DRAFT

1996 ENERGY POLICY AND CONSERVATION REPORT

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CHAPTER 1

OVERVIEW OF STATE ENERGY POLICY

CHAPTER 1 -- OVERVIEW OF STATE ENERGY POLICY

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I. INTRODUCTION

The Department's 1996 Energy Policy and Conservation Report (1996 Quadrennial Report, 1996 Report or Report) is required by Minnesota Statutes section 216C.18. This Report is the third quadrennial since the statute was enacted in 1988. The Report discusses critical energy issues facing the State of Minnesota, lays out broad policy goals, and offers specific strategies and actions for achieving these goals. Topics include:

- a statewide energy objective;
- four broad policy goals to guide our more specific recommendations;
- historical, current and projected energy use and expenditures patterns;
- multi-industry issues;
- issues associated with Minnesota's energy resources--electricity, natural gas, petroleum and alternative energy; and
- specific recommendations for federal, state, local and consumer strategies and action steps to implement the energy objective and achieve the four broad policy goals.

II. NEED FOR A LONG-TERM ENERGY POLICY

Affordable energy is as critical to the state economy and the well-being of Minnesotans as it is for the rest of the nation. Occasional disruptions in energy supplies over the past 30 years have illustrated that we cannot take secure and affordable energy supplies for granted. Examining the history of energy over the last three decades reveals positive and negative trends in terms of production, technical advances and consumption.

The State has endured rancorous debates over the siting of electric transmission lines and storage facilities for nuclear waste. Extreme temperatures in the summer and winter have, at times, strained the ability of suppliers and the energy infrastructure to meet residential and commercial demand. Sporadic shortages of (primarily) petroleum and natural gas have caused instability and short-term price increases. There has been a steady increase in the use of motor vehicles, and there is steady growth in the overall demand for energy.

Yet even considering the factors above, there are many positive aspects to the complete energy picture in Minnesota and the nation.

Our regional supplies are generally reliable. This portion of the country has avoided the severe "blackouts" and "brownouts" that can deprive large areas of electricity and cause widespread disruption.

The environmental impact of energy use in Minnesota has been significantly less than in other areas of the nation and world. Minnesota's high air-quality standards, stringent siting processes and willingness to proactively address a range of issues is in large part responsible for this success.

Minnesota's energy prices are either below or well below the national average. In a recent open letter to the public, Governor Carlson discussed a range of factors that have contributed to the upgrading of Minnesota's bond rating to AAA for the first time in 22 years. The AAA rating is the highest possible and a prime indicator of the State's financial health. In noting that energy prices play a role in our economic health, Governor Carlson said:

> Energy is less expensive in Minnesota than in other states. Northern States Power, for example, receives an average of 4.6 cents per kilowatt hour from industrial users -- 10 percent less than the U.S. average. Electric rates in the Twin Cities are far below those in the largest metropolitan areas of the United States.[1]

Minnesota's average prices and comparative national ranking are provided in Figure I-1.

FIGURE I-1

Average 1994 Prices in Minnesota for Electricity and Natural Gas

Class of Customer	Average Price of Natural Gas in MN ($/Mcf)	National Rank (1 = lowest)	Average Price of Electricity in MN (¢/kWh)	National Rank (1 = lowest)
Residential	$5.18	8	7.16¢	18
Commercial	$4.36	6	6.25¢	16
Industrial	$2.87	8	4.41¢	20

Sources: *Electric Sales and Revenue 1994*, Energy Information Administration, U.S. Department of Energy, November 1995.

Natural Gas Annual 1994, Energy Information Administration, U.S. Department of Energy, November 1995.

[1] The complete text of the Governor's letter is provided as Attachment 1 of this Report.

These comparatively low prices help ensure the affordability of essential energy supplies for all Minnesotans. They are also a tremendous factor in the continued economic development and high level of employment across the State.

On a broader scale, technical advances are moving such renewable energy sources as wind, photovoltaics and biomass into the realm of cost-effectiveness. The cost of electricity from photovoltaic and biomass generation sources, while still significantly greater than the cost of power and energy from traditional generation, has declined significantly in recent years. Meanwhile, the winning bid for the most recent phase of the 425-megawatt (MW) wind-development project in southwestern Minnesota and the surrounding region guarantees wind-generated electricity at 3.0¢ per kilowatt-hour (kWh), a very competitive price compared to traditional electric generation sources.

There have also been dramatic reductions in emissions from coal-fired power plants during the past 30 years. According to the U.S. Department of Energy (DOE) and DOE Secretary Hazel O'Leary, particulate emissions from a typical 300-MW coal plant have dropped from 47,000 tons per year in the 1960s to 250 tons per year in 1990.[2] There have been tremendous reductions in sulfur dioxide (SO_2) and nitrogen oxides (NOx) during the same time frame as well. According to DOE, SO_2 emissions from a typical 1960s coal plant have dropped from 33,000 tons per year to 1,600 tons per year, while NOx emissions have declined from 8,000 tons per year to 1,700 tons per year. DOE's Secretary O'Leary went so far as to say the following:

> [T]his administration, this Secretary of Energy, knows that coal will remain a major player in the global energy mix. It is, and will be the primary fuel for electricity generation well into the 21st century.

Secretary O'Leary said the only problem is that the public does not know about this "fabulous" story.

The efficiency of home appliances has improved significantly in just the last 15 years. According to the Gas Research Institute (GRI), energy consumption among the largest energy-using home appliances have been reduced as follows:[3]

- refrigerators.....-37.3%
- freezers.....-50.0%
- gas stoves/ovens.....-45.6%
- gas dryers.....-21.1%

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[2] Source: *Energy Daily*, May 17, 1996.
[3] Source: *Energy and Housing Report*, December 1995.

There have also been major improvements in the efficiency of air conditioners, furnaces and water heaters. In commercial buildings there have been huge gains in lighting efficiency, which accounts for approximately half of all energy use in the commercial sector.

Advances in building-code requirements and construction practices have resulted in commercial structures that require up to 50 percent less energy to heat and cool than 20 years ago.

There have been similar gains in transportation efficiency. According to DOE in its April 1995 publication *Energy Conservation Trends*:

> The estimated fuel economy of the average new car in 1973 was 14 miles per gallon (mpg). This improved to 28.6 mpg in 1988, but subsequently declined to 28.0 mpg in 1993 -- still a 100% improvement in 20 years. The average new light truck (pickups, vans, and utility vehicles) had an 11 mpg rating in 1983, which grew to 21.6 mpg in 1986 and then declined to 20.8 mpg in 1993 -- still an 89% improvement over 20 years.

Yet even when all the factors discussed above are considered, history has illustrated that we cannot take secure and affordable energy supplies for granted. Moreover, energy requirements are not likely to diminish over time. Minnesota currently consumes about 990 trillion Btus of end-use energy annually. Even with anticipated increases in efficiency, the Department projects that State energy consumption will grow by about 56 percent by 2020. Although additional conservation can satisfy some of this demand, additional investments in energy facilities and fuel seem unavoidable. The energy policies we have pursued during the past four years and will pursue into the next century will help determine how these needs are met.

III. STATE ENERGY POLICY

A. STATEWIDE ENERGY OBJECTIVE

Minnesota policy makers must clearly keep an overall objective in mind as they set energy policy goals. The guiding principle offered in the Department's 1992 Quadrennial Report is as valid today as it was four years ago:

> **Assure continued access to reliable, reasonably priced, efficient, and economically sound energy services to Minnesotans now and into the future through environmentally responsible resource use.**

The 1996 Report will continue to provide the "road map" for achieving this statewide energy objective.

B. *POLICY GOALS FOR 1996 QUADRENNIAL REPORT*

The first step in achieving the statewide energy objective listed above is to set forth broad policy goals that can serve as reference points for more specific strategies and action steps. In 1996 the Department offers four broad goals. Two of these goals are very similar to those put forward in 1992. The other two are new. Each goal is explained below.

GOAL 1

> *Advocate for meeting Minnesota's energy needs at the lowest societal cost, while ensuring affordable and reliable energy services.*

The first goal recognizes that providing energy services has widespread effects. For example, emissions from an electric power plant may harm people spread out over a wide area, including people who receive no electricity from the plant. Minnesota's goal should not be simply to obtain the cheapest energy possible. It should be to maximize the welfare of all Minnesotans. To achieve this goal we must assess all consequences of our energy decisions--not simply the direct or private costs to producers and consumers. Governmental bodies and individual citizens are in a unique position to promote this societal goal.

GOAL 2

> *Encourage more competition and customer choice where possible, while pursuing governmental intervention where the State can best advance the following goals: State economic development; environmental quality; risk mitigation through resource diversity; energy education; access to investment capital; and acceleration of new technologies to market.*

The second goal recognizes that competition and free markets can benefit all energy consumers. Consequently, sound energy policy is not simply a list of governmental mandates, taxes and subsidies. The State can adopt a very aggressive, activist set of policies that will actually make things worse. For example, specifying that Minnesota electric utilities reduce air emissions by 80 percent would be an extremely aggressive policy that would advance the public-interest goal of environmental protection. Yet this goal could also greatly increase the cost of utility services, and perhaps impair the reliability of these services. The net effect on Minnesota of this aggressive policy could well be worse energy services from a societal (social-cost) perspective.

One of the most difficult challenges is determining the conditions under which governmental bodies should not intervene and should allow free markets to best serve our energy needs. Over the past 20 years industries ranging from trucking to airline to natural gas have been increasingly deregulated. The electric industry is also becoming more competitive, and is poised to continue this trend over the next few years. In particular, the generation sector of the electric industry is no longer a natural monopoly. As industries become more competitive, the need to develop competitively neutral energy policies increases. Only when we conclude that free energy markets will not achieve our preferred goals should we intervene actively. Yet there are many legitimate roles for governmental bodies and citizens in helping shape our energy future. This second goal lists the most important objectives that free markets may not adequately satisfy.

GOAL 3

Improve the efficiency of Minnesota's energy use, measured in Btus per real dollar of gross state product, by at least 30 percent by the year 2020, while lowering the total energy cost per real dollar of gross state product.

The third goal is a slight variant of a 1992 goal. Promoting energy efficiency reduces our energy expenditures, promotes a healthier environment, and improves the well-being of all Minnesotans. Minnesota law expresses a strong preference for energy efficiency. Yet these initiatives must be cost-effective from a societal perspective, and ideally should be cost-effective based on internal or private costs. Consequently, the 1992 goal is modified to require a quantitative measure of cost-effectiveness. Specifically, energy-efficiency programs should lower energy costs (including the costs of the programs) per dollar of gross state product.

GOAL 4

Promote a self-supporting, innovative energy industry with emphasis on renewable and other alternative energy development in Minnesota.

The fourth goal recognizes that indigenous, renewable resources offer unique advantages. These resources may spur State economic development, reduce environmental damages, and diversify the State's mix of generating units. Moreover, Minnesota law strongly encourages the development of renewable resources. Consequently, they merit particular attention.

C. *PROGRESS IN MEETING GOALS FROM 1992 QUADRENNIAL REPORT*

Over the past four years, there has been progress in meeting the five goals offered in the 1992 Quadrennial Report. Although in this Report the Department sets new policy goals for the next four years, the 1992 policy goals are not forgotten; each is incorporated in some fashion in the 1996 goals. This section describes the progress Minnesota has made on each of the five 1992 policy goals.

GOAL 1

Ensure that the U.S. Department of Energy (DOE) begins to remove Minnesota's nuclear waste by 2000, and hold DOE to its schedule for operation of a nuclear waste repository by 2010.

In the 1996 Report we redefine this first goal from 1992 as an industry-specific *strategy* in Chapter 4 (Electricity). Resolving the State's nuclear-waste problem is critical and remains one of the Department's top priorities. However, we view the safe and timely storage of nuclear waste as a strategy to achieve our broader policy goals -- such as meeting the State's energy needs at the lowest societal cost and promoting governmental intervention when justified.

PROGRESS/STRATEGIES USED TO ACHIEVE GOAL

As part of its obligations under the Nuclear Waste Policy Act (NWPA), DOE is scheduled to begin removing spent nuclear fuel from the nation's power plants by January 31, 1998. When it became clear that DOE would have difficulty meeting this obligation, the Department was instrumental in establishing the Nuclear Waste Strategy Coalition (NWSC). The NWSC was formed in 1993, with a mission of ensuring the timely development of a cost-effective, safe and environmentally sound system for the permanent disposal of high-level radioactive waste. The NWSC consists of 39 members from 22 states, all with an intense interest in ensuring that DOE honors its statutory commitments. The NWSC is administered by Department staff.

The NWSC has worked directly with members of Congress to resolve this issue and is currently pursuing federal legislation. Legislation amending the NWPA has been introduced in both the Senate and the House of Representatives (House) during the first session of the 104th Congress. While a number of bills have been introduced, two bills appear to be most prominent:

- In the House, H.R. 1020, introduced by Representatives Fred Upton of Michigan and Edolphus Towns of New York; and

- In the Senate, S. 1936, introduced by Senators Frank Murkowski of Alaska and Larry Craig of Idaho.

While the House and Senate bills do differ, they each contain the following four critical elements:

- Authorization and siting of an interim-waste storage program and facility;
- Continuation of the development program for a permanent repository;
- Facilitation of the transportation of waste to the interim and permanent sites; and
- Requirement that the funds collected for waste disposal be used to develop the disposal program.

Congressional action this session is likely; however, budget resolution in the House and the Senate could greatly reduce funding. Therefore, the specific outcome of the legislative process is difficult to predict.

