Added--1962 to 1967 (percent per year)	Rate of Growth of Energy Used--1962 to 1967 (percent per year)	Ratio of Rate of Growth in Energy Used to Rate of Growth in Value Added
20	1.20	1.13	0.942	3.7%	2.5%	0.676
21	1.19	2.00	1.681	3.5	14.9	4.257
22	1.26	1.28	1.016	4.7	5.1	1.085
23	1.32	1.67	1.265	5.7	10.8	1.895
24	1.31	1.58	1.206	5.5	9.6	1.716
25	1.39	1.25	0.899	6.8	4.6	0.677
26	1.30	1.25	0.962	5.4	4.6	0.852
27	1.35	1.40	1.037	6.2	7.0	1.129
28	1.39	1.31	0.942	6.8	5.5	0.809
29	1.50	1.22	0.813	8.5	4.1	0.482
30	1.49	1.29	0.866	8.3	5.2	0.627
31	1.19	1.00	0.840	3.5	0.1	0.029
32	1.21	1.16	0.959	3.9	3.0	0.767
33	1.37	1.20	0.876	6.5	3.7	0.569
34	1.52	1.43	0.941	8.7	7.4	0.851
35	1.63	1.29	0.791	10.3	5.2	0.505
36	1.50	1.41	0.940	8.5	7.1	0.835
37	1.27	1.23	0.969	4.9	4.2	0.857
38	1.37	1.25	0.912	6.5	4.6	0.708
39	1.70	1.29	0.759	11.2	5.2	0.464
Sector total	1.38	1.24	0.899	6.7	4.4	0.657

* Constant dollars.

Sources: 1963 Census of Manufactures.
1967 Census of Manufactures.
Stanford Research Institute.

TABLE 5

Major Group 20--Food and Kindred Products

Major Group 21--Tobacco Manufactures

Major Group 22-Textile Mill Products

Major Group 23--Apparel and Other Finished Products Made From Fabrics and Similar Materials

Major Group 24--Lumber and Wood Products, Except Furniture

Major Group 25--Furniture and Fixtures

Major Group 26--Paper and Allied Products

Major Group 27--Printing, Publishing, and Allied Industries

Major Group 28--Chemicals and Allied Products

Major Group 29--Petroleum Refining and Related Industries

Major Group 30--Rubber and Miscellaneous Plastics Products

Major Group 31--Leather and Leather Products

Major Group 32--Stone, Clay, Glass, and Concrete Products

Major Group 33--Primary Metal Industries

Major Group 34--Fabricated Metal Products, Except Ordnance Machinery, and Transportation Equipment

Major Group 35--Machinery, Except Electrical

Major Group 36--Electrical Machinery, Equipment, and Supplies

Major Group 37--Transportation Equipment

Major Group 38--Professional, Scientific, and Controlling Instruments; Photographic and Optical Goods; Watches and Clocks

Major Group 39--Miscellaneous Manufacturing Industries

Source: Office of Emergency Preparedness, The Potential for Energy Conservation, Oct. 1972.

The areas where conservation can be affected include:

-- Improvements in the efficiency of industrial processes

-- Replacement of inefficient equipment

-- Recycling of materials

-- Reusing of components

-- Development of more efficient technologies

The areas where the largest savings can be developed are in the increased efficiency of industrial processes and the replacement of inefficient equipment. The second greatest potential for energy savings is in recycling and reusing materials. The savings that can be expected from the development of new technologies are indeterminate.

B. Taxation

Industrial users are currently exempted from the sales tax levied on the sale of electricity and natural gas.[104] Removal of this exemption would be one step in raising energy costs to encourage greater efficiency. The removal of the exemption, however, would not be directly related to energy conservation because it is levied on the sales price rather than the amount consumed. This would be corrected if rate structures were inverted or flat rate. An advantage in removing the exemption would be the increased revenues received by cities which levy the sales tax, thereby furnishing more potentially available funds for mass transit.

Exemption from property taxes would be an incentive to industrial installation of equipment for energy conservation and partici-

pation in experimental energy conservation projects. Such an exemption would require a constitutional amendment in order to comply with the requirements of Article VIII, §2 of the Texas Constitution.

An energy users tax levied on the amount of electricity or natural gas consumed would be more directly related to energy conservation. It could be either a flat rate or progressive tax. There are no Texas constitutional provisions which would prohibit the levy of this tax by the legislature.

The increased industrial energy costs would probably simply be passed directly to the consumer. There would be some incentive to cut energy costs where possible to reduce the increase in price to the consumer. The incentive would be to prevent a loss in demand.

C. Recycling and Reusing Components

The reuse of materials has the potential of substantial energy savings. An example is the container field where disposable containers for soft drinks require 4.1 times as much energy as returnable containers.[105] The reuse of returnable bottles and other reusable items offers greater potential for energy conservation than recycling.

Texas already offers some encouragement for the use of returnable soft drink bottles by exempting these containers from the sales tax which is levied on disposable bottles.[106] Currently wrapping, packaging, packing and package supplies and containers are exempt from the sales tax. An extension of this tax to the

disposable materials with an exemption for reusable materials would provide additional incentive. This would mean that disposable packaging materials would be taxed when sold to the industrial or commercial purchaser while reusable items would continue to be exempt.

Oregon has demonstrated that legislation prohibiting disposable bottles and cans can be effective. The major policy argument made against the Oregon bottle law is that it restricts the market area of beverage manufacturers. The Oregon courts have upheld the statute against arguments that it is unconstitutional under the due process and commerce clauses.[107]

Most items that can be recycled or reused are currently contributing to the solid waste disposal problems of Texas. Jurisdiction over solid waste is split at the state level between the Texas Water Quality Board (industrial) and the Texas State Department of Health (municipal).[108] Texas counties and other political subdivisions may also regulate solid waste disposal sites.[109] It is clear that the purpose of regulation is to protect "the health, welfare, and physical property of the people."[110] There is no statutory authority for either the Water Quality Board or Health Department to require that specific types of solid waste be recycled rather than buried in a sanitary landfill or disposed of by incineration.

Certain types of materials are already being reclaimed at some disposal sites. Agricultural solid waste recently was a major disposal problem. The lack of chemical fertilizers increased demand

for agricultural solid waste as a fertilizer and also partially solved the solid waste disposal problem. Increased energy costs and shortages in other areas could further encourage reuse and recycling of other items.

While economics will encourage recycling and reuse where profitable, the role of the state in managing solid waste disposal to encourage such recycling could be strengthened in several ways. The state could offer aid to political subdivisions for establishing reclamation facilities. The Texas Solid Waste Act could be amended to clearly state that recycling and reclamation of solid waste for the purpose of energy and other resource conservation recycling and reuse is the policy of Texas and is to be implemented by the rules and regulations of the Water Quality Board and State Health Department.

D. End Use of Fuel Controls

End-use controls have been proposed as a method of eliminating wasteful uses of energy sources. The purpose would be to assure that each energy source is used in the most efficient and beneficial way.

1. Natural Gas

A major example of a wasteful energy practice is the use of natural gas as a boiler fuel. The fuel proposed for substitution is coal which is not currently used in any substantial amount in Texas. The feasibility of conversion to coal by industrial concerns depends on the availability of coal and the environmental controls

needed to meet the requirements of the Clean Air Act and Texas Clean Air Act. The energy shortages which have developed in Texas could furnish incentives to seek coal as a dependable energy source despite the cost of installing air pollution control equipment.

Texas industries have used natural gas as their major fuel because of its historic abundance and cheap cost. The natural gas consumed by industry is 44% of the total energy consumed in Texas.[111] Therefore, any major limitations on the use of natural gas by industry could have substantial economic impact.

Because from an energy conservation standpoint coal should be substituted for natural gas, particularly as a boiler fuel, coordination between the policies of the Texas Air Control Board and energy conservation must be obtained. An additional problem will be the requirements of the Environmental Protection Agency (EPA) issued under the Clean Air Act. In cases of conflict, the statutory requirements of the Clean Air Act will prevail under the supremacy clause.[112] The validity of regulations issued by the Administrator is subject, of course, to court challenges.

Legal Analysis. There is precedent in Texas for the control of the end use of natural gas to prevent waste. These controls were imposed in an earlier era of oversupply rather than overdemand. The natural gas statute prohibits the use of sweet gas to manufacture carbon black when sour gas is available, and its physical waste, for example, by flaring in conjunction with the production of oil.[113]

The United States Supreme Court has held that the current Texas statutes restricting end uses of natural gas are constitutional.

Writing for the Court, Mr. Justice Brandeis stated that the legislature may regulate natural resources for the purpose of conservation as well as to prohibit physical waste.[114]

Article 6008 could be revised to allow a broader interpretation of waste of natural gas.[115] It is arguable that Article 6029 empowers the Railroad Commission to issue end-use controls through its rule-making authority. Subsection (1) empowers the Commission to issue regulations prohibiting the waste of oil and gas as defined in other sections, while Subsection (8) directs the Commission to do "all things necessary for the conservation of crude petroleum, oil and natural gas and to prevent the waste thereof, and shall make and enforce such rules, regulations or orders as may be necessary to that end."[116] (Emphasis added.)