In addition to its involvement in legislative action through the NWSC, the Department has taken legal action to ensure that DOE honors its commitment. In 1994 the Department joined with 71 other parties across the nation in a lawsuit against DOE. In this lawsuit the petitioners request that the U.S. Court of Appeals require DOE to meet the disposal requirements mandated by NWPA. The petitioners currently await a decision by the Court.

The Department has also worked closely with other states and utilities to secure private interim storage of spent nuclear fuel until DOE honors its commitments. This group has explored a number of private alternatives, including a potential interim storage site in Mescalero, New Mexico. In December 1994 Northern States Power Company (NSP) and 33 other electric utilities negotiated an agreement with leaders of the Mescalero Apache Tribe (Mescalero Tribe) in New Mexico in which the Mescalero Tribe agreed to accept 20,000 metric tons of nuclear waste. But in April 1996 negotiations between the utilities and the Mescalero Tribe were suspended when the parties failed to reach substantive agreement on storage conditions. Despite the failure of the Mescalero negotiations, NSP and the spent-fuel consortium of 12 utilities intend to continue negotiating with other communities interested in accepting nuclear waste until the federal government takes possession of such waste.

Finally, the Department recently concluded an investigation into the prudency of NSP's payments to the Nuclear Waste Fund and alternatives to the federal storage program. In our Report of Investigation and Recommendations to the Minnesota Public Utilities Commission (Commission or PUC), we recommend that NSP divert its payments to the Nuclear Waste Fund to an externally managed escrow account. NSP

should then use these funds for either federal or private storage programs, depending on which option(s) best satisfy the State's needs. Our goal is to ensure a timely solution to the problem of nuclear-waste disposal in Minnesota.

GOAL 2

Protect a strong state role in future nuclear licensing and pipeline siting decisions.

In the 1996 Report we redefine this second goal from 1992 as an industry-specific *strategy* in both Chapter 4 and Chapter 5 (Natural Gas). Again, our intervention in licensing and siting procedures allow us to advance broader policy goals. This redefinition does not reduce our commitment to licensing and siting issues.

PROGRESS/STRATEGIES USED TO ACHIEVE GOAL

The Nuclear Regulatory Commission (NRC), a federal agency, oversees the relicensing of nuclear power plants. If NSP seeks relicensing of its nuclear plants, Minnesota's regulatory and environmental agencies will actively participate to represent Minnesota's interests. How effectively these interests are represented, however, will be affected by rules the NRC recently prepared to govern relicensing.

In 1992 the NRC proposed rules that would apply to broad environmental issues and allow very few issues to be considered on a case-by-case basis. The proposed rules also included a determination of need by the NRC, which could have preempted the State's ability to determine whether nuclear plants are needed. The Department opposed these rules in written comments, because they would have severely limited state and public participation in decisions on environmental issues. The NRC substantially altered its initial proposal and issued a new proposal that addresses our concern.

Since 1990, the Department has reviewed one request for a Certificate of Need for construction of an oil pipeline. After carefully analyzing the need for this pipeline and its potential environmental impacts, the Department recommended approval. There have been no Certificate of Need requests for gas pipelines since 1990.

GOAL 3

At a minimum, double the total amount of renewable based energy used within the state by 2020.

We are moving beyond this third goal from 1992 for two reasons. First, Minnesota is already well on its way to meeting this goal. While the Department forecasts that we may fall a little short of the 1992 goal of doubling renewable energy use by 2020 (see discussion below), this forecast is conservative in several respects. The actual growth in renewable energy will likely be much greater. (See Chapter 7 for a more detailed discussion of the projected growth in renewable energy.)

Second, in recognition of a more competitive energy industry we are de-emphasizing mandated penetration rates and numerical goals for renewable energy. We are now emphasizing direct incentives for energy providers and consumers to account for the benefits of renewable resources and continued State support for research and development. This approach allows the market more flexibility to choose the appropriate mix of all resources--including renewable resources.

PROGRESS/GOAL MEASUREMENT

Figure I-2 compares Minnesota's use of renewable energy resources in 1990 and 1994 with forecasted use in 2020.

FIGURE I-2
Minnesota's Use of Renewable Resources

Alternative Source	1990 Consumption (TBtus)	1994 Consumption (TBtus)	2020 Consumption (TBtus)
Hydro	65.43	114.98	114.98
Wind	0.01	0.31	10.40
Solar	1.13	0.64	1.71
Ethanol	2.06	10.58	17.97
Wood/Biomass	39.36	38.91	66.88
Municipal Waste	10.19	11.27	11.27
TOTAL	118.18	176.69	223.21

Under the Department's Baseline forecast, Minnesota's use of renewable energy will increase by 89 percent between 1990 and 2020.[4]

[4] The Department used Energy 2020 to generate the forecasts provided in this Report. The price forecasts used in the model are included as Attachment 2, while an explanation of Energy 2020 is included as Attachment 3. The forecast that embodies our best estimate of the future is referred to in this Report as the "Baseline" or "Reference" scenario or forecast.

PROGRESS/STRATEGIES USED TO ACHIEVE GOAL

The Department has consistently advocated for the increased use of renewable resources in integrated resource planning (IRP) proceedings before the Commission. The Department has also approved a number of renewable energy pilot projects through the Conservation Improvement Program (CIP). These efforts have resulted in additional research and development of the following technologies: wind, photovoltaics, and ethanol-based motor-vehicle fuels. The Department has also been instrumental in developing accurate data for assessing wind energy in Minnesota. For example, through the Wind Resource Assessment Program (WRAP) the Department has developed an extensive database on wind potential in Minnesota.

Additionally, as a result of the legislation approving dry-cask storage of spent nuclear fuel at NSP's Prairie Island nuclear facilities, NSP's resource acquisition schedule now includes a mandated and significant commitment to renewable energy. NSP's future acquisitions of renewable resources are summarized in Figure I-3.

FIGURE I-3
NSP's Additions of Renewable Resources

Approximate Year RFP Was/Will Be Issued	Nominal Capacity (MW)	Resource Type	Year Needed
1994	100	Wind	1996
1996	100	Wind	1998
1998	100	Wind	2000
2000	100	Wind	2002
1995	50	Biomass	2000
1996	75	Biomass	2002

Finally, the Department has advocated for the consideration of environmental costs in all decisions on new electric generation resources. This approach recognizes the societal benefits of renewable energy when compared with more traditional sources of electricity. It should also lead to additional renewable resources not captured in our current projections for 2020.

GOAL 4

Improve the efficiency of our energy use, measured in Btus per real dollar of gross state product, by at least 30 percent, by the year 2020, while maintaining or improving our comfort and productivity.

We repeat this fourth goal from 1992, with slight modification, as a goal in the 1996 Report.

PROGRESS/GOAL MEASUREMENT

Figure I-4 provides Minnesota's energy use per real dollar of gross state product from 1990 through 1994, as well as our projection for 2020.

FIGURE I-4
Minnesota's Energy Use per Dollar of Gross State Product

Year	Energy Use Per Gross State Product (Btu/Real $)
1990	1.031
1991	1.016
1992	.993
1993	.964
1994	.945
2020	.993

The Department projects that from 1990 to 2020 Minnesota will reduce its energy use per real dollar of gross state product by only 4 percent.

While this improvement in energy efficiency would fall well short of our goal, we believe our model may understate future efficiency improvements for at least two reasons.

First, the Department assumes no changes in the current automobile efficiency standards through 2020. Although more stringent standards are not anticipated in the near future, the standards could very well be raised before 2020. Predicting market-driven technical advances in transportation efficiency is also difficult. Efficiency gains due to either governmental mandates or technical advances would improve the State's overall energy efficiency.

Second, while Energy 2020 does predict improvements in appliance efficiency, it does not assume any tightening of governmental efficiency standards for appliances. Any governmental mandate that set a higher future standard than what Energy 2020 projects would occur naturally through market forces would improve the State's overall energy efficiency.

PROGRESS/STRATEGIES USED TO ACHIEVE GOAL

The Department has actively supported energy-efficiency initiatives of electric and gas utilities through our oversight of CIP. In addition, the Department has advocated for financial incentives for utilities to implement demand-side management programs. These financial incentives encourage utilities to meet, and even exceed, preset goals for energy savings. The Department has also advocated for innovative electric and gas rate designs that encourage customers to use energy efficiently.

Finally, Minnesota Statutes section 216C.19, subdivision 8, authorizes the Department to adopt Minnesota Energy Code rules. The adopted energy code, Minnesota Rules part 7670, is part of the State building code. With support of a grant from DOE, the Department is conducting a two-year Energy Code Advancement Project (ECAP) to work toward that goal. The ECAP is implementing a variety of projects to improve compliance with the State's energy code for all buildings. The goal is to ensure the highest degree of energy efficiency in all new and remodeled buildings. The energy code is enforced by local building officials in many, but not all, jurisdictions in the State.

GOAL 5

Create a self-supporting, innovative, sustainable energy industry in Minnesota.

We repeat this fifth goal from 1992, with slight modification, as a goal in the 1996 Report.

PROGRESS/STRATEGIES USED TO ACHIEVE GOAL

The Department supports the establishment and growth of innovative energy-technology businesses by encouraging the use and demonstrating the viability of local renewable resources. Through WRAP and various federal programs, the Department conducts and supports wind-energy research and demonstrations. The success of these and other initiatives is evident in the acceptance and use of Department data by independent wind developers. The Department has also worked closely with NSP to develop a bidding program for the procurement of wind and biomass electric generation resources.

Through our Clean Fuels Minnesota initiative, the Department is also a leader in the promotion of alternative fuel use and availability in the transportation sector. The Clean Fuels Minnesota Steering Committee, established in December 1994, set a goal of displacing 5 percent of conventional fuel by 2005. To achieve this goal, the Department leverages federal grant funds to offer various programs that encourage both the supply of and demand for alternative fuels. One of the first such programs placed twelve E-85 vehicles in four cities, and financed refueling stations in each location. This

demonstration is providing useful performance and emissions data, and is increasing public awareness of E-85 as a viable alternative to gasoline. As of 1996, six ethanol production facilities were operating. Four more will open soon, and seven are in the planning stage.

IV. IMPLEMENTING STATE ENERGY POLICY

The next step in implementing a sound energy policy is to develop specific strategies and action steps consistent with the policy goals explained above. To set the stage we provide an overview of historical and projected energy consumption and expenditures in Minnesota (Chapter 2).

The next five chapters cover multi-industry issues (Chapter 3) and specific energy industries: electricity, natural gas, petroleum and alternative energy (Chapters 4-7). In these five chapters we summarize historical trends and some of the most pressing issues and challenges facing Minnesota. We then offer specific strategies and action steps.

The final chapter (Chapter 8) highlights regulatory initiatives of the Minnesota Public Utilities Commission.

The Department offers a cautionary note about this Report. The four broad policies described above are sound anchors that we can use now and into the future. But the specific strategies and action steps based on these policies are not as immune to industry changes. While the Department endorses these recommendations based on the best available information, it is important to remember that the future no doubt holds surprises. A comparison of historical prices of petroleum and natural gas with prior projections of these prices offers a sobering reminder of our inability to predict the future accurately. Technological breakthroughs and economic changes can render obsolete many specific strategies or goals. The State's implementation of an energy policy must adapt to these changes if it is to remain relevant and effective.

CHAPTER 2

STATEWIDE ENERGY USE AND EXPENDITURES

CHAPTER 2 -- STATEWIDE ENERGY USE AND EXPENDITURES

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I. CURRENT ENERGY PRODUCTION, CONSUMPTION AND EXPENDITURES BY SECTOR

In 1994 Minnesotans -- including residential, commercial, industrial, agricultural and transportation customers -- used 990 trillion Btus of energy (Figure II-1). The transportation sector continues to be the largest user of energy with total expenditures of $2.3 billion (Figure II-2). To make this energy available to consumers, for what we call "end-use" energy, Minnesota utilities and other energy providers generated or purchased more than 1.5 quadrillion Btus of "primary" energy. The difference between the two numbers is mainly due to energy lost in the generation and transmission of electricity. These losses accounted for about 28 percent of the total primary energy used within the State in 1994 (Figure II-3).