However, Article 6029 authorizing the Commission to make rules and regulations was first enacted in 1919 and last amended in 1935. Article 6008 was first enacted in 1899 and subsequently amended many times. The specific statute controlling the end use of sour and sweet gas, Article 6008a, was first enacted in 1937, and amended in 1947 and 1949. The legislature apparently felt that either the Commission did not have authority under Article 6029 to issue such regulations or that additional legislative guidance was needed. Amendment of Article 6029 could clarify the Commission's regulatory authority in this area.

The FPC regulates interstate natural gas and has established priority rankings for uses. United States Supreme Court decisions have held that FPC regulation totally preempts state regula-

tion.[117] Therefore, state regulation of the end use of interstate gas will face strong preemption arguments.

In support of state regulation, two arguments may be made. First, that state regulation does not conflict with FPC regulation and serves to further the policy of the FPC. Second, that the state regulation only operates when the natural gas has come to rest in Texas, is no longer in interstate commerce, and operates on both intra- and inter- state gas. State regulations which directly conflict with FPC orders would be invalid under the policy that where it is impossible to comply with both a state and federal regulation or statute the federal will prevail.[118]

It could be to the benefit of Texas' economic future well being to encourage the substitution of other fuels for natural gas unless major new reserves are discovered. Whether specific statutory controls would be of benefit is doubtful. In a situation where other, more efficient, energy sources were available and the sole reason for using natural gas is lower cost, statutory control could serve a useful energy conservation purpose. The most feasible statutory control might be a phasing out of specific uses of natural gas geared to the projected availability of substitute fuel sources. To prevent the creation of unnecessary legal barriers to more efficient energy uses, the statute might delegate to a state agency or the Governor's Office the authority to issue regulations for the purpose of insuring the most efficient use of fuel for industrial purposes. Where fuel substitution is not considered feasible, equipment changes to use waste heat recovery systems and other

technical advances could be required. This would be particularly effective under a state allocation system where the priority of the user could be lowered for failure to demonstrate efficient use and conservation practices.

2. Other Energy Sources

Petroleum products used by industry represent 9.5% of the total energy consumption of Texas. Electricity used by industry is 2.5% of the total energy consumed in Texas. These figures may appear minor when compared to the 44.3% of total energy consumption which industrial natural gas use represents.[119] Together, industrial use of petroleum products and electricity exceeds the total amount of all energy consumed by the Texas residential/commercial sector. These energy uses, therefore, are far from minor.

A switch from natural gas to fuel oil is generally a poor one for energy efficiency and conservation. To prevent this, a statute which provides for elimination of specific uses of natural gas could also provide that the substitute fuel will be more efficient.

Electricity, although considered less efficient than natural gas for many uses such as space heating and cooling, probably could be left out of any end-use regulations. Electricity has the advantage of being the end product of generation from numerous fuel sources. Substitution of more efficient for the less efficient of these fuel sources in conjunction with equipment efficiency requirements could be the area of concentration for fuel efficiency in the use of electricity. Industries could be encouraged to pursue the goal of more efficient use of electrial energy by using this informa-

tion as part of a priority ranking system for natural gas.

VI. ENERGY CONSERVATION IN THE ELECTRIC UTILITIES SECTOR

A. Introduction

The electric utility sector consists of electric power generating facilities. Texas is in a unique position with respect to electric power generation: its utilities are not subject to Federal Power Commission regulation. This is due to the intrastate nature of Texas' utility industry.

There are two electric power systems in Texas which are interconnected, and 70 other electric power companies. The two major systems are the Texas Interconnected System (TIS), which provides 80 percent of all electricity consumed in the state, and the Texas Municipal Power Pool (TMPP).[120] These two systems and the independent companies are cooperatively associated in the Electric Reliability Council of Texas (ERCOT). ERCOT is not connected with other power pools outside the State of Texas,and is therefore exempt from Federal Power Commission regulation.

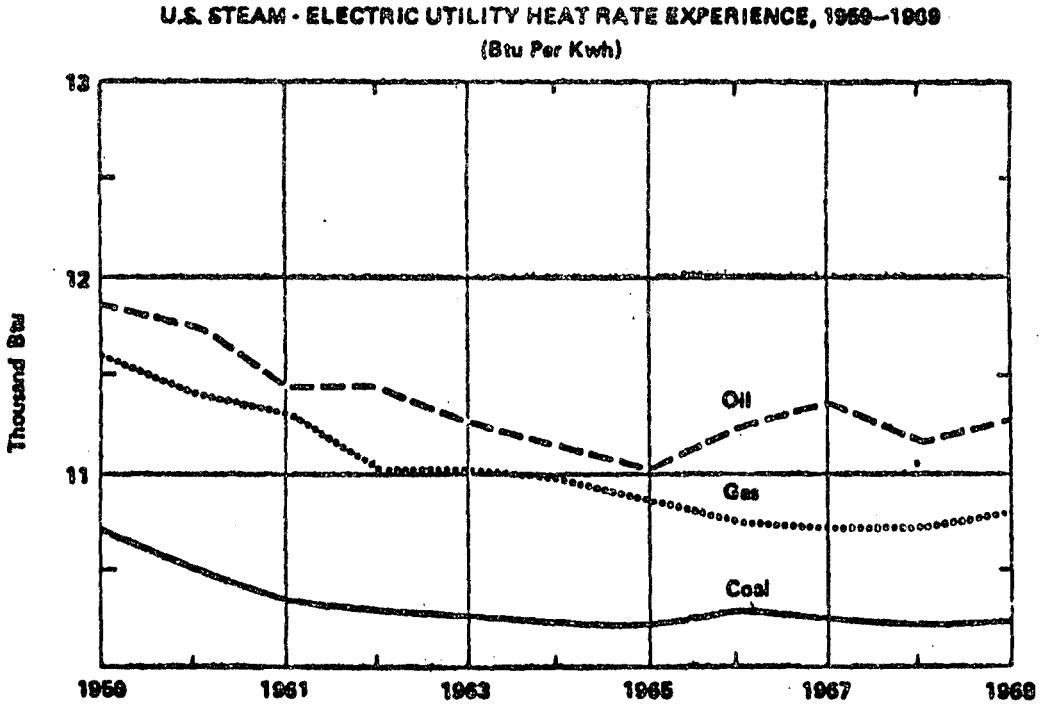
The electric utility sector is the fastest growing of the four energy-consuming sectors. Between 1971 and 1980, electric utilities are projected to increase their demand for electricity by 72 percent, and between 1980 and 1990, by 78 percent. Currently, energy consumption in the electric utility sector is 25 percent of the total U.S. demand. It has been projected that by 1980 it will be equal to industrial consumption at 28 percent of the national energy use, and by 1990 it will require 38 percent of all energy consumed in the U.S. (See Figure 1).

Electric utilities in Texas consume 12.9 percent of the total energy used in the state to create electricity which is 5.9 percent of the energy used in Texas.[121] In conversion to electricity, therefore, a substantial amount of energy is lost. On the national level, electric utilities in 1970 consumed the equivalent of 7.1 million barrels of oil per day of which the equivalent of 4.6 million barrels per day were lost in conversion.[122]

In Texas before 1973, electric utilities were 95 percent dependent on natural gas as a boiler fuel. Since then, due to the shortage of natural gas, utilities have had to switch, to some extent, to middle distillates and residual fuel oil. Still, natural gas remains the predominant fuel for electric power generation.

The national trend for efficiency of the utility sector has steadily increased.[123] Figure 3 shows the average heat rates of electric utilities using coal, gas and oil. From Figure 3 it can be seen that coal is the most efficient fuel for electric power generation, that gas is second, and oil is last. It should be noted that as conversion efficiency increases, thermal discharges decrease proportionately, thereby reducing a major environmental stress. It is not encouraging that Texas has been moving from natural gas to oil. At present, there are two coal-fired plants in the state, one owned by Alcoa in Milam County, and the other owned by Texas Utilities Company in Freestone County. Texas Utilities

Figure 3



Source: National Coal Association, Steam-Electric Plant Factors, 1971.

Note: The efficiency of a power plant is measured in terms of its heat rate, which is defined as the Btu input of the boiler fuel per kilowatt hour output.

is planning two more coal-fired plants, and the City of Austin in cooperation with the LCRA is planning a coal-fired plant near LaGrange.

The problem of achieving energy conservation in the utility sector can be approached in four ways:

-- Reduce demand for electricity in other sectors;

-- Smooth out daily demand cycle;

-- Switch power generation to more abundant fuel sources;

-- Increase efficiency of power generation.

B. Regulatory Policy: Legal Analysis.

Utility rate regulation can be used to accomplish several conservation purposes. Rate levels can affect the demand for electricity by increasing cost. Rate levels can also be structured to increase the cost of electricity used during peak periods to reduce peak demand and smooth out demand cycles. This is the basis of telephone rate structures.

The rate structures of electric utilities are regulated by cities, towns and villages.[124] Gas Utilities are subject to rate regulation under these articles, but are also subject to state regulation if the utility involved appeals to the Railroad Commission.[125] In addition, the Railroad Commission has the right to regulate the rates of intrastate gas pipelines[126] and may establish a rate structure which gives a different rate to different users.[127] Ultimately, the rates of both electric and gas utilities are subject to judicial review following the exhaustion of

administrative remedies.