Figure II-1: 1994 Energy End-Use by Sector

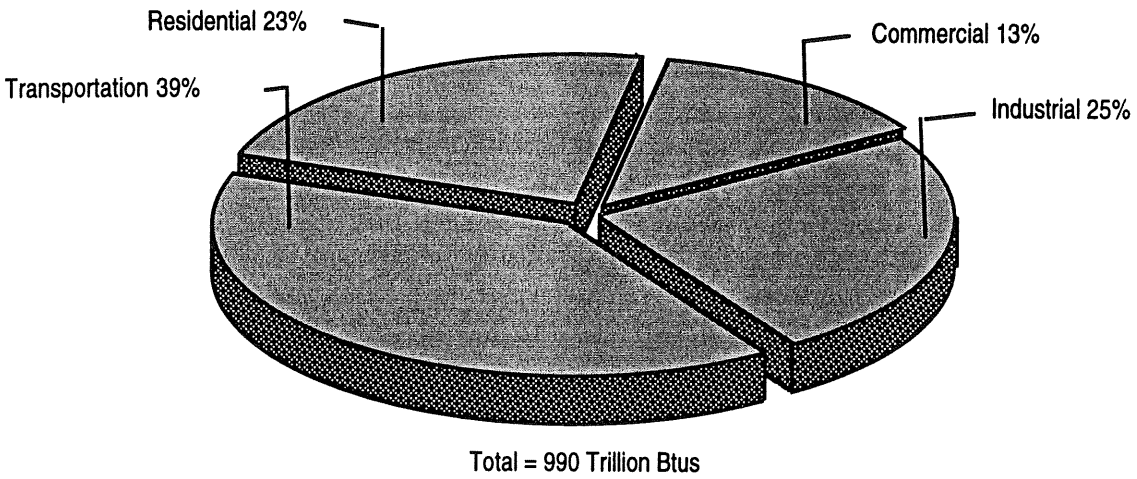


Figure II-2: 1994 Consumer Energy Expenditures by Sector

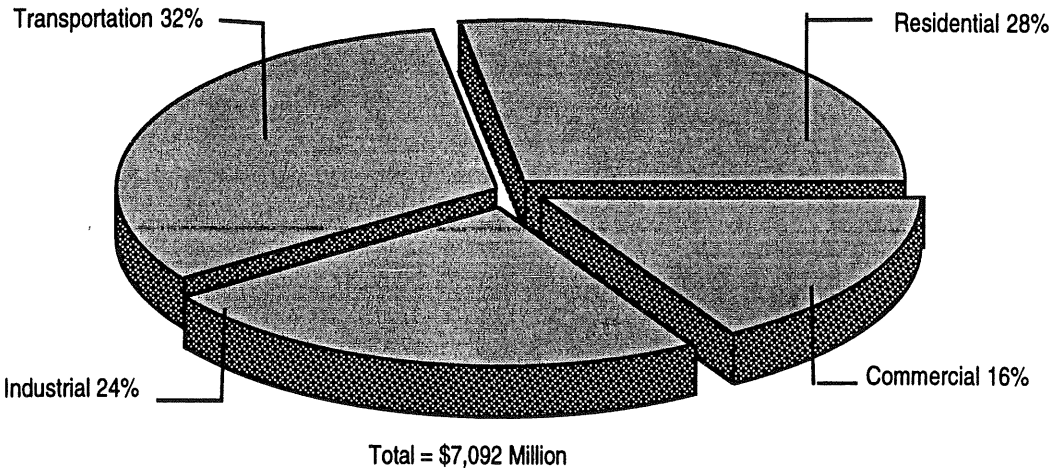
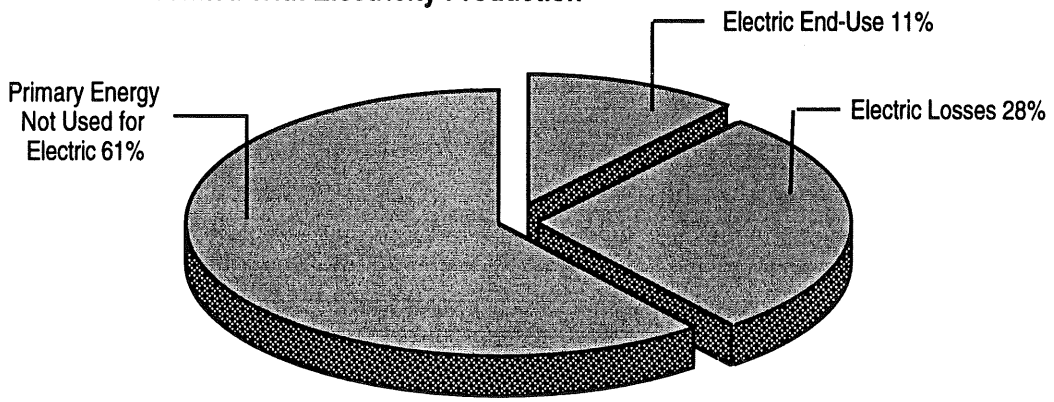


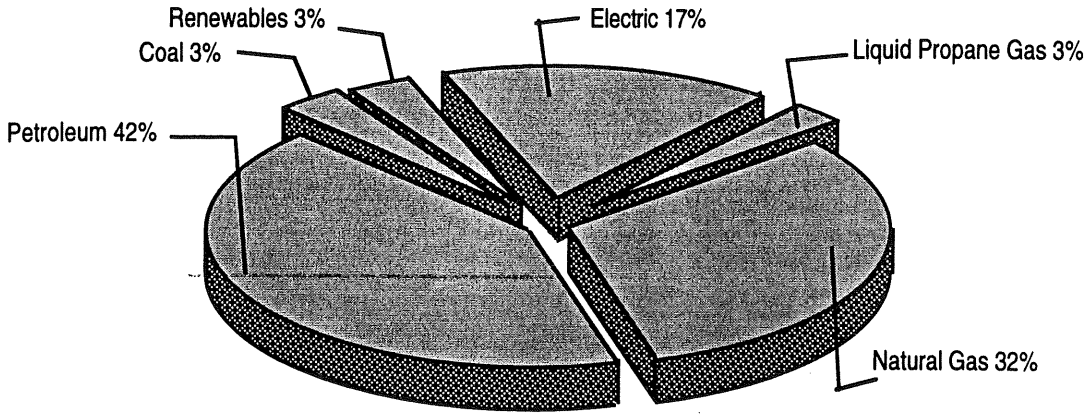
Figure II-3: 1994 Statewide Energy Consumption, Including Losses Associated With Electricity Production



II. CURRENT ENERGY PRODUCTION, CONSUMPTION AND EXPENDITURES BY FUEL

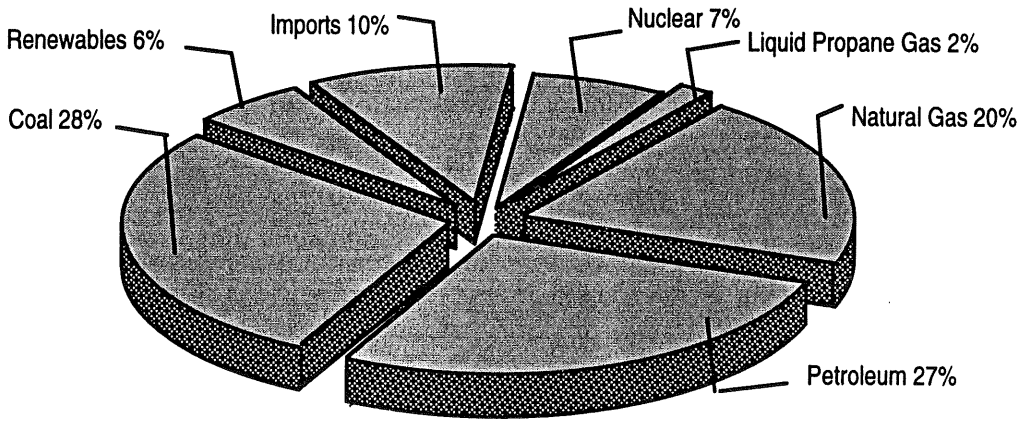
Fossil fuels dominate the State's fuel mix. In 1994 petroleum accounted for almost half of end-use consumption, while electricity and natural gas accounted for most of the remaining amounts (Figure II-4). Primary energy use is dominated by petroleum, coal and natural gas (Figure II-5).

Figure II-4: 1994 Consumer End-Use Energy Consumption



Total = 990 Trillion Btus

Figure II-5: 1994 Primary Energy Use by Fuel



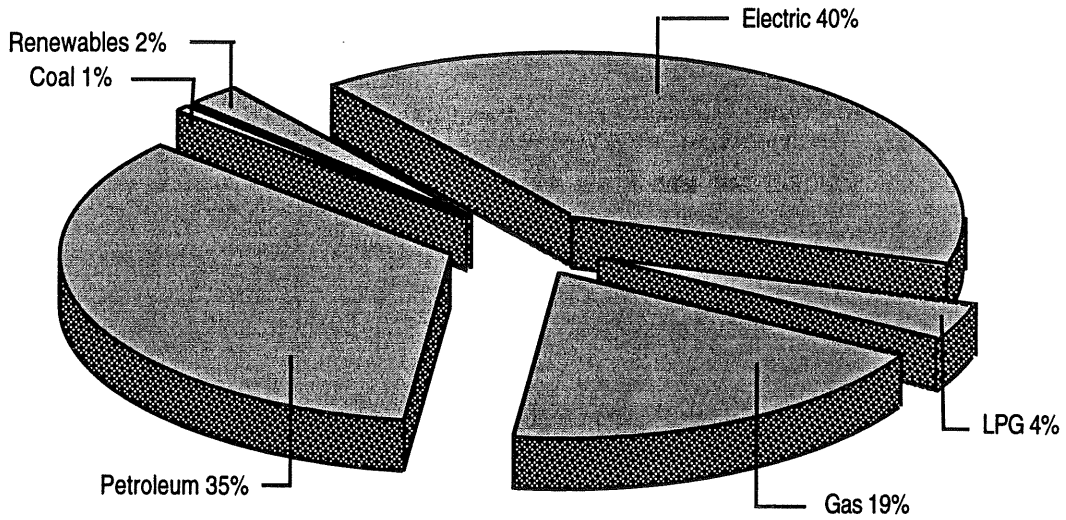
Total = 1,500 Trillion Btus

Note that primary and end-use consumption are broken down differently. End-use consumption data include electricity as a separate component, since consumers pay directly for electricity through their monthly electric bills. The fuels used to generate this electricity are not directly paid for by consumers and are accounted for in primary energy use. As a result, primary energy use is a better barometer of the actual fuels used to provide energy services in the State and better illustrates the State's reliance on coal and nuclear power.

Petroleum, electricity and natural gas also dominate Minnesota's energy expenditures (Figure II-6). Electricity accounts for a much larger percentage of end-use expenditures than end-use consumption. Again, the reason is that the

generation and transmission of electricity involves significant losses--such that the consumer's cost of electricity includes the cost of much more energy than the consumer actually uses.

Figure II-6: 1994 Consumer Energy Expenditures By Fuel



Total = $7,092 Million

III. TRENDS IN ENERGY USE AND EXPENDITURES

Primary energy consumption of fuel has grown from 694 trillion Btus in 1960 to 1,500 trillion Btus in 1994. By 2020 primary energy consumption is expected to reach 2,264 trillion Btus (Figure II-7). In constant 1994 dollars, consumer energy expenditures have grown from $4,218 million in 1960 to $7,092 million in 1994. By 2020 energy expenditures are expected to reach $13,157 million (Figure II-8).

Figure II-7: Primary Energy Consumption 1960-2020

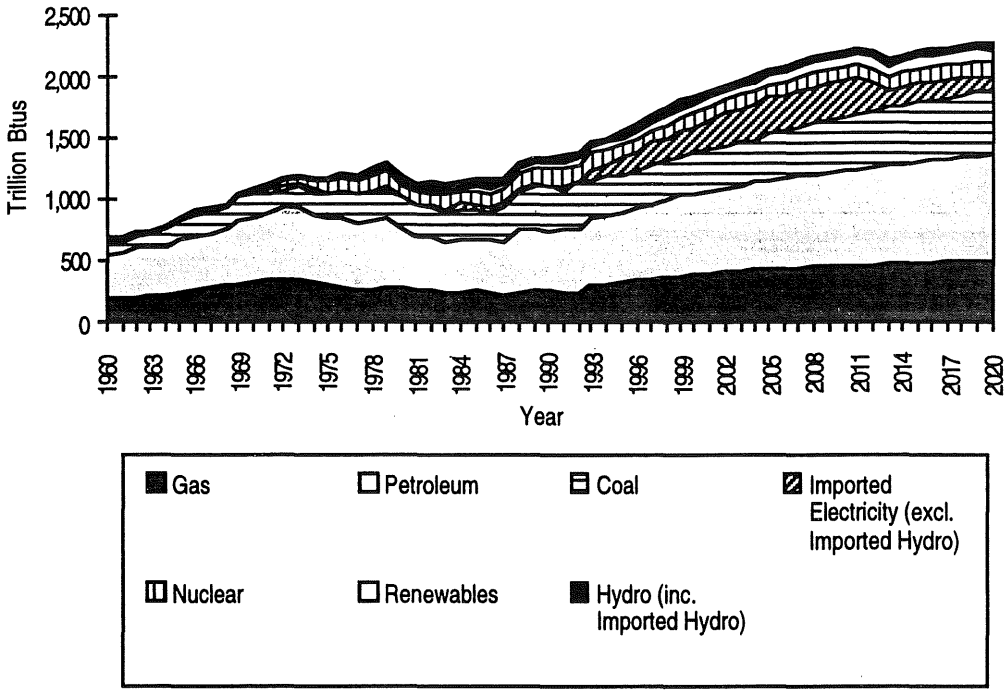
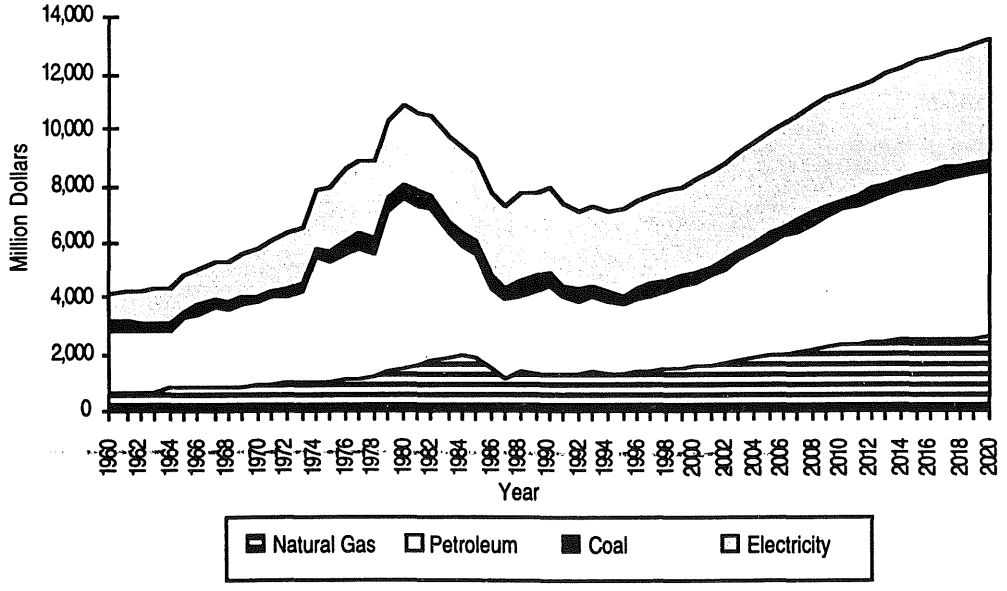


Figure II-8: Consumer Energy Expenditures 1960-2020 (Constant 1994 Dollars)



CHAPTER 3

MULTI-INDUSTRY ISSUES

CHAPTER 3 -- MULTI-INDUSTRY ISSUES

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I. INTRODUCTION

The energy market consists of many sectors and industries, each with its own unique characteristics and challenges. However, these differences do not mean that each industry or sector requires its own energy policy. To the extent possible a sound state energy policy should apply principles and goals consistently across industries and sectors. For example, the four broad goals explained in Chapter 1 provide a good starting point for each energy industry or sector. Implementation strategies can then be tailored to meet the unique needs of each.

In this chapter the Department discusses the trend toward increased competition and explains the conditions under which active state intervention is justified. We then offer some concrete examples involving one or more sectors or industries to better illustrate when state oversight is warranted.

II. INCREASED COMPETITION

A major trend during the past 20 years is increased competition. This trend is often described as "deregulation"; but in most cases the objective is not to eliminate regulation. Instead, the objective is to increase efficiency by introducing more competition when it appears that workable competition will provide better services to consumers than a more heavily regulated, centralized approach. Industries most affected by increasing competition over the past few years include airline, trucking and natural gas.

In general the Department supports increased competition in the various energy industries, such as electricity, natural gas and petroleum. Competition provides suppliers with strong incentives to lower prices and adapt services to meet customers' preferences. But competition will not work if one firm or small group of firms can independently (or through collusion) raise prices, reduce the reliability of service or impose unacceptable environmental damages. Some level of governmental intervention is necessary when such "market failures" exist.

The elimination of federal price controls on natural gas is a prime example of a successful competitive initiative. It not only eliminated the shortages engendered by artificially low prices, but in the long run spurred constant or declining prices for natural gas (see Chapter 5).

The electric industry is also becoming increasingly competitive, partially in response to technological breakthroughs in generation and lower prices for natural gas. Although the electric industry is commonly viewed as one of the last energy industries to experience significant competition, the seeds for this competition have already been planted. For example, the federal Public Utility Regulatory Policies Act of 1978 (PURPA) and state initiatives with competitive bidding have spurred the development

of independent generators and advanced generation technologies. The result is a growing awareness that the generation of electricity is no longer a natural monopoly and that it should be open to competition. The Energy Policy Act of 1992 (EPAct) memorializes the federal government's preference for open competition in the wholesale generation market. Now all stakeholders -- including suppliers, investors, consumers, regulators and the general public -- are exploring alternative ways of implementing this policy. Moreover, individual states are debating whether individual customers, as well as traditional utilities, should have the right to shop for their own generation services.

Facilitating effective competition in energy markets will be one of the most pressing issues for state policy makers over the next few years. It requires difficult judgments as to when to let the market and competition rule -- and accept the results -- and when to maintain some restrictions or regulations to advance public-policy objectives not adequately accounted for by the private sector.

III. NEED FOR GOVERNMENTAL INTERVENTION

A. POLICY RATIONALE

As explained in Chapter 1, the Department believes that any intervention in energy markets should have a well-defined rationale. In other words, there must be clear public-policy objectives. Moreover, there must be an objective reckoning of all advantages and disadvantages of a given initiative. For example, if taking steps to improve environmental quality also raises energy costs, both the environmental benefits and economic costs must be considered. Energy decisions are usually difficult and controversial because no one strategy best advances each policy goal. If the need to "balance" goals were not so prevalent, energy policy would be relatively straightforward. The Department summarizes below some of the most important reasons for intervention in energy markets, using our second policy goal as a springboard.

B. ENVIRONMENTAL QUALITY

One common market failure is the lack of incentives for providers and consumers of energy services to account for the environmental impacts of their decisions. Utilities and other energy providers are required to limit their environmental impacts by meeting a panoply of local, state and federal standards. Yet even after meeting these standards, energy production imposes a variety of environmental costs. Producers often have little incentive to reduce these costs below the standards, i.e., they have little incentive to further reduce the environmental costs they impose on others. A good example is emissions of carbon monoxide (CO) from motor vehicles. While automobile manufacturers are required to meet certain thresholds for fuel efficiency, limit gasoline evaporation rates and install catalytic converters, CO emissions are not eliminated.

Indeed, in some municipalities CO emissions continue to be one of the most pressing environmental problems. One legitimate role of state energy policy is to incorporate these and similar impacts into energy decisions.

Taking steps to account for environmental impacts may be impractical or counter-productive in some cases. But the Department actively supports a "social-cost" approach that forces producers and consumers of energy services to bear the environmental costs of their actions. This approach has the advantage of improving the competitiveness of clean resources while avoiding inflexible strategies such as mandating abatement equipment or prohibiting polluting technologies. It also effectively balances the competing objectives of a clean environment and low energy prices. If polluters are willing to pay for the environmental costs they impose, then it is in society's best interest to allow them to produce. If they are not willing to bear these costs, then they should not produce. This policy applies to all energy industries and sectors, and is reflected in the Department's specific strategies and recommendations in subsequent chapters.

C. *RESOURCE DIVERSITY*

1. Rationale for Resource Diversity

Relying heavily on one or two technologies or fuels can be risky, because the technologies may prove to be unreliable or the prices of the fuels may increase significantly. Energy providers and consumers can reduce these risks through mechanisms such as insurance policies, futures contracts, contracts with equipment vendors that include performance requirements, and fuel contracts with specified escalation rates or market-out provisions. Yet there are limits to the effectiveness of these strategies. One of the best long-term protections against an uncertain future is resource diversity.

Despite the well-accepted benefits of resource diversity, any evaluation of specific strategies should recognize several caveats.

First, resource diversity is desirable only if it accomplishes specific policy objectives. Resource diversity is often treated as a goal in and of itself -- similar to low prices, reliable service and environmental quality. This treatment has the advantage of simplicity and is harmless as long as we remember that resource diversity is only a *means* of achieving policy goals. In general, the odds of achieving true policy goals such as low prices, reliable service and environmental protection are better in the long run if we do not put all of our eggs into one basket.

This clarification is important. People often conclude that we should pay a little (or a lot) more for a new resource to obtain a more diversified resource mix. But this increased diversity is beneficial only if it truly leads to risk reduction in the areas of price, reliability or environmental quality. Pursuing a new resource with uncertain reliability and fuel availability will diversify the State's resource mix, but may well

increase the total risk to the State.[1] Consequently, it is important to examine carefully whether a proposed movement to resource diversity will actually promote the State's policy goals.

Second, the "resource diversity" rationale should not be used to double-count environmental benefits already captured through other mechanisms. For example, in some cases the environmental impacts of alternative resources may already be factored into resource decisions. If so, there is no longer any justification for pursuing resource diversity on the basis of environmental benefits. The rationale for resource diversity should then be limited to price or reliability benefits.

Third, some price and reliability risks are already reflected in the market price of a given fuel or technology. For example, investors in a technology with perceived reliability problems or an uncertain regulatory future will probably demand a high return to compensate them for assuming a relatively high investment risk. Consequently, the cost of this technology will reflect its additional risk. There is no need for the State to intervene in such cases in the name of resource diversity; the market price of the technology already includes a cost premium that captures the additional risk the State would be attempting to mitigate or avoid.

These three caveats illustrate the need to evaluate carefully any policies designed to promote resource diversity.

2. Industry-Specific Considerations

The issue of resource diversity takes on a completely different emphasis in the petroleum, natural-gas and electric industries. (Except for wood biomass, most alternative energy is used for either electric generation or transportation.)

Most petroleum products are used for transportation, a sector that currently exhibits little resource diversity. The emphasis in the transportation sector has historically been on securing stable supplies of petroleum at reasonable prices -- through exploration, the maintenance of petroleum reserves, diplomacy and (if necessary) armed aggression. However, the use of alternative transportation fuels is projected to increase due to governmental mandates and incentives.

The same holds for the natural-gas industry. By definition the emphasis is not on fuel diversity per se, but on securing a diversified portfolio of contracts for one fuel (natural gas), supplemented by purchases on the spot market and option contracts.

[1] The recent bankruptcy of Kenetech illustrates the risk of pursuing fuel diversity. For example, if Kenetech had developed a project for NSP and was unable to maintain the project due to its financial demise, NSP ratepayers would at a minimum bear the burden of increased costs, and, at worst, the loss of the entire project. While this development does not appear to jeopardize the 25-MW wind project at Lake Benton because it is owned by a solvent company, it is typical of the problems that can arise when pursuing new technologies to promote fuel diversity. Developmental or operational problems can often reduce the reliability of a project or increase its costs.

There are relatively more options for resource diversity in the electric industry. A number of fuels and technologies can generate electricity at reasonably comparable costs. Even if choices are limited to non-renewable options, generating resources can be apportioned among nuclear, coal, natural gas and petroleum. Adding renewable resources such as hydroelectric, wind, biomass and solar further expands the menu of options.

In the following industry-specific chapters the Department offers several recommendations for diversifying the State's energy resources. The Department does not repeat the above discussion of fuel diversity in each chapter. But in all cases our intent is to pursue diversification strategies that truly reduce the risks to consumers of high prices, unreliable supplies or adverse environmental impacts.

D. STATE ECONOMIC DEVELOPMENT

Economic development presents one of the most difficult public-policy challenges. At its worst, this policy objective is used to justify the creation of a few local jobs at the expense of a dirtier environment or higher costs and less development for the remainder of the State or nation. At its best, it can promote greater wealth and a cleaner environment for everyone. Distinguishing between the two cases is difficult. While each case must be assessed on its own merits, we offer several guidelines.

First, claims of job creation must be examined critically. If our only goal were simply to create jobs, we could require taxpayers to pay every unemployed Minnesotan to dig holes on Monday, Tuesday and Wednesday, and fill them on Thursday and Friday. The government certainly has the wherewithal to create many such jobs, and can even require high wages for these jobs. But the ultimate goal of policy initiatives is not job creation for its own sake; it is societal wealth. If people provide services that consumers highly value, they are rewarded with high-paying jobs that truly improve our standard of living. Absent the market test of consumer acceptance, government-induced jobs may do little to improve societal welfare. They then simply become means of shifting wealth to one segment of the population at the expense of society as a whole.

A concrete example may better illustrate this point. Mandating the purchase of energy services from indigenous firms, or firms using indigenous fuels, may generate a handful of new jobs in the State. But the capital and labor devoted to this new enterprise come at the expense of other economic opportunities that could have used the same resources. Moreover, if the indigenous firm produces energy at significantly higher costs, then all Minnesotans paying those higher costs have less money to use for other purposes -- such as buying groceries or building manufacturing plants. This loss translates into fewer jobs and less wealth. Because these dampening effects of economic-development initiatives are diffuse and insidious, they are often ignored. Yet the appropriate consideration of these indirect costs may lead us to conclude that a mandate to encourage home-grown resources could actually harm the State's economy.

To illustrate this point, the effects of changes in future fuel prices on Minnesota employment and output are provided in Figures III-1 and III-2. The top bar of each figure assumes that annual increases in fuel prices are 3 percent more than the escalation rates assumed in the Reference scenario. The bottom bar of each figure assumes that annual increases in fuel prices are 3 percent less than the escalation rates assumed in the Reference scenario. The difference in Minnesota's economic activity in 2020 under these two scenarios is profound. Specifically, the difference is about 100,000 jobs and $7 billion (1994 dollars) of gross state product.