Rate structures are subject to attack as discriminatory. The courts, however, have upheld the use of different rates to different classes on the basis that such differences were "reasonable."[128] Although Texas cases do not go into the economic justification for lower rates to larger users, it can be justified in the electric utility as an attempt to reach marginal cost pricing in a declining cost industry.

An inverted rate structure (where higher rates per unit are charged with increased usage) is true economic discrimination because the cost per unit of serving the user decreases with increased usage when fixed costs are not increased by adding additional capacity. The courts and legislature have not, however, concerned themselves with the problems of economic discrimination, but have looked toward discrimination between two consumers in the same or similar circumstances.[129] Therefore, an inverted rate structure, although never before tried, apparently would not be subject to the legal attack of discrimination.

An additional consideration before enacting an inverted rate structure is that the fixed costs of an electric utility in terms of generation capacity and transmission costs are substantial and that under state law the company is entitled to a fair rate of return on its reproduction cost new less depreciation.[130] A rate structure is formulated to give the utility the opportunity to earn the rate of return established on this reproduction cost new

rate base. If the inverted rate structure does reduce demand, the new rate structure must give the company an opportunity to earn that amount. The popular belief among small users that use of an inverted rate structure will reduce costs to them, therefore, is not necessarily true. All users will be required to meet a larger portion of the electric utility's fixed costs due to the probable loss in revenues.

A second attack on an inverted rate structure would theoretically be possible, although the United States Supreme Court since Nebbia[131] and Hope Natural Gas[132] has ceased to review the wisdom of economic legislative controls using the doctrine of substantive due process. This is the theory that the regulation imposed must be reasonably related to the purpose for which it was imposed. Therefore, if it can be shown that the use of an inverted rate structure is not a reasonable means to accomplish energy conversation, such a rate structure could be struck down.

Another possible rate structure change is to institute higher rates for energy consumed during peak-load periods or "peak-load pricing." The Federal Power Commission is currently studying the use of both types of rate structure changes. A third possibility would be a flat rate for all usages.

The use of a rate structure as a tool of conservation is based on two assumptions: first, that the price elasticity of large user demand is sufficient to result in a substantial reduction in use; and second, that such reduction is not due to turning

to alternative sources, such as company installed generators which could be even less efficient in energy use. If the first is not true, the changed rate structure will not accomplish its purpose and could result in substantially higher and unjustifiable returns to electric utilities. If the second is not true, energy waste instead of conservation will result.

These two problems can be dealt with by a coordinated program of energy conservation. The problem of windfall profits due to regulatory lag can be handled with taxes, or requirements that the money be utilized for conversion to new nergy sources or research development programs. Governor McCall of Oregon has suggested that such profits be allowed and used in research and development programs. The second problem can be dealt with by a prohibition of private generator installations, except as emergency equipment and end-use controls which would probhit the sale of gas or oil for such a purpose. Reliance on higher market prices alone might not work in this instance because the changed rate structure would have no relationship to actual costs.

A significant problem with revised rate structure proposals is that the consumer has been faced with steadily rising costs in all areas, and any proposal to increase utility rates in a manner not justified by cost would be subject to great public opposition. Any sudden increase probably would not substantially lower use over the immediate period because consumer behavior in all purchases is governed by expectation.[133] It would result in delaying

new purchases or purchases of a different sort if the change in cost is viewed as long term. It is also hard to measure how much convenience is worth to the consumer.

A major problem with implementing any new rate structures in Texas is the lack of a state utility commission. Utilities are essentially free from any true regulation except in large cities with sufficient funds to acquire expert advice. Implementation of rates for conservation purposes on a state-wide basis is impossible to assure under the present statutory scheme.

The legislature could preserve the current system of local control and still implement new rate structures by amending the statutes to require the use of a flat rate for all users or an inverted rate structure or of peak-load pricing or a combination of any of these. The legislature could also enact a simplified procedure for determining the projected revenues a utility is entitled to seek. The currently used reproduction cost new rate base presents great administrative difficulties. An alternative would be to use original cost with any needed adjustments made to the rate of return -- for example, an automatic inflation adjustment factor. If a state utilities commission is formed, these same changes in the method of rate regulation would be an appropriate subject for its consideration.

C. End Use of Fuel Controls

In Texas, electric utilities currently rely almost entirely on natural gas. Current shortages of natural gas have caused some

conversion to fuel oil which is a move toward greater inefficiency. Electric utilities are making plans for construction of nuclear power plants and coal-fired power plants.

The Texas Railroad Commission currently has exercised its powers to establish priorities among users of natural gas during curtailments. Litigation is pending in which the issue is whether the Commission has even broader allocation authority.[134] The area is extremely sensitive because of natural gas shortages and the problems involved in conversion to coal-fired plants. Equitable problems arise because the needs of the residential/commercial users of electrical power are in conflict with the needs of direct industrial consumers.

It appears that electric utilities fully realize that conversions must be made to other fuels. However, as in the industrial sector, it would be advisable to delegate to a state agency, probably the Railroad Commission, the authority to order conversion to other fuels. The problems of conversion, including the meeting of necessary environmental safeguards and obtaining the capital necessary to make those conversions should be part of the statutory guidelines given the Commission or agency. If it becomes apparent that electric utilities are not converting to coal when and where possible, at that time steps should be taken to encourage necessary conversions.

VII. SUMMARY OF ALTERNATIVES

The following is a summary by sector of the major proposals

which would require action by the Texas Legislature.

A. Residential/Commercial Sector

1. Building Design

The conservation of energy in building design can be implemented by adoption of a state building code statute which would require the administrative agency to develop, in addition to traditional building code requirements, criteria based on energy usage per square foot, to control lighting installation, and to control the energy efficiency of equipment.[135] Counties could be given the authority to enact and/or enforce the building code requirements.

2. End Use of Fuel Controls

In this sector, the consideration of end-use legislation could be limited to empowering an administrative agency to prohibit the installation of new equipment on the basis of the type of energy required for its operation.

3. Regulation of Goods

Although a national standard of energy efficiency for major appliances and equipment would be preferable, the Congress has not made progress in establishing mandatory national standards. To aid the citizens of Texas, therefore, the legislature could consider enactment of a statute providing for the adoption by an administrative body of efficiency requirements and efficiency labeling.[136]

4. Taxation

To enable the legislature to provide a property tax exemption for energy conservation purposes, consideration could be given to passage of a constitutional amendment allowing such exemption for submittal to Texas voters. The legislature could also consider providing exemptions from the sales tax for items purchased for energy conservation purposes.

B. Transportation Sector

1. Regulatory Policy

Consideration could be given to creation of a single transportation agency for the State of Texas which could enforce as well as develop an overall transportation policy and plan. The advantage gained by this step would be to insure that transportation modes would be used in the most efficient way. The legislature could also consider directing any transportation agency to insure that the true cost of transportation is reflected in the rate charged to prevent economic distortion in transportation choices.

2. Automobile Equipment

Amendment of the present statute[137] that specifies required equipment could be considered for the purpose of energy conservation additions such as radial tires.

3. Taxation

The following taxes could be considered as energy conservation incentives: horsepower tax, accessories tax, revised grad-

uated license tax.[138]

4. Vehicle Efficiency Requirements

While the legislature might be able to enact legislation directing the establishment of mandatory vehicle efficiency requirements which would be upheld against federal constitutional issues, such action is not recommended. It is, however, suggested that consideration be given to legislation which would establish labeling criteria for all new vehicles sold and, possibly, for used cars when the information is available (for example, used 1974 models).

5. Mass Transit

The major problem facing Texas communities in the mass transit area is the funding of operating costs. State subsidies could be considered. An indirect subsidy would be the exemption of mass transit companies from the payment of the state excise taxes on fuel.[139] It is also recommended that counties be authorized to jointly own, operate, or contract for mass transit systems with cities.

6. Restrict the Use of Automobiles

It is suggested that the legislature consider enacting a statute which would clearly say that a community may enact transportation control plans which would prohibit access for specified classes of vehicles for the purpose of energy conservation, pollution abatement, and the public welfare. An incentive to restrict the use of automobiles in downtown or other congested areas would be increased parking costs. It is suggested that the legislature

consider the levy of a gross receipts tax on parking lot businesses, or a tax on the charge for parking in private lots.

7. Land-Use Planning

While land-use planning is needed in many areas, it is of special importance in the transportation sector. The transportation needs of a community revole around where people live, work and shop. It is recommended that the legislature consider the enactment of a state land-use planning act.[140] It is additionally recommended that the legislature consider giving county government authority to make and enforce land-use ordinances, whether a state land-use act is passed or not.

C. Industrial Sector

1. Taxation

Industry is currently exempted from the sales tax levied on natural gas and electricity.[141] Removal of this exemption might be a conservation incentive. An energy users tax, directly related to the consumption of energy, is more nearly related to energy conservation. Both taxes, however, could be passed on to the consumer at least in part, thereby reducing the conservation incentive. Despite this possibility, it is recommended that the legislature consider the enactment of either or both. From the opposite view, tax exemptions may provide energy conservation incentives. In particular, a property tax exemption for demonstration projects and conservation improvements could be effective. The proposed constitutional amendment discussed under

residential/commerical sector-taxation, would allow such exemptions.