Figure III-1: Effect of Annual Increases in Real Fuel Prices On Minnesota Gross State Product in the Year 2020 (Constant 1994 Dollars)

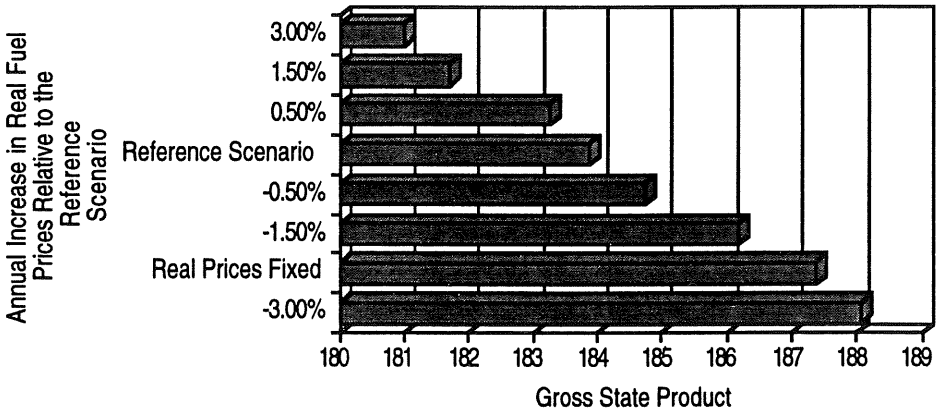
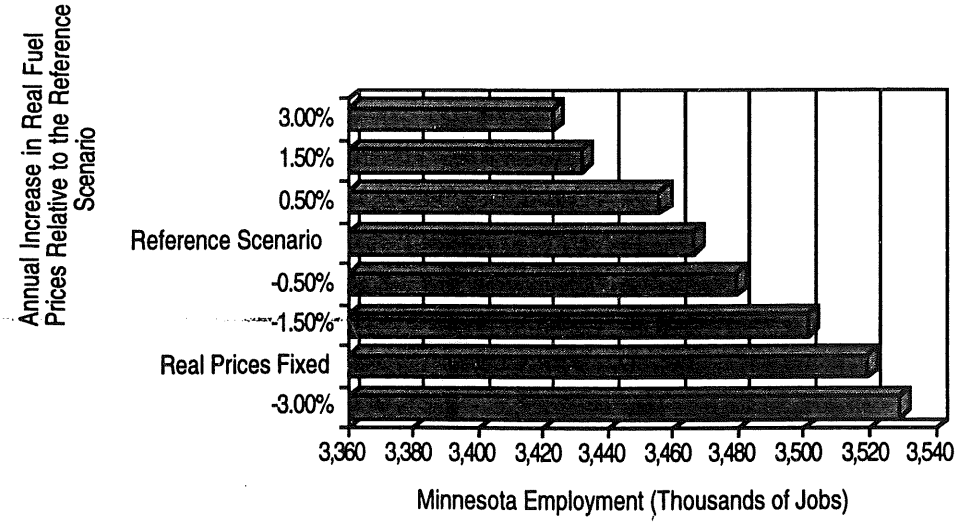


Figure III-2: Effect of Annual Increases in Real Fuel Prices On Minnesota Employment in the Year 2020



Second, economic-development initiatives should focus on jump-starting industries in the State with the best long-term growth potential. Ideally, we should focus on encouraging growth in areas that the private sector has balked at due to the relatively high business and financial risks. Public subsidies to encourage these new industries may bear dividends when the industry matures and prospers. Of course, this justification assumes that the government can pick the best industries to back. The government's record in this regard is mixed.

Third, initiatives enacted to further economic development should be financed to the extent possible by a broad base of local or state taxpayers -- not the consumers of energy services. Specifically, customers of gas and electric utilities, as well as owners and operators of motor vehicles, should not be responsible for subsidizing economic growth in various regions of the State.

E. ENERGY EDUCATION

Governmental bodies are in a unique position to offer energy education to the public. While most businesses have an understandable interest in promoting their particular fuels, technologies or services, the public sector has an obligation to provide more objective assessments. Public education programs can be extremely effective; they are often inexpensive and can materially help many consumers. The Department has emphasized energy education in the past and will continue to do so. Examples include the following:

- Energy Information Center, which provides consumer information through publications, news releases, radio-line responses to phone calls, participation at the Minnesota State Fair, and home shows, trade shows, etc.

- Wind Resource Assessment Project, which includes research and information dissemination to develop the potential of wind as an energy resource.

- Energy Code Advancement Project, which provides industry education on meeting Minnesota's advanced energy building code.

F. RESEARCH AND DEVELOPMENT

New technologies or services often have difficulty competing with businesses using established technologies and an infrastructure geared to their needs. Alternative technologies cannot be developed overnight; they require basic research and limited demonstration before they can promise sufficient commercial viability to warrant private financing. While the private sector conducts significant R&D, the public sector can often bridge important gaps. The need for public R&D is generally greater the newer and more untested the technology.

In most cases federal funding of energy research is more appropriate than state funding for two reasons. First, the benefits of energy research usually accrue to the nation as a whole. Second, the federal government has greater financial resources than the State of Minnesota. Effective research often requires levels of funding that an individual state cannot realistically hope to provide.

The best opportunities for State R&D are in areas where Minnesota can capitalize on its own resources. For example, well-targeted research into wind energy, biomass energy and ethanol production has a better justification than research into clean-coal technologies. The State has an abundance of the former resources and little of the latter. As with economic-development initiatives, public R&D efforts should focus on technologies with the most promising futures in Minnesota. These efforts should not duplicate private R&D initiatives.

G. *ACCESS TO INVESTMENT CAPITAL*

Individual citizens and businesses often forego attractive energy investments because they cannot raise the necessary capital. As a result, both the individual and society lose. One goal of State energy policy should be to provide access to investment capital in such instances at affordable interest rates.

The Department administers several such programs, such as the Energy Conservation Investment Loan Program, the Rental Energy Loan Fund, and the Conservation Improvement Program.

The Energy Conservation Investment Loan Program provides public entities with access to investment capital to implement energy conservation improvements. Over the past nine years, this program has reduced energy costs in hundreds of public buildings. Currently, the Department is evaluating whether to provide funds from this program to help finance a wind generator at a public school in Minnesota.

The Rental Energy Loan Fund, for which the Department administers monies and facilitates access to federal funds, is provided by the Center for Energy and Environment (a non-profit energy-services provider). This organization uses the federal funds to provide loans for energy-conservation weatherization improvements on residential rental properties.

The Department also administers CIPs, which are discussed in detail in Chapters 1, 4 and 5. Several CIP projects offered by Minnesota's electric and gas utilities promote customer access to investment capital, usually by providing them with rebates and other incentives for cost-effective energy conservation improvements. Utilities offer these projects to all classes of customers, and give particular consideration to the needs of low-income customers.

IV. ENERGY TAX POLICY

A. *INTRODUCTION*

Energy tax policy has been a contentious issue at all levels of government for many years. Even if everyone agrees on the goals of a specific tax initiative, its actual effects are often difficult to predict and can have unintended results. Moreover, distinguishing energy tax policy from general tax policy is not always easy. For example, the levels of state income taxes that utilities and other energy providers pay is not strictly an energy-policy issue. These levels are based on the State's overall revenue needs. If energy providers were taxed at the same rates as other Minnesota businesses, determining whether the levels are too high or too low would be one of general tax policy rather than energy tax policy.

When referring to energy tax policy, the Department means the wide variety of taxes, fees, tax exemptions, tax credits, etc., that are:

- applied strictly or primarily to energy producers or consumers, and
- have the effect (if not always the intent) of encouraging or discouraging certain fuels, energy technologies or energy services.

These measures can be enacted at the federal, state, county or municipal level. As long as a tax policy is truly energy related, as defined above, it should be evaluated based on its ability to further the State's broad energy goals.

The Department of Public Service and the Public Utilities Commission will soon assist the Department of Revenue in drafting a comprehensive study of utility taxation. This study is due to the Legislature by January 15, 1997. It should cover tax policy in more detail than we can in this Report, which covers a wide range of energy topics. Nonetheless, in this Report the Department will outline an approach to evaluating alternative policies.

To illustrate this approach the Department addresses two aspects of the State's current energy tax policy -- renewable tax incentives/production incentives and utility taxes. The Department evaluates these policies based on how well they promote the six reasons for governmental intervention listed in the Department's second energy-policy goal. We also consider how well they mesh with tax policies at other levels of government. While this exercise obviously excludes many important taxation issues, it illustrates at least one systematic approach to evaluating tax policies.

B. *TAX, PRODUCTION INCENTIVES FOR RENEWABLES*

The federal government and State of Minnesota have enacted a variety of tax exemptions and production incentives for renewable resources. The primary incentives are listed in Figure III-3.

Figure III-3
State and Federal Tax and Production Incentives For Renewable Energy

Resource	Federal Incentives	State Incentives
WIND		
Property Tax		Exemption for Projects Under 2 MW Partial Exemption for Projects Over 2 MW
Production Incentive	Tax Credit of 1.5¢/kWh for Projects Installed by June 30, 1999 (for 10 Years)	Payment of 1.5¢/kWh for Wind Generation at Owner's Site or by Agricultural Co-op (for 10 Years)
HYDROPOWER		
Production Incentive		Payment of 1.5¢/kWh for Generation after July 1, 1994, at Dam in Existence by March 31, 1994 (for 10 Years)
Property Tax		Exemption if Site Owned by State or Local Government
BIOMASS		
Production Incentive	Tax Credit of 1.5¢/kWh for Closed-Loop Systems Installed by June 30, 1999 (for 10 Years)	
SOLAR		
Property Tax		Exemption for Photovoltaic Systems
ETHANOL		
Production Credit		Payment of 20¢/Gallon for Ethanol Produced in the State; Annual Payments Limited to $3 Million for any One Producer and $30 Million in Total
Tax Credit	Benefit of 54¢/Gallon for Ethanol Used as Transportation Fuel	
Blender's Credit		Excise Tax Credit of 5¢/Gallon for Ethanol Blended to Make 10 Percent Blended Gasoline (Expires October 1, 1997)

By encouraging relatively clean resources with little market penetration, these tax incentives and production credits can be justified on environmental and R&D grounds. They may also stimulate economic development, although, as explained above, the Department believes these benefits are often overstated. Whether a sophisticated social-cost approach would confirm the levels of these incentives is debatable. In other words, it is uncertain whether the level of incentives offered a particular renewable resource accurately captures the additional (net) benefits of this resource over other energy resources not offered the same incentives. The combined incentives to small wind projects appear generous, especially when coupled with other incentives such as low-interest loans and mandated buyback rates for sales to electric utilities. Nonetheless, the renewable tax policy is based on legitimate public-interest goals.

C. *UTILITY TAXES*

In Attachment 4 the Department provides an overview of the various state and local taxes paid by Minnesota electric utilities. One obvious conclusion from this analysis is that utilities account for a large portion of Minnesota's tax base. They pay a variety of taxes at the state and local levels. In many respects these taxes are no different from those assessed on other, similarly situated businesses. Yet there are some troubling differences.

The most striking difference is that utilities pay substantially higher property taxes than they would if they were not utilities. In fact, the property taxes of the eight large utilities in the sample are 565 percent higher due to their status as utilities. This additional burden could be justified as part of a sound energy policy if it advanced policy goals (as the renewable tax policy does). But this does not appear to be the case. It is hard to justify the additional tax burden on the basis of any of the goals articulated earlier.

The primary justification appears to be that utilities are a convenient target for high taxes. This justification is dubious on its face. Another argument for higher utility taxes is that utility facilities impose relatively high levels of environmental costs. But reflecting these costs through higher property taxes is a questionable strategy for at least two reasons. First, other industrial (non-utility) plants that impose similar or greater environmental costs are exempt from the higher taxes. Second, the environmental impacts of utility facilities may exhibit a spurious correlation with their assessed value. Consequently, taxes that rise with property value are a poor means of incorporating environmental impacts in resource decisions.

More importantly, there are some significant disadvantages to assessing relatively high taxes on Minnesota utilities. First, energy costs to Minnesota consumers are artificially raised. For example, the additional property taxes imposed on NSP and Minnesota Power (MP) raise their rates to retail customers by about 9.4 percent and 6.1 percent, respectively. Second, Minnesota electric utilities are placed at a competitive disadvantage compared to other providers of energy services in Minnesota. Third, Minnesota-based electrical generation is placed at a competitive disadvantage

compared to generating units sited in other states. The recent need for one developer to seek property-tax exemptions to make its cogeneration plant in Cottage Grove more competitive with similar projects in Wisconsin illustrates this concern.

Franchise fees are assessed by municipalities and, in most cases, the revenues become part of the municipality's general operating fund. Franchise fees can also raise the costs of utility service compared to the costs of non-utility energy services. But the magnitude of this concern is less than in the case of property taxes.

The inequities of the current tax system will only be exacerbated as the electric industry becomes more competitive. The result may be cases where developers site generation facilities in other states, even when building in Minnesota would be cheaper if the tax disparities were eliminated. Moreover, electric service in general will be priced artificially high compared to other, competing services.

D. ENERGY TAX POLICY REVISITED

Based on the above analysis, the Department recommends no major changes in the State's tax policy governing renewable energy. The levels of the incentives may be too low in some cases and excessive in others; however, they advance legitimate public-policy objectives.

In contrast, the property taxes and franchise fees assessed on utilities in Minnesota create inequities that appear to meet no reasonable objective of state energy policy. Consequently, in Attachment 4 the Department offers four recommendations to address these inequities. They are repeated as action steps at the end of this chapter.

The Department recommends evaluating all aspects of the State's energy tax policy based on their effectiveness in promoting the legitimate goals of governmental intervention. We look forward to a more comprehensive assessment of tax policy in the near future.

V. ENERGY SERVICES FOR LOW-INCOME CUSTOMERS

During the past year the federal government has reduced subsidies to low-income energy consumers. Two salient examples are the federal Energy Assistance Program, with Minnesota funds reduced by over 40 percent from the 1995 to 1996 heating season, and the DOE's Weatherization Assistance Program, with funds cut in half from last year's levels. Many are concerned that increasing numbers of low-income Minnesotans will be unable to afford energy for heating and other critical needs. One pressing challenge over the next few years is ensuring that all Minnesotans have access to basic energy services.

The Department notes that the problems low-income customers experience in paying for energy services are only one indication of a much broader societal problem. This broader problem is best addressed by programs financed through general funds (social mechanisms). These programs allow low-income people to afford not only energy services, but also food, housing, clothing and other basic needs. To the extent subsidies are warranted specifically for energy services, these subsidies should come from all taxpayers. Ratepayers of gas or electric utilities, as well as users of propane, fuel oil or other heating fuels, should not bear the brunt of such social programs. In short, maintaining universal service is not primarily an "energy-policy" issue: It is a broader societal issue.