2. Recycling and Reclamation

It is recommended that the legislature consider amending the Solid Waste Act [142] to state that recycling and reclamation of solid waste for the purpose of energy and other resource conservation is the policy of the state to be enforced by the rules and regulations of the Water Quality Board and State Health Department. In conjunction with such an amendment, funds could be made available to assist in the development of community reclamation centers. It is also recommended that the legislature consider adoption of a statute similar to the Oregon Bottle Law[143] which would ban the sale of beverages and beer in nonreturnable containers.

3. End Use of Fuel Controls

One recommendation for end-use controls in this sector is possible clarification by the legislature of the Railroad Commission's authority to establish priorities and make allocations. Such clarification may not be necessary if a recent court decision giving the Commission broad allocation powers is not overruled.[144] It is also suggested that Commission be given the authority to order conversion to fuels other than natural gas when those fuels are obtainable and environmental regulations are met.

D. Electric Utilities Sector

1. Regulatory Policy

It is recommended that the legislature consider the creation of a public utilities commission to obtain more effective rate regulation throughout the state. The legislature should also consider revision of the method of rate regulation to simplify the method of determining needed revenues and to require the use of inverted or flat rate structures for the purpose of cutting the demand for electricity.

2. End Use of Fuel Controls

As in the industrial sector, it is recommended that the Railroad Commission be given the authority to order conversion from natural gas to other fuels when possible.

E. General Recommendations for State Government

1. Consumer Education

It is suggested that the legislature might fund a public information program for energy conservation. In conjunction with this program, the state could serve as an example of the conservation measures discussed for the residential/commercial and transportation sectors. This would generally be a continuation of existing practices and programs.

2. Mass Transit

The legislature might consider operating a demonstration mass transit project for the state employees in the Capitol complex, either alone or in cooperation with the City of Austin.

APPENDIX A

ENERGY CONSERVATION MEASURES AND PROJECTED SAVINGS IN THE RESIDENTIAL/ COMMERCIAL SECTOR [145]

A. Short-Term Measures

Immediate energy savings can be achieved through an educational program that encourages the following measures:

(1) Heating

- -- Set thermostats at lowest acceptable level during winter (68° F.)
- -- Clean and adjust furnace at least annually
- -- Close damper in unused fireplace
- -- Keep filters clean in air distribution system

(2) Air Conditioning

- -- Use air conditioning only when necessary
- -- Set thermostats at highest acceptable level during summer (78° F.)
- -- Plant a tree or shrub near windows to shield from sunlight
- -- Keep damper in unused fireplaces closed
- -- Keep condenser coils on air conditioner clean
- -- Keep filters clean in air distribution system
- -- Install blinds and draperies to reduce heat from sunlight, and draw blinds and draperies whenever possible and in unoccupied rooms

(3) Appliances

- -- Use full loads in washing machine and diswashers (See Table 6)

Table 6

COSTS OF OPERATING ELECTRICAL CLOTHES DRYERS

Usage: Number of Loads per week	*Energy Consumed Per Year (Kwh)*	*Annual Cost of Energy**
1	260	$ 6.14
2	520	12.27
3	780	18.41
5	1300	30.68
10	2600	61.36

* Cost per load: 11.8 cents; based on a 5,000-watt dryer

Lighting

As the list of appliances on page 32 points out, a great deal of the average family's electrical bill is due to use of lights in the home. Much of this could be cut

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

-- Repair faucet leaks promptly

-- Pull electric plug on "quick-on" TV's when viewing is concluded

(4) Lighting

-- Turn off lights in unused rooms

-- Use a minimum of lighting for all activities

-- Remove unnecessary lights

-- Use fluorescent lighting where applicable, rather than incandescent lighting

(5) Water heating

-- Wash clothes and dishes in unheated water

-- Keep heat transfer surface free of soot which interferes with heat transfer

See Table 7 for an itemized list of appliances, their annual energy consumption, and cost to the average American family.

Energy Savings

Approximately 1% of projected residential/commercial consumption (See Figure 1) could be saved over a three-year period.

B. Mid- and Long-Term Conservation Measures

(1) Appliances

Minimum acceptable efficiencies should be established and the energy consumption rate should be stated on each appliance, on its price tag, and on every advertisement which displays the selling price.

Table 7

ENERGY CONSUMPTION BY HOME APPLIANCES AND LIGHTING

	Annual Energy Consumption (kilowatt-hours)	*Annual Cost of Energy Consumed**
Air Conditioner	2000	$ 47.20
Electric Blanket	150	3.54
Can Opener	0.3	.01
Clock	17	.40
Clothes Dryer	1200	28.32
Coffee Maker	100	2.36
Dishwasher (with heater)	350	8.26
Fan (Attic)	270	6.37
Fan (Furnace)	480	11.33
Fluorescent Light (3 fix)	260	6.14
Food Freezer (16 cu. ft.)	1200	28.32
Food Mixer	10	.24
Food Waste Disposer	30	.71
Frying Pan	240	5.66
Hair Dryer	15	.35
Hot Plate (2 burner)	100	2.36
Iron (hand)	150	3.54
Light Bulbs	1870	44.13
Radio (solid state)	20	.47
Radio Phonograph (solid state)	40	.94
Range	1550	36.58
Refrigerator (frost-free) (12 cu. ft.)	750	17.70
Sewing Machine	10	.24
Shaver	0.6	.01
Television (black/white)	400	9.44
Television (color)	540	12.74
Toaster	40	.94
Vacuum Cleaner	45	1.06
Washer (automatic)	100	2.36
Totals	11,938 Kwh	$281.72

* Cost of electricity = 2.36 cents per kilowatt-hour

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

(2) Water Heating

Measures which can improve the efficiency of water heaters are:

(a) better insulation of the heater shell and hot water pipes

(b) replacement of the pilot light with an electric ignition system to start burners

(c) more efficient burners

(d) recovering the heat from hot water after use, perhaps to preheat incoming city water

(3) Cooking

Measures which can improve the efficiency of electric and gas ranges are:

(a) pots and pans that have insulated sides and tops

(b) pots and pans that fit tightly over an electric range, to minimize heat loss into the surrounding air; this is especially important in air-conditioned houses

(c) electric ignition of gas ranges, rather than by continuously burning pilot light

(4) Refrigeration

Measures which can reduce the power requirements of refrigerators are:

(a) increase in insulation

(b) motor compressor bearings that are more friction-free

(c) electric motors containing more copper and steel to reduce internal heating losses

(d) installation of a switch to shut off resistance heaters around the door opening when humidity conditions make the heat unnecessary

(e) it should be recognized that frost-free refrigerators use more electricity than conventional types (See Table 8)

(5) Air Conditioning

There are a wide range of efficiencies among air conditioners--the best are twice as efficient as the worst. State and/or federal legislation could set standards for air conditioner efficiency.

(6) Lighting

Measures which could improve the efficiency of lighting are:

(a) the development of an inexpensive, compact, fluorescent light which could be screwed into a common mazda socket

(b) an inexpensive device to turn off lights automatically after the last occupant has left the room

(c) discourage the use of gas lights

(7) Insulation[146]

The most significant energy savings in the residential/commercial sector can be gained from building designs which minimize heat loss in new structures and from increasing insulation in existing structures. The capital cost of additional insulation and the energy saved will vary with the climate, local prices, and the type of comfort system in use (gas or electric), but it has been demonstrated that increased insulation can reduce energy consumption and costs to the consumer. Table 9 outlines the insulation standards of the Federal Housing Administration's Minimum Property Standards (FHA-MPS) for a southern climate. Atlanta, Georgia is used as a case study and is cited here as an analogue to Texas' climatic characteristics and insulation requirements. Table 10 shows the amount of energy and money that can be saved

Table 8

COMPARISON OF STANDARD AND FROST-FREE REFRIGERATORS

Type of Refrigerator	*Annual Energy Consumption (Kwh)*	*Annual Cost of Energy Consumed*
Refrigerator (12 cu. ft.)	580	$13.69
Refrigerator, Frost-free (12 cu. ft.)	750	$17.70
Refrigerator-Freezer (14 cu. ft.)	950	$24.42
Refrigerator-Freezer, Frost-free (14 cu. ft.)	1500	$35.40
Refrigerator-Freezer, Frost-free (17 cu. ft.)	2100	$49.56

As you can see, frost-free refrigerators consume 50 percent more energy and dollars to operate than the standard model. The side-by-side refrigerator/freezer models use up to 45 percent more energy than the conventional models.

This table also points up the fact that the freezer frost-free accessory costs more to operate too. It's best to consider thoroughly whether your potential

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

Table 9

Reference Insulation System Cases

Region and Type of Heat	Amount of Insulation			
	Windows	Floor	Ceiling	Walls
Atlanta				
Gas heat	P	0	1-7/8	0
Gas heat with A-C	P	0	3-1/2	1-7/8
Electric heat	P	0	1-7/8	0
Electric heat with A-C	P	0	3-1/2	1-7/8
New York				
Gas heat	P	0	1-7/8	0
Gas heat with A-C	P	0	3-1/2	0
Electric heat	P	0	1-7/8	1-7/8
Electric heat with A-C	P	0	3-1/2	1-7/8
Minneapolis				
Gas heat	P	0	3-1/2	1-7/8
Gas heat with A-C	P	0	3-1/2	1-7/8
Electric heat	P	F	6	2-1/2
Electric heat with A-C	P	F	6	2-1/2

P - plain windows
F - foil and air gap

Source: National Technical Information Service, The Value of Thermal Insulation in Residential Construction: Economics and the Conservation of Energy, Dec. 1971.

Table 10

Economically Optimum Insulation and Resultant Savings

Region and Type of Heat	Economically Optimum Insulation				Annual Monetary Saving, $/yr	Reduction of Energy Consumption, %	
	Windows	Floor	Ceiling	Walls		Gas	Electricity
Atlanta							
Gas heat	P	F	3-1/2	3-1/2	6	31	-
Gas heat with A-C	P	F	6	3-1/2	6	20	7
Electric heat	SW	F	6	3-1/2	87	-	53
Electric heat with A-C	SW	F	6	3-1/2	63	-	39
New York							
Gas heat	SW	F	3-1/2	3-1/2	32	49	-
Gas heat with A-C	SW	F	6	3-1/2	37	50	26
Electric heat	SW	F	6	3-1/2	155	-	47
Electric heat with A-C	SW	F	6	3-1/2	135	-	42
Minneapolis							
Gas heat	SW	F	6	3-1/2	42	43	-
Gas heat with A-C	SW	F	6	3-1/2	45	43	18
Electric heat	SW	F	6	3-1/2	119	-	29
Electric heat with A-C	SW	F	6	3-1/2	122	-	29

P - plain windows
SW - storm windows
F - fwil insulation

Source: National Technical Information Service, The Value of Thermal Insulation in Residential Construction: Economics and the Conservation of Energy, Dec. 1971.

when housing insulation is increased in gas and electrically heated homes, with and without air conditioning. It is important to note that while the gas heated home can gain only a small monetary saving as compared to the electrically heated home, both types can gain significant savings in the amount of gas and electricity used. It should also be noted that storm windows are not economically justifiable in gas heated homes, and that 6" ceiling insulation is justifiable only in gas heated homes with air conditioning. Table 11 shows that monetary and energy savings are still possible when (a) the cost of insulation increases by 33%, and (b) the cost of energy increases by 33%. However, in the event that insulation costs increase 33%, the energy and monetary savings for the gas heated home are almost negligible, but in every other case savings are significant. Furthermore, it seems likely that energy costs will rise in the future to reflect increased production costs and pollution abatement costs; this would make additional insulation in existing structures increasingly attractive.

(8) Substitution of Natural Gas for Electricity

The data presented in Tables 10 and 11 point out that homes heated by gas require less insulation in temperate climates. This results from the greater efficiency of gas in space heating. Gas is also more efficient when used directly for water heating, clothes drying, cooking and possibly for refrigeration and air conditioning. Thus, energy may be conserved by using gas for these purposes in the home and office. While this increases the demand for gas in the residential/commercial sector, it decreases demand for electricity. In

Table 11

Economically Optimum Insulation and Resultant Savings with Increased Insulation or Energy Costs

Region and Comfort System	Insul. Cost x 1.33							Energy Cost x 1.33						
	Windows	Floor	Ceiling	Walls	Annual Saving, $	Gas Consumption Reduction, %	Electricity Cons. Reduction, %	Windows	Floor	Ceiling	Walls	Annual Saving, $	Gas Consumption Reduction, %	Electricity Cons. Reduction, %
Atlanta														
Gas Heat	P	O	3-1/2"	0"	9	6	-	P	P	3-1/2"	3-1/2"	18	31	-
Gas Heat + A-C	P	O	3-1/2"	3-1/2"	1	6	3	SW	P	3-1/2"	3-1/2"	15	38	14
Electric Heat	SW	P	3-1/2"	3-1/2"	43	-	48	SW	P	6"	3-1/2"	131	-	53
Electric Heat + A-C	SW	P	6"	3-1/2"	38	-	43	SW	P	6"	3-1/2"	96	-	39
New York														
Gas Heat	P	P	3-1/2"	3-1/2"	30	30	-	SW	P	3-1/2"	3-1/2"	64	49	-
Gas Heat + A-C	P	P	3-1/2"	3-1/2"	22	27	33	SW	P	6"	3-1/2"	69	50	26
Electric Heat	SW	P	6"	3-1/2"	138	-	43	SW	P	6"	3-1/2"	218	-	47
Electric Heat + A-C	SW	P	6"	3-1/2"	116	-	43	SW	P	6"	3-1/2"	189	-	42
Minneapolis														
Gas Heat	SW	P	3-1/2"	3-1/2"	33	38	-	SW	P	6"	3-1/2"	73	43	-
Gas Heat + A-C	SW	P	3-1/2"	3-1/2"	29	38	16	SW	P	6"	3-1/2"	77	43	18
Electric Heat	SW	P	6"	3-1/2"	167	-	33	SW	P	6"	3-1/2"	165	-	29
Electric Heat + A-C	SW	P	6"	3-1/2"	108	-	33	SW	P	6"	3-1/2"	168	-	29

Source: National Technical Information Service, The Value of Thermal Insulation in Residential Construction: Economics and the Conservation of Energy, Dec. 1971.

Texas, where the generation of electricity is dependent on natural gas, a decreased or slower rate of growth in demand for electricity, would ease the gas shortage experienced by electric utilities. Because gas used directly is more efficient than when burned under a boiler to produce electricity, the increased demand for gas in the residential/commercial sector could be offset by the diminished demand for gas by electric utilities.

(9) Solar Power

The use of solar power to augment space heating and cooling and water heating in the home and office is technologically feasible, and would reduce the demand for electricity and natural gas. However, solar heating systems are not economically competitive as yet with electricity and natural gas, but as energy costs continue to rise, solar power will become increasingly attractive. Solar power may be used initially as a supplementary system to electricity and natural gas and is particularly applicable in regions, such as Texas, that have ample sunshine.

(10) Modular Integrated Utility Systems (MIUS)

MIUS, which are systems for recycling waste heat, solid wastes, water, and for generating electricity, are technologically feasible. Such systems could be applied to single dwellings or groups of dwellings, such as apartment complexes or neighborhoods, to make more efficient use of energy. As yet, however, MIUS are not economically feasible on a wide scale.

APPENDIX B

ENERGY CONSERVATION MEASURES AND PROJECTED SAVINGS IN THE TRANSPORTATION SECTOR[147]

A. Short-Term Measures

(1) Automobile Transportation[148]

(a) Use

-- When possible, other more energy-efficient modes of transportation should be used (See Table 12)

-- Automobile trips should be planned to include as many activities as possible to reduce total number of trips; most auto trips are of less than five miles (See Table 13)

-- Car pools should be organized (See Tables 14 and 15)

(b) Efficiency

-- Highway speed limit should be reduced to 55 mph

-- Acceleration should be done smoothly, and excessive braking should be avoided by releasing accelerator pedal well in advance of braking

-- Engines should not be idled for longer than three minutes while waiting; in cold weather, slow driving for first quarter mile is preferable to racing motor or idling in order to warm engine

-- Engine should be kept in good repair and properly tuned

-- Tires should be kept properly inflated (radial tires are most efficient)

-- Gasoline tank should not be filled to overflowing

-- Air conditioners should be used only when necessary, and then at lowest comfortable temperature

-- Low or no-lead gasoline should be used; appropriate octane rating is preferable to one that is higher than required

Table 12

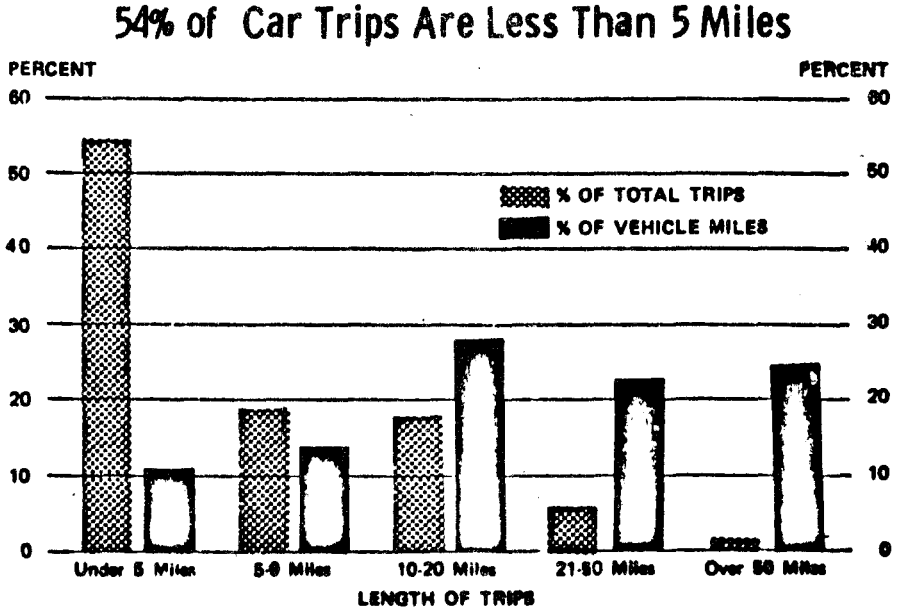
COMPARISON OF ENERGY EFFICIENCY OF TRANSPORTATION MODES

Mode	Energy (Btu/Passenger-mile)	Mode	Energy (Btu/Passenger-mile)
Intercity		*Urban*	
Bus	1,600	Bicycle	200
Railroad*	3,900	Walking	300
Automobile	3,400	Mass Transit	3,800
Airplane	8,400	Automobile	8,100

*Pullman Train - 10,460 Btu/Passenger-mile
(Source: E. Hirst and J. C. Moyer, Potential for Energy Conservation, March 1973.