Gas and electric utilities currently administer programs to help low-income customers. For example, utilities are prohibited from disconnecting service to customers who depend on this service for their primary heating needs, as long as these customers take certain steps to guarantee repayment of their bills. In addition, two of the State's largest utilities -- NSP and Minnegasco -- provide rate discounts to low-income customers. Finally, each investor-owned gas and electric utility is required to develop a CIP. By State law these programs must include energy-savings projects that specifically address the needs of low-income customers.

The Department does not recommend further subsidies from utility ratepayers or other consumers of energy services. Instead, additional assistance should be provided by the Legislature through contributions from all Minnesotans. These programs could be simple transfers of income to the needy, or funds earmarked specifically for defraying energy costs. This strategy recognizes that attempting to solve inability-to-pay problems through energy policy is an inefficient, piecemeal approach.

VI. SUMMARY AND RECOMMENDATIONS

To the extent possible energy policies should be applied consistently across all industries and sectors. While most recommendations in this Report are contained in the industry-specific chapters to follow, in this chapter we offer two strategies and related action steps applicable to all industries and sectors. These strategies address energy tax policy and energy services to low-income customers.

We also note that some of the industry-specific strategies and action steps provided in subsequent chapters -- particularly those addressing energy efficiency and performance-based regulation -- are identical or similar across industries. These strategies and action steps, taken together, could also be considered multi-industry recommendations. In many cases the distinction between industry-specific and multi-industry recommendations is tenuous.

The Department recommends that Minnesota adopt the strategies and action steps listed below.

Strategy 1 - TAX POLICY: Ensure that Minnesota's energy consumers, providers and technologies are not unduly disadvantaged by State tax policies.

To implement this strategy, the Department recommends the following action steps:

1. Identify clearly to consumers all taxes included in utility rates.

2. Treat utilities and non-utility businesses similarly for tax purposes.

3. Subject providers of equivalent services to the same franchise fees and terms. Track franchise fees to ensure that these taxes are used only for their intended purpose.

4. Investigate whether the ability of Minnesota utilities to compete with out-of-state businesses is impeded due to varying tax policies among states.

Strategy 2 - ENERGY SERVICES TO LOW-INCOME CUSTOMERS: Ensure that State general funds are used to pay for energy-assistance programs.

To implement this strategy, the Department recommends the following action step:

1. Require that energy-assistance programs for eligible low-income Minnesotans be funded through State general fund obligations rather than through subsidies from other energy consumers.

CHAPTER 4

ELECTRICITY

I. INTRODUCTION

Minnesota's steadily growing demand for electricity ensures that the debate over how to best regulate, produce and use electricity will continue. The Department recognizes that a safe, low-cost supply of electricity is essential to the State's economic health. How this low-cost electricity is provided to Minnesota customers can have a significant impact on the State, particularly the State's natural environment. Certainly, the failure of the federal government to make progress in developing a nuclear-waste disposal facility makes us acutely aware of how the energy choices we make now have serious consequences for the future.

The Energy Policy Act of 1992 (EPAct) has dramatically affected the electric industry over the past four years. EPAct has stimulated competition, because it authorizes federal regulators to open transmission lines to competing generators of electric power. EPAct also promotes renewable energy development and electric and natural-gas energy efficiency.

This chapter examines our energy past, present and future with respect to electricity. A review of Minnesota's trends in electricity use, prices and expenditures and how Minnesota's future electricity needs are likely to be met is followed by a discussion of:

- the storage and disposal of nuclear waste and the relicensing of nuclear power plants,
- electric industry restructuring,
- regional regulation,
- performance-based regulation,
- mergers,
- energy efficiency, and
- environmental costs.

Finally, we identify directions Minnesota should pursue in charting its electric energy future.

II. INDUSTRY HISTORY AND BACKGROUND

In the 1800s waterwheels and wind mills were scattered across the Minnesota landscape, producing on-site electricity to individual businesses and farmers. Minnesotans began mass-producing electricity at a central generating plant and distributing it by wire to customers in the 1880s. Stillwater was the first Minnesota city to generate power for businesses, and Minneapolis was reportedly the first city in the United States to distribute electric power to homes.

By the 1920s entrepreneurs were buying up privately owned city power plants and forming networks of transmission and distribution lines to connect regions of the State. These companies were the forerunners of the major electric power companies serving Minnesota today. Federal regulation of the electric industry also began in the 1920s with the passage of the Federal Water Power Act. The original law was limited, governing only hydroelectric licensing. It was a compromise between those who wanted only the federal government to operate and build dams and those who wanted to give electric companies a free hand subject only to state regulation.

Electricity generation and distribution did not extend to the State's rural areas until 1935, when President Roosevelt signed the Rural Electrification Act. Between 1936 and 1940 Minnesota farmers began to take advantage of the Act's low-interest loans and formed rural cooperatives to bring power to their homes and farms.

The electric industry generally provides three functions:

- generation,
- transmission, and
- distribution.

These three functions are currently regulated at various levels of government and by various entities. FERC regulates the rates, terms and conditions of wholesale electricity sales. State public utilities commissions, as well as municipal and co-operative boards, are responsible for regulating retail sales of electricity. Electric utilities are also subject to a variety of financial and environmental regulations at the federal, state and local levels.

Electric utilities operate under a "regulatory compact." This compact grants utilities a monopoly on the provision of electricity within their service territories. No electricity may be sold to customers within a utility's territory other than by that utility, except in certain limited circumstances. In exchange for this monopoly, the utility assumes the obligation to serve each customer within that service territory and to provide quality service at just and reasonable rates.

Since 1978, both the federal and state governments have taken steps to encourage wholesale competition in the generation section of the electric industry. At the federal level PURPA provides qualifying facilities (QFs) -- non-utility generators that are either cogeneration facilities or small power producers using specified energy sources such as biomass, solar, wind or geothermal -- with a guaranteed market for their power and energy. The utility in whose territory the QF is located is required to purchase power and energy from the QF at no more than the utility's "avoided cost." In addition, EPAct increases the ability of independent power producers to construct new generation facilities and, more importantly, allows FERC more authority to order wholesale transmission access. In 1996 FERC issued Order 888, which specifically requires transmission access, thus paving the way for wholesale competition.

The future of the industry is hotly debated, as discussed later in this chapter. One unanswered question is whether competition will be extended to the retail level, thereby allowing customers to choose their own suppliers of electricity and modifying the traditional regulatory compact. Developments over the next four years will profoundly affect the future of the electric industry.

III. ELECTRICITY USE, EXPENDITURES AND PRICES

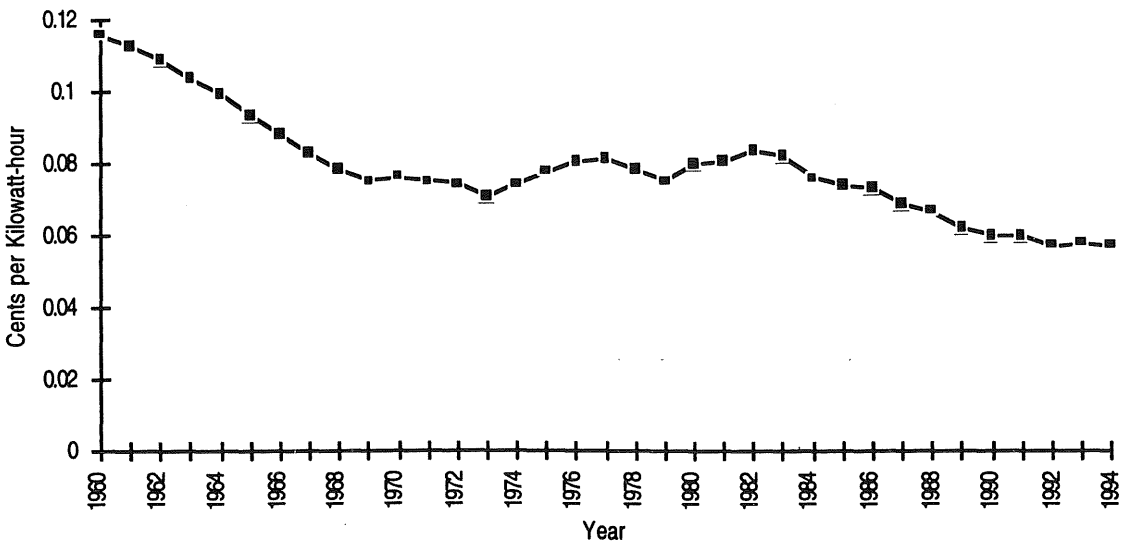
A. HISTORICAL CONSUMPTION, PRICES AND EXPENDITURES

Electricity consumption has grown by an average annual rate of 5 percent since 1960, from 8,923 GWh in 1960 to 49,584 GWh in 1994. This growth is expected to continue, due primarily to an increasing population in Minnesota and the increasing saturation of air conditioning in the residential market and office equipment in the commercial market. The industrial sector has been the largest user of electricity in Minnesota, followed by the residential and commercial sectors (agriculture is considered part of the industrial sector).

Minnesotans' real expenditures for electricity increased by an average annual rate of 3 percent from 1960 to 1994. Expenditures reached $2.9 billion in 1994, which represented 41 percent of Minnesotans' 1994 total energy expenditures.

Average real electricity prices declined at an annual average rate of 2 percent from 1960 through 1994 (Figure IV-1).

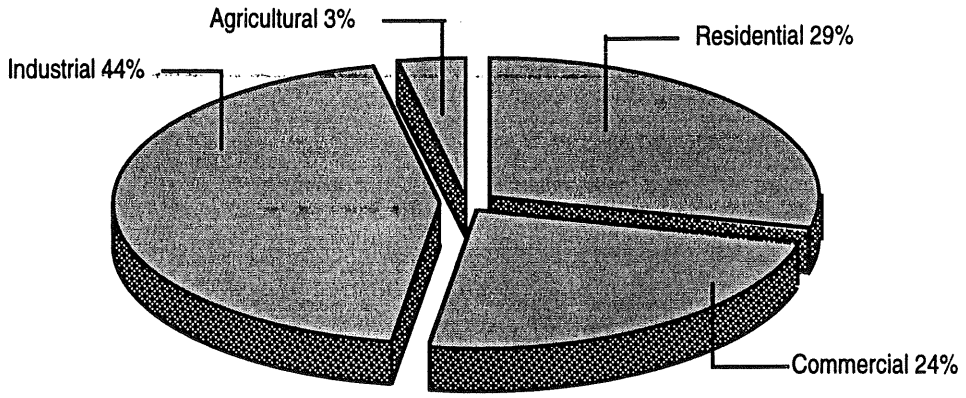
Figure IV-1: Average Real Electricity Prices 1960-1994 (Constant 1994 Dollars)



B. *CURRENT USE BY SECTOR AND END-USE*

The industrial sector is the largest user of electricity in Minnesota, followed by the residential, commercial and agricultural sectors (Figure IV-2).

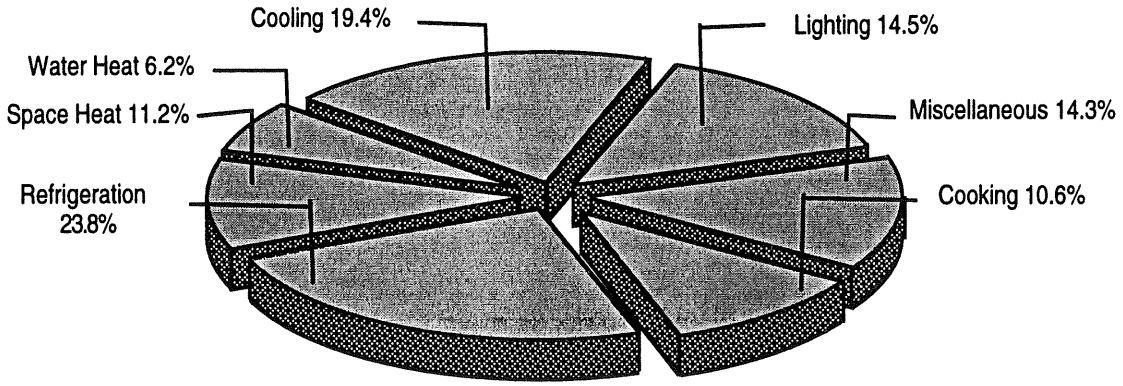
Figure IV-2: 1994 Electric Consumption by Sector



Total = 49,584 Gigawat-Hours

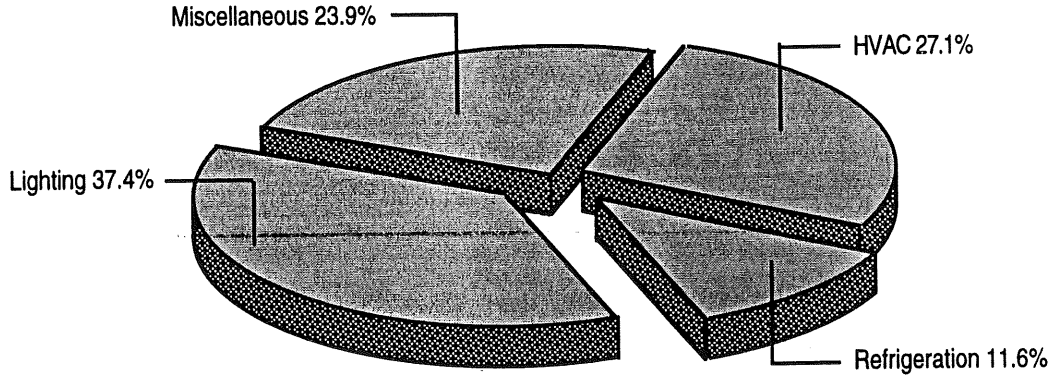
Different types of consumers use electricity in a variety of ways, with motors, lighting and cooling as major uses (Figures IV-3, IV-4 and IV-5).

Figure IV-3: 1994 Residential Electric Consumption by End-Use



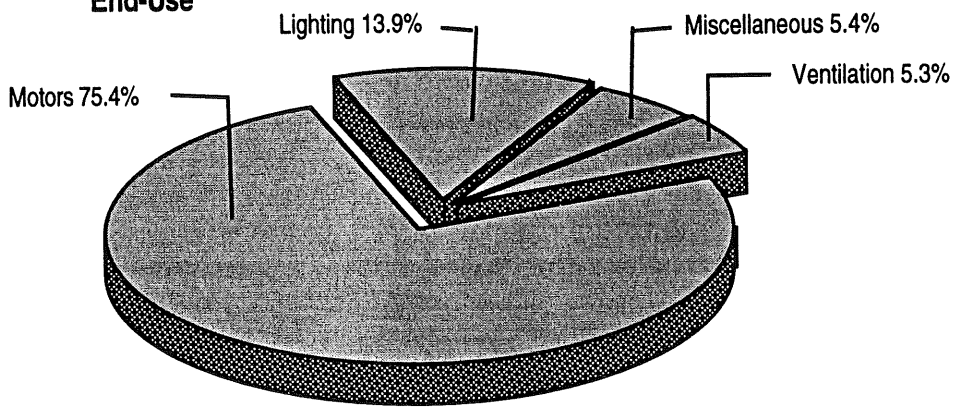
Total = 14,431 Gigawatt-Hours

Figure IV-4: 1994 Commercial Electric Consumption by End-Use



Total = 13,357 Gigawatt-Hours

Figure IV-5: 1994 Industrial Electric Consumption by End-Use

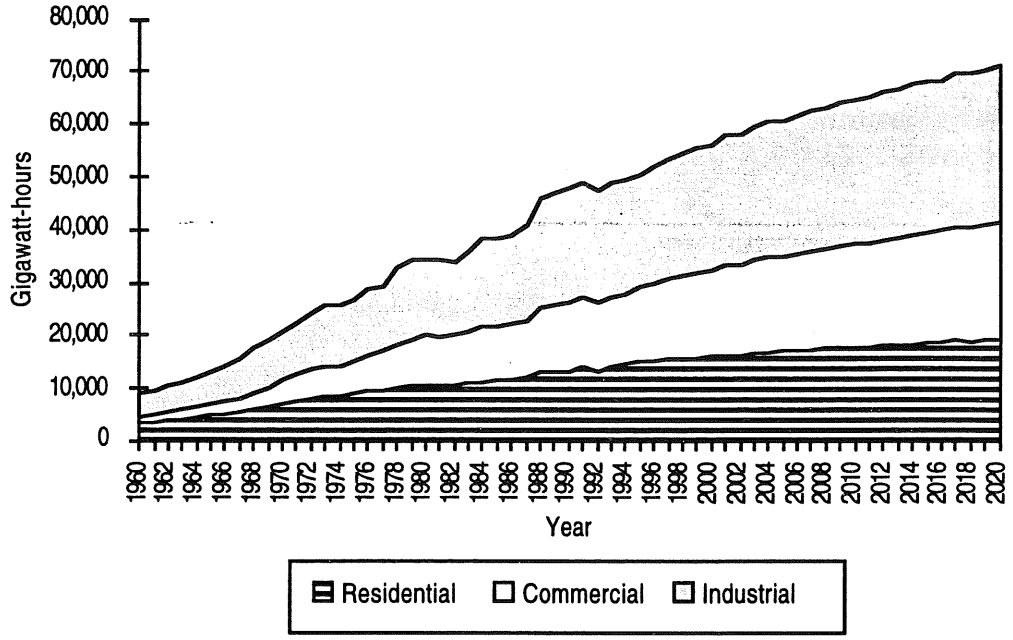


Total = 21,796 Gigawatt-Hours

C. *FORECASTED CONSUMPTION AND EXPENDITURES*

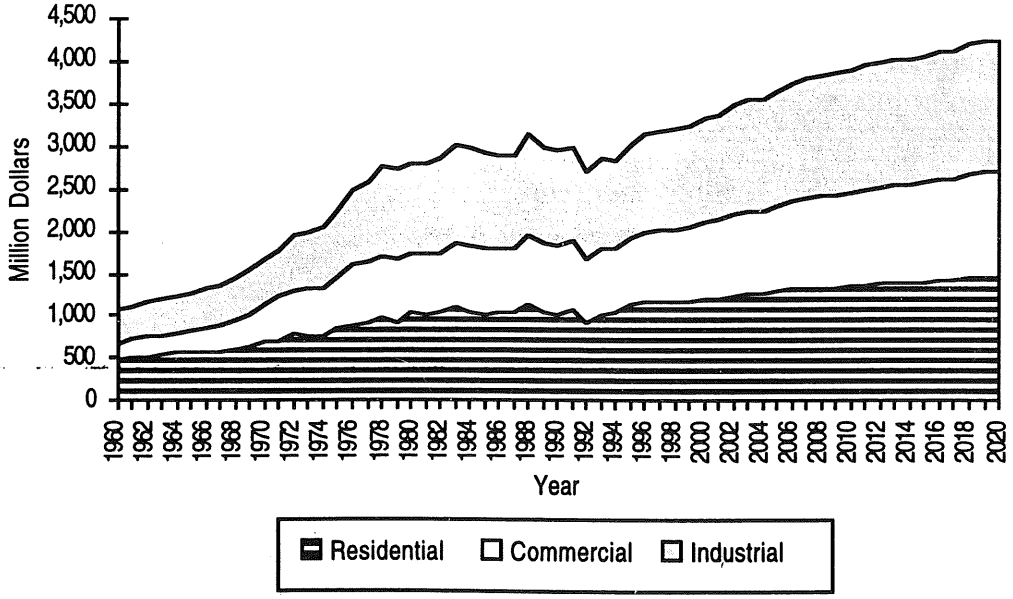
The Department forecasts growth in electricity consumption of 44 percent between 1994 (49,584 GWh) and 2020 (71,447 GWh) (Figure IV-6). Growth in residential consumption accounts for 22 percent of the total increase, with residential use growing 34 percent from 14,431 GWh in 1994 to 19,328 GWh in 2020. Growth in commercial consumption accounts for 40 percent of the total growth in the use of electricity, with commercial use growing 66 percent from 13,357 GWh in 1994 to 22,159 GWh in 2020. Growth in industrial consumption accounts for 37 percent of the total growth in the use of electricity, with industrial use growing 37 percent from 21,796 GWh in 1994 to 29,959 GWh in 2020.

Figure IV-6: Electric Consumption By Sector 1960-2020



Electric expenditures are expected to reach $4.2 billion (1994 dollars) by 2020 (Figure IV-7).

Figure IV-7: Electric Expenditures By Sector 1960-2020 (Constant 1994 Dollars)

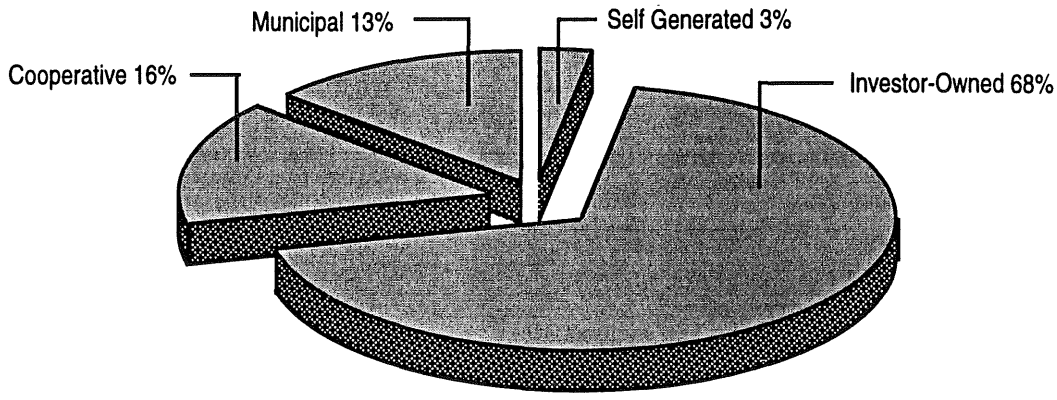


IV. MEETING MINNESOTA'S ELECTRIC NEEDS

A. *TYPES OF UTILITIES SERVING MINNESOTA*

Electricity is supplied to Minnesotans by several types of utilities: investor-owned, municipal and cooperative. As shown in Figure IV-8, investor-owned utilities (IOUs) supply the vast majority of Minnesota's electricity.

Figure IV-8: 1994 Electricity Sales by Utility Type



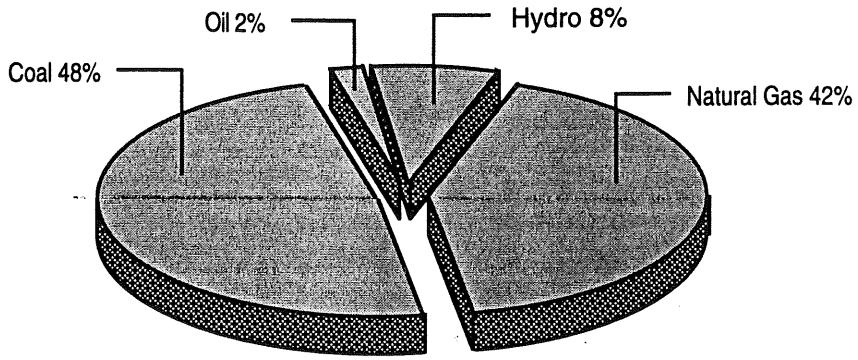
Total = 49,584 Gigawatt-Hours

Of these utilities, only the five IOUs and one cooperative distribution utility are subject to rate regulation by the Minnesota Public Utilities Commission. Cooperative and municipal utilities are primarily accountable only to their member- or citizen-customers. But they are subject to some state over-sight, most notably on construction of large power plants and transmission lines, determination of service territories, quality of service, minimum investments in demand-side resources and integrated resource planning (IRP).

B. *HISTORICAL FUEL MIX*

The mix of fuels used to generate electricity in Minnesota plants has changed significantly over the last 34 years. In 1960 electric generation was dominated by coal and natural gas (Figure IV-9). During the 1970s, NSP added three nuclear generating units to its system, making nuclear power a large contributor to our generation mix. At the same time, increases in natural-gas prices and federal restrictions on the use of natural gas significantly reduced the amount of natural gas in our fuel mix. Other major additions of generation capacity over the past 35 years include the completion of several coal-fired baseload plants in the late 1970s and early 1980s, several waste-to-energy facilities, and many peaking plants fueled by oil and/or natural gas.

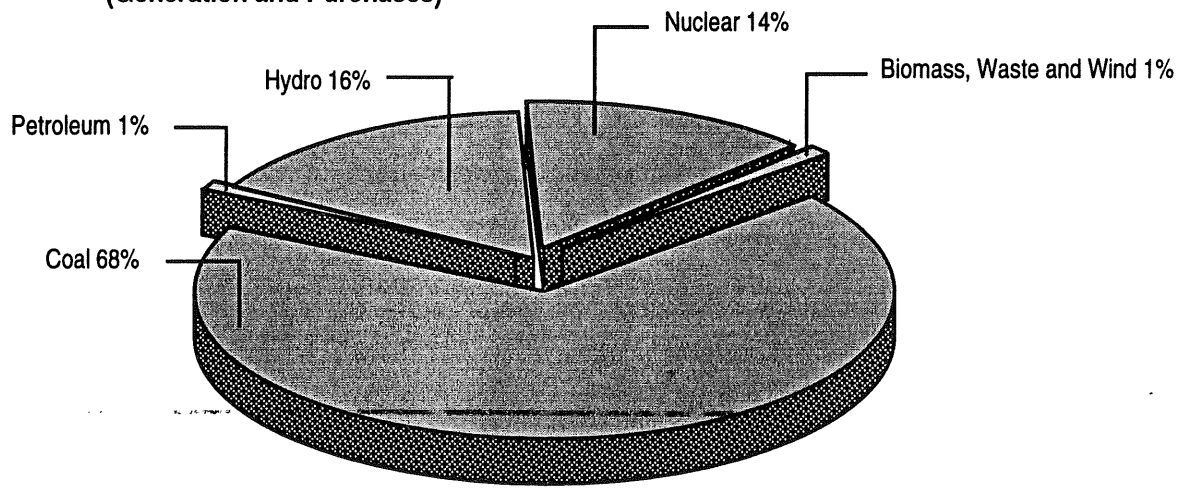
Figure IV-9: Fuel Sources Used to Generate Electricity in Minnesota Plants in 1960



C. *CURRENT FUEL MIX AND RESOURCE ACQUISITION*

As shown in Figure IV-10, in 1994 the most common fuel used by electric utilities serving Minnesota (including both generation and purchases) was coal, followed by water (hydroelectric) and uranium (nuclear).[1] Although not shown as a resource, utility conservation measures have significantly reduced the need for new generation facilities, particularly peaking plants. In 1994 investments by IOUs alone reduced energy needs by 464,610 MWh and peak demand by 166 MW. Other trends in electric generation include significant increases in the use of natural-gas, biomass and wind resources.