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

Table 13



Source: Office of Emergency Preparedness, The Potential for Energy Conservation, Oct. 1972.

Table 14

Distribution of Passenger Car Trips, Travel and Occupancy by Major Purpose of Travel

Purpose of Travel	Percentage Distribution Trips	Travel	Average Trip Length One-Way (Miles)	Average Occupants Per Car
Earning a living:				
To and from work	32.3%	34.1%	9.4	1.4
Business related to work	4.4	8.0	16.0	1.6
Total	36.7	42.1	10.2	1.4
Family business:				
Medical and dental	1.8	1.6	8.3	2.1
Shopping	15.4	7.6	4.4	2.0
Other	14.2	10.4	6.5	1.9
Total	31.4	19.6	5.5	2.0
Educational, civic, or religious	9.4	5.0	4.7	2.5
Social and recreational:				
Vacations	0.1	2.5	165.1	3.3
Visit friends or relatives	9.0	12.2	12.0	2.3
Pleasure rides	1.4	3.1	19.6	2.7
Other	12.0	15.5	11.4	2.6
Total	22.5	33.3	13.1	2.5
All purposes	100.0%	100.0%	8.9	1.9

SOURCE: Preliminary results from the Nationwide Personal Transportation Survey, 1969-1970, Department of Transportation, Federal Highway Administration, Office of Planning.

Source: Office of Emergency Preparedness, The Potential for Energy Conservation, Oct. 1972.

Table 15

AVERAGE DOLLAR SAVINGS PER FAMILY FROM CAR POOLING TO WORK*

	Existing Habits	*Using Three-Man Car Pool*	*Average Savings Per Family*
Average Occupants/Trip	1.4	2.8	—
Average Car Trips/Year	360	180	180 trips
Average Car Miles Traveled/Year	3384 miles	1692	1692 miles
Gas Used (@ 13.3 miles/gallon	254 gallons	127	127 gallons
Gas Costs (@ 37.8¢/gallon)	$96	$48	$48/year
Other costs of Operation (@ 10.16¢/mile)	$344	$172	$172/year
Total Savings Per Family	—	—	$220/year

* Assumes a car pool of three people; allows for average absences of each person 17 days a year.

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

(c) Purchasing

-- Horsepower of car should not exceed typical driving requirements

-- The smallest car that meets a consumer's needs is preferable; gasoline consumption is directly related to the weight of the car (See Table 16)

-- Fuel economy should be considered; operating costs over a period of time vary significantly among different make cars of the same size

-- Optional electrical accessories reduce fuel economy and should be purchased only if needed

(d) Traffic Flow Efficiency

-- Reversible lanes

-- Driver advisory displays

-- Freeway ramp control

-- Traffic monitor systems

-- Reversible, one-way streets

-- Embargoed traffic zones

-- Pedestrian control/walkways

(2) Truck Transportation

Most conservation measures applicable to automobiles are also applicable to trucks; however, there are these additions:

-- Freight movement should be consolidated in urban areas, and "piggybacking" (freight of different firms carried on same truck) encouraged

-- Truck trips should be planned so that complete cargo capacity is used to and from destination

Table 16

DOLLAR SAVINGS PER HOUSEHOLD FROM OPERATING A COMPACT CAR 12,150 MILES PER YEAR[a]

	Medium Car	*Compact Car*	*Savings*
Weight (lbs)	3500	2500	—
Miles Per Gallon	13.5	19.5	6.0
Gallons Per Year	900	623	277
Dollars Spent Per Year[b]	$367	$235	$132

a) Excludes other operating costs which also will be less for compact car than medium sized car, thereby increasing savings.

b) Assumes medium sized car requires premium gasoline which costs 3¢ more per gallon than regular.

Source: Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation

-- Air resistance of trucks should be minimized

-- Operation of trucks should be banned during periods of high traffic congestion

-- Containerization should be encouraged to reduce handling requirements

(3) Bus Transportation

(a) Urban

-- Create priority bus lanes

-- Bus service should be made more attractive to induce consumer acceptance

(b) Inter-City

-- Bus service, including terminals, should be made more attractive and comfortable, to decrease automobile use (See Table 12)

(4) Rail Transportation

-- Railroad service should be expanded to interconnect major cities, in order to decrease automobile use (See Table 12)

(5) Air Transportation

-- Rates should be structured so that the real cost of short flights is reflected in the cost to the passenger; in the past the rates for long flights were used to subsidize unrealistically low rates of short flights. Such rate restructuring would encourage a shift of passengers to more efficient modes of transportation (bus, rail and car transportation are all more efficient than travel by air--See Table 12).

Energy Savings

It has been estimated that implementation of the savings outlined for the short term could result in an energy saving of 10% of projected growth (See Figure 1) for the next three years.

B. Long-Term Measures

(1) Automobile Transportation

-- A selective registration tax to discourage excessive auto weight, engine power and power attachments

-- Controls on auto size and number of occupants per auto permitted in central business districts, or other limitations on autos in the central city

-- Prohibition of autos in central city

(2) Truck Transportation

-- Improved engines; possible retrofitting of truck fleets

-- Increased freight consolidation

(3) Bus Transportation

-- Improved propulsion systems

-- Improved traffic flow systems (exclusive bus lanes, etc.)

-- Improved mass transit service ("Dial-a-Bus," etc.)

-- Reservation of city center travel for mass transit systems and pedestrians

(4) Rail Transportation

-- More extensive inter-city rail networks; improved passenger services (Note: This is of doubtful applicability in Texas.)

-- Improved rail freight handling (containerization)

(5) Air Transportation

-- Continue operating procedures to minimize energy consumption (perhaps a lowering of speed limits)

(6) Land-Use Planning

-- Design of neighborhoods and road systems (suburban and urban) should minimize the need for individual auto transportation and encourage walking, bicycling, and mass transit

(7) Other

-- Increased fuel costs to encourage mass transportation

-- Pilot implementation of promising alternatives to internal combustion engine

-- Improved propulsion systems (engine, drive train, etc.)

Energy Savings

It is estimated that implementation of the above conservation measures could result in a 20% reduction in projected energy consumption (See Figure 1) over the next eight years.

APPENDIX C

ENERGY CONSERVATION MEASURES AND PROJECTED SAVINGS IN THE INDUSTRIAL SECTOR[149]

A. Short-Term Conservation Measures

(1) Changing Inefficient Equipment and Processes

-- Increase the cost of energy by implementing a progressive industrial energy users tax

-- Initiate an educational energy conservation campaign

(2) More Efficient Use of Gas Equipment[150]

Table 17 shows the dependency of the industrial sector on various energy sources. The largest source of energy in the industrial sector is natural gas, and for that reason, special attention should be given to the conservation of gas.

A careful examination of production schedules and operating practices can help save a significant amount of gas with existing equipment.

-- Rearrange schedules to utilize process equipment for continuous periods of operation. This avoids numerous short runs and minimizes heat-losses.

-- Shut down or idle equipment at holding temperatures whenever production is interrupted (especially weekends). Do this with gas burners as well as steam-operated equipment fed from gas-fired boilers.

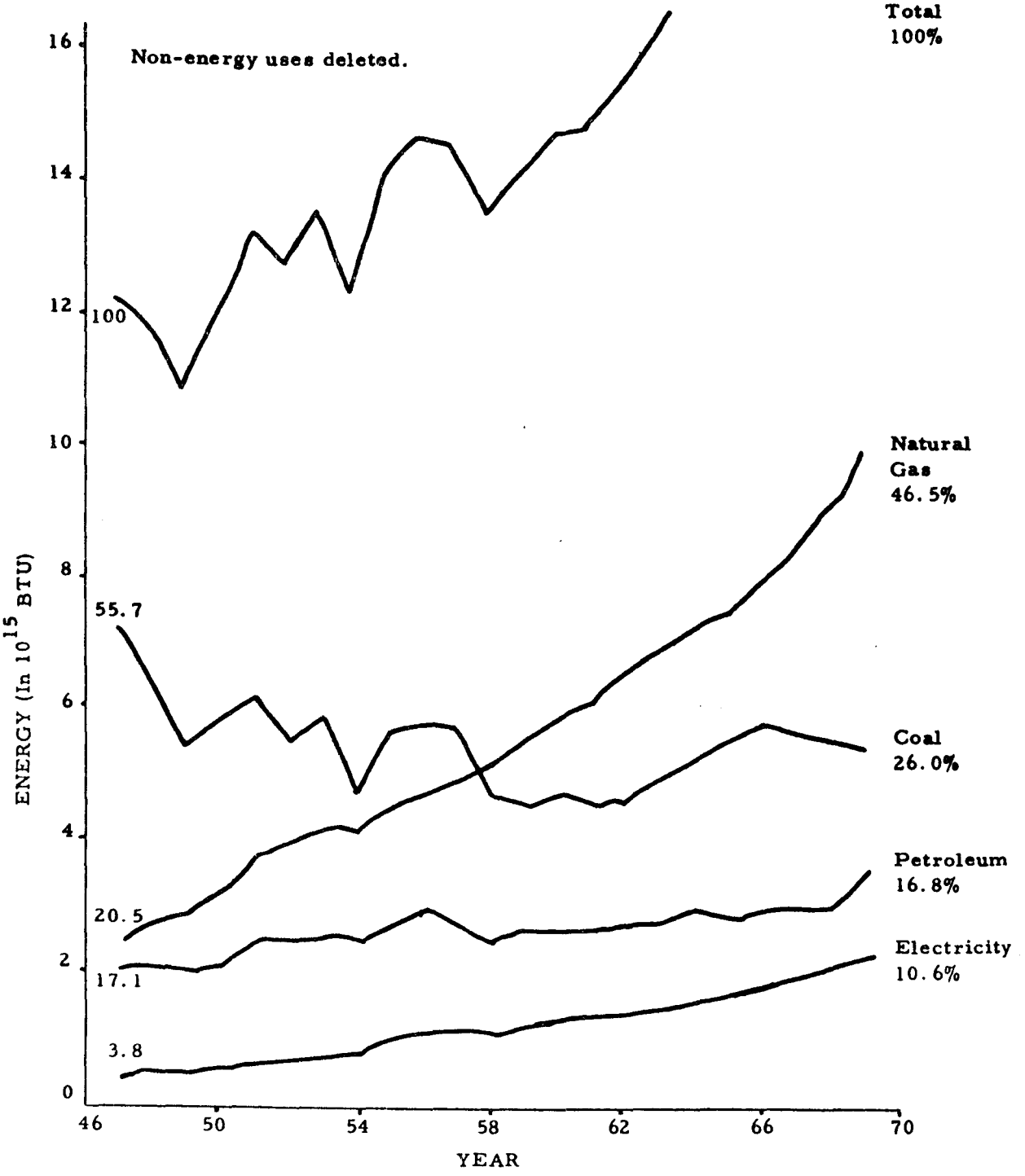
-- Reduce temperature inside buildings to reasonable comfort levels. Plants operating on a one-shift basis should reduce temperature settings by several degrees both nights and weekends.

Get better heat confinement. Heat is only useful when it is confined to those areas with work in process. There are several ways to prevent unnecessary heat losses:

-- Combustion and heat transfer efficiency should be kept under

Table 17

Energy Used in the Industrial Sector



Source: Rand Corporation, Interim Report: The Growing Demand for Energy, April 1971.

continual close surveillance and checked at regular intervals by competent personnel. Excess air should be limited to actual needs since it carries away useful heat. Flames should be confined to heating areas; flames in flues represent wasted heat. On multi-burner equipment, the proper air/gas ratio at each burner should be maintained.

-- Structural heat confinement can be improved by tightening cracks; by closing or reducing openings on equipment such as heated ladles or slot forge furnaces; by closing doors promptly; by the use of reflective heat shields and by the adequate application of proper insulation.

-- Maintain optimum flame geometry in impingement heating jobs.

-- Reduce building heat losses by sealing cracks around exterior windows and doors, by replacing broken windows and by limiting fan exhaust to actual needs.

-- Insulate lines conveying steam and hot liquids.

(3) Regular Maintenance

Regular equipment maintenance assures both satisfactory performance and reduced fuel consumption.

-- Eliminate heat transfer barriers by cleaning both sides of heat transfer surfaces regularly. This removes scale, sludge and loose refractory.

-- Check valves, fittings and connections to avoid gas and steam line leaks.

-- Keep full lining thickness on furnace shells by regular reapplications where spalling or other wall deterioration occurs. (Any visible hot spots indicate excessive heat losses via lining deterioration.)

(4) Heat Recovery Equipment

Heat being vented directly to the atmosphere can be recovered by a number of devices. This otherwise wasted heat can be used to heat combustion air, preheat incoming products or heat plant air for employee comfort.

-- Install stationary or rotating recuperators of metal or ceramic construction.

-- Use regenerators with checkered brickwork.

-- Check into waste heat boilers and water heaters.

(5) Improving Existing Equipment

Equipment redesign and improvement can increase production and save fuel.

-- Install modern temperature and air/gas ratio control devices that eliminate manual valve and temperature adjustments.

-- Substitute sealed-in burners for open hole furnace firing. Substitute power burners for large atmospheric combustion systems.

-- Return all steam condensate to gas-fired boilers.

-- Replace or cover water-cooled work rails with suitable refractory materials.

-- Apply additional insulation, particularly on overheated exterior surfaces.

(6) New Equipment and Processes (New Technologies)

Still more savings can be achieved by installing the latest processes using advanced technology. This also improves quality and production.

-- Convert liquid heaters from underfiring to immersion or submersion heating.

-- Use shaft-type melting furnaces to preheat incoming material.

-- Install radiant comfort heaters for high bay factory space heating.

-- Convert large batch type processes to continuous operation.

-- Convert from indirect to direct firing wherever feasible.

-- Substitute direct flame impingement or infra-red processing for chamber-type heating (where suitable).

-- Use continuous equipment which returns process heating conveyors within the heated chambers. This saves fuel and eliminates the necessity for continual reheating.

(7) Recycling and Reusing Components

Recycling and reusing components and materials of the industrial system is a conservation strategy that will yield only limited savings in the short run. However, such a program can be initiated now with the expectation of eventually yielding significant energy savings.

The container industry has been recently committed to disposable containers. The use of soft drinks in returnable bottles has declined from 98 percent to 80 percent between 1958 and 1966, while use of returnable beer bottles has declined from 55 percent to 35 percent over the same period.[151] However, it has been shown that the disposable container system involves a greater expenditure of energy, varying from 4.1 times as much for soft drinks, to 1.6 times as much for milk in throwaway cartons.[152]

The automobile industry may also develop energy savings by recycling metal and other materials. Such a recovery system would require some component design changes to facilitate the recycling process. It has been estimated that 0.35 percent of the auto industry's energy consumption could be conserved through recycling.[153] However, this estimate does not include certain indirect energy costs, which could increase the percentage as much as five times.

In general, the greatest energy savings could result from reuse, rather than recycling, of components, containers, etc. Original design of reusable items is critical to their continued usefulness, and should receive considerable attention by manufacturers as a way to reduce their energy consumption.

Energy Savings

Over a four-year period, it is estimated that recycling/reusing and, primarily, the change of inefficient equipment and processes, could reduce projected energy consumption by 6 to 11 percent (See Figure 1). Recycling/reusing could contribute only 1 percent to energy savings in the industrial sector.

B. Mid- and Long-Term Conservation Measures

Over the long run, the conservation measures initiated for short-term savings should be continued and intensified. An effort should also be made to increase standardization of components in the automobile and other industries, where recycling/reusing has applicability. The development of new, more efficient technologies can be expected to have an increasing impact on industrial energy consumption. However, the extent of the impact of new technologies cannot be predicted.

Energy Savings

Over a nine-year period, the continuation of conservation measures can yield a 12 to 17 percent reduction in the industrial sector's projected energy demand (See Figure 1).

APPENDIX D

ENERGY CONSERVATION MEASURES AND PROJECTED SAVINGS IN THE ELECTRIC UTILITIES SECTOR[154]

A. Short-Term Conservation Measures

The following measures can be implemented in the short term to achieve energy savings:

(1) Smoothing Out the Daily Demand Cycle

An extra charge levied on peak-load-hour users of electricity would discourage consumption of electricity during the hours of greatest demand (usually four to six p.m.). It is inefficient for a utility to meet highly variable demand. By distributing demand more evenly throughout the day, the utility would not have to use inefficient peaking equipment. Furthermore, utilities may be able to reduce their capital investment in peaking facilities.

(2) Reducing Maintenance and Construction Delays

A significant cause of overall system inefficiency is dependence on old, inefficient generating facilities while the completion of new power plants is being delayed. Delays can be minimized by adopting these measures:

(a) coordinate the increasing demand for labor and equipment necessary to build power plants

(b) impose economic penalties on manufacturers and utilities to reduce equipment failure

(3) Reducing Demand for Electricity

Any reduction in demand for electricity in other sectors results in a threefold saving in boiler fuel. This is because, on the average, only one-third of the heat in boiler fuel is converted to electricity.

Energy Savings

Over a four-year period, four percent of projected electric utility's energy consumption (See Figure 1) may be saved by implementing the above conservation measures.

B. Mid- and Long-Term Conservation Measures

The potential for energy conservation over the long run is dependent on the continuation of short-run measures, and the implementation of new technologies and systems. Conservation measures which can yield energy savings over the mid- and long-term are:

(1) Waste Heat Utilization

There are several methods of utilizing waste heat produced in power plants. Ordinarily, waste heat is a by-product of generating electricity. By putting it to work, some of the heat value of the boiler fuel is recovered. Waste heat in the form of steam may be sold by the electric utility to industries which use steam in manufacturing processes. Waste heat may also be sold for agricultural (or aquacultural) purposes as warm water.

(2) Total Energy Systems

Power plants may use waste heat in a system to produce hot water for residential space heating, for air conditioning by absorption chillers, and for steam generation for industrial purposes. Such a system requires a well-planned balance of electricity for waste heat to be successful. The role of absorption chillers is critical to the success of the total system approach. (Absorption chillers are used for cooling and air conditioning. They are the

products of an old technology, and could be improved with a relatively modest research investment).

(3) Coal Systems

Coal can be used in a variety of ways in the generation of electricty. Some examples are:

-- Coal may be strip mined and shipped to a power plant.

-- A power plant may be constructed on the strip mine site.

-- Coal may be gasified at the mine site, and the gas then transported by pipeline to an electricity demand center.

-- Coal may be gasified and the gas burned at the mine site to generate electricity for transmission to a load center.

-- Coal may be shipped to a load center for gasification and generation of electricity using gas as a boiler fuel.

The choice of options is a matter of selecting the most economical with respect to the quality of the coal, distance to the load center, and environmental tolerances at the load center. The process of gasification and power generation is an attractive alternative, because it is an effective method of eliminating sulfur from gas stack emissions.

(4) Geothermal Energy

The Texas Bureau of Economic Geology is currently investigating the extent of geothermal resources in the state. Geothermal power, which was previously thought to be unavailable in Texas, may have great potential in the coastal zone. In using geothermal steam for generating electricity, two useful by-products are derived by "flashing": methane (natural gas) and fresh water. Geothermal steam must be near demand centers, and must be of high

quality (a minimum of corrosive contaminants) in order to be useful for power generation. The discovery of a geothermal resource meeting these criteria could significantly relieve the demand by power plants for natural gas and oil.

(5) Solar Power

The use of solar power for the generation of electricity is even more inefficient than fossil fuel conversion. However, solar energy could be very useful in relieving the demand for electricity, if modular solar units for homes were used for heating and cooling. Individual homes could reduce their demand for electricity, and secondarily, reduce the demand for fossil fuels used in power plants. This concept would require the mass production of inexpensive solar heating and cooling systems, and the development of a distribution and service industry. In the long term, solar power has potential for electricity generation as well.

(6) Fusion

Of all the nuclear processes, the production of electricity by fusion is the most potentially significant and the farthest from development. If fusion is demonstrated and can be used to provide economical electricity, it could provide an endless source of energy. The "fuel" for the fusion process is water. Fusion power plants theoretically could use sea water to produce electricity, without creating any pollutants.

Energy Savings

Disregarding coal, geothermal, solar, fusion, and other new technologies, the continuation of the short-term conservation measures could reduce

projected energy consumption in the electric utility sector by four percent over a nine-year period (See Figure 1). The impact of new technologies over the long term cannot be predicted.

LIST OF TABLES

LIST OF FIGURES

FOOTNOTES

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2. U. S. Senate Committee on Interior and Insular Affairs, Hearings on Energy Conservation, Part I, 93d Cong., 1st Sess., March 22 and 23, 1973; Testimony of Lester Lees, California Institute of Technology, Environmental Quality Laboratory.

3. King v. Mullins, 171 U.S. 404.

4. "But what are the police powers of a state? They are nothing more or less than the powers of government inherent in every sovereignty to the extent of its dominions. And whether a State passes a quarantine law, or a law to punish offenses, or to establish courts of justice, or requiring certain instruments to be recorded, or to regulate commerce within its own limits, in every case it exercises the same power; that is to say, the power of sovereignty, the power to govern men and things within its dominion. It is by virtue of this power that it legislates . . ." License Cases, 46 U.S. (5 How.) 504, 583 (1847).

5. District of Columbia v. Brooke, 214 U.S. 138 (1909); Queenside Hills Realty Co. v. Saxl, 328 U.S. 80 (1946).

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7. Sweet v. Rechel, 159 U.S. 380.

8. Goldblatt v. Town of New Hempstead, 369 U.S. 590 (1962).

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21. For example, billboard prohibition laws were initially struck down as merely aesthetic zoning until courts began to hold the laws were also related to public safety. St. Louis Gunning Advertising Co. v. St. Louis, 137 S.W. 929 (1911).

22. The importance of delegation can be illustrated by considering zoning powers. In Texas, zoning powers have not been generally delegated to counties. Therefore, a county zoning ordinance would not be a valid exercise of police power. TEX. REV. CIV. STAT. ANN. art. 2372ℓ (1971); art. 2372ℓ-1 (Supp. 1974); arts. 46e-1 thru 46e-15 (1969); art. 1581e-1 (Supp. 1974).

23. L/R-4, pp. 5-6.

24. For a more detailed analysis see L/R-6, pp. 31-36.

25. L/R-6, p. 33.

26. Braniff Airways v. Neb. Bd., 347 U.S. 590 (1954).

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122. Joint Committee on Atomic Energy, UNDERSTANDING THE "NATIONAL ENERGY DILEMMA," 1973.

123. Council on Environmental Quality, ENERGY AND THE ENVIRONMENT, ELECTRIC POWER, Aug. 1973.

124. TEX. REV. CIV. STAT. ANN. arts. 1119, 1124, 1175(13) (1963).

125. TEX. REV. CIV. STAT. ANN. art. 6058 (1962).

126. TEX. REV. CIV. STAT. ANN. art. 6053 (1962).

127. TEX. REV. CIV. STAT. ANN. art. 6057(a) (Supp. 1974).

128. City of Wink v. Wink Natural Gas, 115 S.W.2d 973 (Tex.Civ.App. -- El Paso 1938, writ ref'd).

129. I.L. Sharfman, the Interstate Commerce Commission (1931-1937) excerpts found at 250-277, WILLIAM K. JONES, CASES AND MATERIALS ON REGULATED INDUSTRIES (1967).

130. Railroad Comm'n v. Houston Natural Gas, 155 Tex. 502, 289 S.W.2d 559 (1956).

131. Nebbia v. New York, 291 U.S. 502 (1934).

132. Federal Power Commission v. Hope Natural Gas Co., 320 U.S. 591 (1944).

133. James C. Bonbright, Principles of Public Utility Rates (1961) as quoted at 336, WILLIAM K. JONES, CASES AND MATERIALS ON REGULATED INDUSTRIES (1967).

134. Railroad Comm'n v. City of Austin, Docket No. 12,169 (Tex.Civ. App. -- Austin, July 10, 1974).

135. California has recently enacted the State Energy Resources Conservation Development Act which empowers a commission to set such criteria. 42 BNA ENERGY USERS REPORT C-4 (1974). The National Bureau of Standards has submitted new standards to the National Conference of States on Building Codes and Standards for its consideration. 29 BNA ENERGY USERS REPORT A-35 (1974). The Council of State Governments has developed three suggested acts for building criteria--State Building Code Act, Manufactured Building Act, and Mobile Home Act. Council of State Governments, SUGGESTED STATE LEGISLATION, Vol. 33 (1933).

136. The California State Energy Resources Conservation and Development Act has such provisions. 42 BNA ENERGY USERS REPORT C-4 (1974).

137. TEX. REV. CIV. STAT. ANN. art. 6701(d) (1969).

138. TEX. REV. CIV. STAT. ANN. art. 6675a-5 (1969).

139. TEX. TAX. - GEN. ANN. art. 9.01 et seq. and art. 10.01 et seq. (1969).

140. A proposal which merits attention is the ALI MODEL LAND DEVELOPMENT CODE, A Tentative Draft, No. 3.

141. TEX. TAX. - GEN. ANN. art. 20.02 (1969).

142. TEX. REV. CIV. STAT. ANN. art. 4477-7 (Supp. 1974).

143. ORS 459.810-459.890 (1971).

144. Railroad Comm'n v. City of Austin, Docket No. 12,169 (Tex. Civ. App. -- Austin, July 10, 1974).

145. Office of Emergency Preparedness, The Potential for Energy Conservation: A Staff Study, Oct. 1972, Washington, D.C. Unless otherwise noted, all material in Appendix A is based on this study.

146. These measures are found in: Office of Emergency Preparedness, The Potential for Energy Conservation: A Staff Study, Oct. 1972, Washington, D.C.; The Value of Thermal Insulation in Residential Construction: Economics and the Conservation of Energy, John C. Moyers, Oak Ridge National Laboratory, distributed by National Technical Information Service, 1972; Citizen Action Guide to Energy Conservation, Citizens' Advisory Committee on Environmental Quality, 1973, Washington, D.C.

147. Office of Emergency Preparedness, The Potential for Energy Conservation: A Staff Study, Oct. 1972, Washington, D.C. Unless otherwise noted, all material in Appendix B is based on this study.

148. Citizen Action Guide to Energy Conservation, Citizens' Advisory Committee on Environmental Quality, 1973, Washington, D.C.

149. Office of Emergency Preparedness, The Potential for Energy Conservation: A Staff Study, Oct. 1972, Washington, D.C. Unless otherwise noted, all material in Appendix C is based on this study.

150. U.S. Senate Committee on Interior and Insular Affairs, Hearings on Energy Conservation, Part I, 93d Cong., 1st Sess., March 22 and 23, 1973. Suggestions presented by the American Gas Association.

151. U.S. Senate Committee on Interior and Insular Affairs, Committee Report on Energy Conservation, 92d Cong., 2d Sess., 1972.

152. Bruce Hannon, System Energy and Recycling: A Study of the Container Industry, University of Illinois, May 1972.

153. As yet unpublished study, funded by the Illinois Institute for Environmental Quality, a state agency.

154. Office of Emergency Preparedness, The Potential for Energy Conservation: A Staff Study, Oct. 1972, Washington, D.C.