Figure IV-10: 1994 Fuel Sources of Electric Utilities Serving Minnesota (Generation and Purchases)



[1] The Department's approach to estimating the sources of Minnesota's electricity consumption is provided as Attachment 5.

Most of Minnesota's future generation resources are now chosen through the IRP process. In 1990 the PUC adopted rules requiring electric IOUs to submit integrated resource plans. In 1993 the Legislature extended IRP to large generation and transmission cooperatives and municipal power agencies. In these plans utilities project consumer demand over 15 years and determine the best mix of resources to meet that demand. These plans must assess:

- supply-side resources (including traditional power plants, renewable energy resources, life-extension of existing power plants and power purchases); and
- demand-side resources (conservation and load-management).

All resources are evaluated based on their cost, reliability, risk (in terms of cost and reliability), and socio-economic and environmental impacts. Interested parties can comment on the utility's plan or propose alternative plans. Integrated resource planning can ensure that environmental impacts and other social issues are factored into resource evaluation and decision-making. After reviewing the plans and comments, the Commission accepts, rejects or modifies the investor-owned utilities' IRPs and advises the other utilities about their resource plans. The Commission's findings may include the designation of a preferred plan, as well as a critique of any alternative plans.

D. FUTURE FUEL MIX AND RESOURCE ACQUISITION

According to the most recent IRPs filed with the Commission, Minnesota electric utilities expect to add 3,425 MW of net capacity between 1996 and 2013 to meet Minnesota's growing needs (Figure IV-11). In addition, NSP's nuclear plants will reach the end of their operating licenses before 2015: Monticello's reactor in 2011 and Prairie Island's two reactors in 2013 and 2014. Much larger amounts of capacity may be needed if these nuclear plants are not relicensed. NSP has committed to using a competitive-bidding process to obtain all of its future generation resources over 12 MW. The Department believes that competitive bidding should be extended to other utilities to ensure that future resources are provided at the lowest social cost.

Figure IV-II
Electric Generation Additions and Repowerments of Utilities Serving Minnesota Consumers

Year	Type of Generation	Total MW	MW Allocated to Minnesota Consumers
1996	Base	102	77
1996	Peak	2	1
1998	Base	102	78
1998	Peak	200	200
1999	Peak	150	126
2000	Base	100	76
2000	Intermediate	100	100
2000	Peak	25	12
2001	Intermediate	395	178
2001	Peak	28	15
2002	Intermediate	200	152
2002	Base	175	133
2002	Peak	104	90
2003	Intermediate	200	152
2003	Peak	128	91
2004	Peak	270	177
2005	Base	610	461
2005	Peak	380	252
2006	Peak	25	12
2007	Base	370	184
2007	Intermediate	100	76
2007	Peak	56	43
2008	Base	100	76
2008	Peak	135	91
2009	Base	450	272
2009	Peak	25	12
2010	Base	100	76
2010	Intermediate	100	76
2010	Peak	100	76
2011	Base	150	20
2013	Base	300	40
Total		**5,282**	**3,425**

V. CURRENT TRENDS AND FUTURE CONCERNS AND DIRECTIONS

A NUCLEAR POWER ISSUES

1. Background

Minnesota's three nuclear plants generated approximately 14 percent of the electricity consumed in the State in 1994. Nuclear generation has some environmental advantages over coal-fired plants: Each year the energy generated by Minnesota's

nuclear plants avoids emissions of thousands of tons of sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulates (PM-10), carbon dioxide (CO_2) and carbon monoxide (CO). But nuclear generation entails the continued accumulation of high-level radioactive waste. Over the last five years, Minnesota's nuclear plants generated an average of 37.4 metric tons per year of spent uranium. Uncertainty regarding the storage of nuclear waste was a primary reason for the Legislature's placing a moratorium on the future construction of nuclear power plants in the State. Compared to facilities in other states, however, Minnesota's nuclear plants are efficient and relatively inexpensive to operate. Minnesota has an economic interest in ensuring that the plants continue to operate safely until the end of their useful lives.

Continued operation of Minnesota's nuclear power plants depends on several issues, including waste storage and disposal and plant relicensing. These issues are discussed below.

2. Nuclear Waste Storage and Disposal

The need for permanent nuclear-waste storage was brought home to Minnesotans in 1991, when NSP requested a Certificate of Need from the Commission for additional storage facilities at the Prairie Island plant. NSP, the only Minnesota utility that owns nuclear generators, would have exhausted its capacity for storing spent fuel at Prairie Island in 1995. (NSP's Monticello plant will run out of storage capacity in 2006.)

DOE is obligated under the Nuclear Waste Policy Act to dispose of nuclear waste from the nation's power plants beginning in 1998. DOE's efforts to develop a permanent, below-ground repository at Yucca Mountain in Nevada have been delayed due to opposition from Nevada, extensive delays, cost over-runs and other problems. DOE's projections to have an operating repository in 2010 are seriously questioned. Based on these and other concerns expressed by the Department, the Commission voted to limit significantly NSP's additional storage capacity and require NSP to seek approval for additional capacity when more information on the federal program is available (see Chapter 1).

Holding the federal government accountable for its obligations to remove and dispose of Minnesota's nuclear waste must continue to be a key State priority. Regardless of whether NSP continues to operate Prairie Island beyond 2003, Minnesota has tons of nuclear waste in need of disposal. In 1993 the Department was instrumental in forming the NWSC to actively work towards a national solution to waste storage. The NWSC's membership, goals and activities are summarized in Chapter 1.

3. Nuclear Plant Relicensing

The Nuclear Regulatory Commission (NRC), a federal agency, oversees the relicensing of nuclear power plants. If NSP seeks relicensing of its nuclear plants, Minnesota's regulatory and environmental agencies will actively participate to represent Minnesota's interests. As explained in Chapter 1, the Department has experienced some success in convincing the NRC to change its relicensing rules to protect state and public participation in decisions on environmental issues. The State should continue to participate actively in proceedings before the NRC.

The Department also recommends that the State extend its Certificate of Need authority to relicensed plants. Requiring a Certificate of Need for relicensed nuclear power plants would ensure that:

- all aspects of the project -- including its financial, environmental, health, and safety impacts -- are considered in one forum; and
- Minnesota retains effective control over its electric generation mix.

B. ELECTRIC INDUSTRY RESTRUCTURING

Electric generation used to be considered a monopolistic service, because large generating facilities offered economies of scale that rendered smaller generating units non-competitive. Utilities were granted exclusive rights to generate electricity for their customers, because society as a whole benefited from the lower costs afforded by large facilities. However, technological breakthroughs in generation technologies, lower prices for natural gas, and regulatory changes have combined to make new, small-scale generation technologies competitive with larger facilities. These changes have prompted all stakeholders to consider and implement initiatives to promote increased competition in the generation sector.

The nation first experienced a rapid expansion in non-utility generation in 1978, when PURPA was enacted (see previous discussion in this chapter). Since PURPA's passage, both state and federal regulators have promoted increased wholesale competition in a variety of ways. For example, the Commission has ordered NSP to use competitive bidding to procure all future generation resources over 12 MW. At the federal level, EPAct memorializes the federal government's preference for open competition in the wholesale generation market. Based on this federal initiative, FERC issued Rule Number 888. This rule requires all owners of electric transmission facilities to transmit power on a non-discriminatory basis. FERC clearly intends to transform the nation's electric transmission system into a common carrier for the delivery of competitively procured generation services.

However, FERC has deferred the issue of direct customer access to generation services (often called retail wheeling) to individual states. Currently, each utility retains an exclusive right to sell electricity in an assigned service territory. State policy makers in Minnesota and throughout the nation are now considering whether (and to what

extent) individual consumers should be allowed to procure their own generation services. Proponents of direct customer access argue that it is the next logical step in promoting competition in the generation sector. Opponents argue that important state policy goals of environmental protection, economic development and universal service may be impeded by retail wheeling.

Regardless of the ultimate resolution of retail wheeling, the electric industry is clearly on the verge of significant structural change. Although today the three traditional service functions -- generation, transmission and distribution -- are primarily provided by vertically integrated utilities, they may soon be provided by two or more entities. The most likely scenario is that generation services will be provided on a competitive basis by a variety of largely unregulated market participants, while transmission and distribution will continue to be monopolistic services. This functional unbundling of electric services will require new forms of regulation. Competition will replace rate regulation in the generation sector, while transmission and distribution services will continue to be heavily regulated.

The Department supports increased competition in the electric industry, including direct customer access, as a means of promoting efficiency and innovation. However, the Department believes significant regulatory and structural changes are needed to address the State's policy goals. The economic benefits of increased competition should not come at the expense of reliability, environmental quality and State economic development. To this end, the Department has sponsored a series of workshops where all stakeholders can share their views on the appropriate levels and types of competition in the electric industry.

Ultimately, legislation must be developed to allow increased customer choice in the market for generation services. This legislation would ideally be comprehensive enough to ensure as much choice as possible, while preserving the legitimate public-interest goals described in Chapters 1 and 3. The promotion of customer choice in the electric industry will be one of the Department's most important initiatives between 1996 and the publication of the next quadrennial report in 2000.

C. REGIONAL REGULATION

Electric restructuring and the movement to more competition highlight the need for more decisions at the regional level--rather than at the utility, local government or state government level. The bulk-power market for electricity is currently operated and regulated by bodies such as utility control centers, power pools and reliability councils. The electric network (grid) of the entire eastern half of the United States, including Minnesota, is interconnected and synchronized. While in this nation individual states assume the primary responsibility for the economic regulation of electric utilities, state boundaries have little relevance to this network. With the introduction of more players into the market, such as independent generators, power marketers and retail customers, the need for a well-coordinated approach to ensuring the fair treatment of all players is paramount.

To promote fair competition in the wholesale market for generation services, FERC is requiring or encouraging open-access tariffs, regional transmission groups (RTGs) and independent system operators (ISOs). Open-access tariffs formalize a transmission owner's obligation to offer the same services at the same prices to all users. An RTG would consist of a number of utilities, independent generators, power marketers, state regulators and other stakeholders in a multi-state region to coordinate bulk-power planning and operations. An ISO would presumably have similar functions.

The Department shares the federal government's preference for more competition and a more regional outlook. Determining which bulk-power functions should be assigned to which regional organizations under which acronyms is a difficult challenge. In any event, the goal should be to have one body plan and operate the regional bulk-power system for the benefit of all users on a nondiscriminatory basis. If this approach is implemented properly, whoever offers the best generation services to a customer will not be thwarted due to unfavorable transmission access or pricing.

The decision-making entities envisioned above must encompass a wide region to maximize system benefits. By the same token, if solutions maximizing regional benefits impose costs on a small subset of stakeholders, these stakeholders should be entitled to some input into the planning process. In some cases they may deserve compensation or mitigation measures.

While continued work in this area is vital, the Department offers two observations:

- Statewide transmission planning makes little sense. While individual states should continue their siting processes to address the local impacts of major projects, the bulk-power system should be planned and operated at a regional level with input from all stakeholders.

- The Upper Midwest should be considered one bulk-power region. This area appears roughly the right size for one regional body, given the need to encompass as large an area as possible without becoming too large to coordinate planning and operations effectively.

MAPP has petitioned FERC to restructure itself into an RTG. MAPP also proposes to continue its reliability functions and assume power-marketing functions. As of July 1996 FERC had not acted on MAPP's petition. The Department supports MAPP's efforts to handle most of the responsibilities normally envisioned for an effective RTG or ISO.

A related issue is integrated resource planning. Many individual states, including Minnesota and Wisconsin, currently require generating utilities operating in their jurisdictions to file IRPs. This statewide planning is reasonable if the utility's

customers are exclusively or predominantly in that state. But for utilities with significant customer bases in two or more states, statewide IRP process is cumbersome. A better solution is to have states band together and require only one IRP proceeding for each multi-state utility. The states should then offer joint decisions and findings on the utility's IRP, thereby avoiding conflicting determinations of future customer needs and the best mix of generating units and demand-side resources to meet these needs. Of the utilities serving Minnesota, NSP appears to be the best candidate for regional IRP proceedings.

For the most part, decisions on transmission upgrades and additions should be turned over to the regional transmission planner (ISO or RTG) and state siting boards.

D. *PERFORMANCE-BASED REGULATION*

While electric restructuring will introduce even more competition into the provision of generation services, most transmission and distribution functions will continue to be monopolistic services. One promising approach to inducing better services at lower costs is performance-based regulation (PBR). By tying a utility's profits to its performance, PBR plans provide direct incentives for utilities to lower their costs and increase the reliability of their services. Both customers and shareholders can benefit from well-designed PBR plans.

The Department supports PBR plans for electric utilities that would cover, at least, distribution and transmission services. Such plans could also be extended to generation services to customers who choose to continue purchasing such services from their local utilities. The design of these plans must account not only for the prices of utility services, but also their quality, environmental impacts and safety.

A pilot PBR program has already been developed for one gas utility (see Chapter 5). The Department supports legislative changes and policy initiatives that extend the use of PBR in Minnesota.

E. *MERGERS*

Since the publication of the 1992 Quadrennial Report, an increasing number of electric utilities have either merged or are proposing to merge. Most utilities merge to reduce operating costs by combining personnel and facilities, to position the new company for competition in a restructured electric industry, and to better provide other services such as information or telecommunications.

Several utilities providing service in Minnesota have recently proposed mergers or an integration of resources. NSP filed a request with the Commission in August 1995 to merge with Wisconsin Energy Corporation. The two companies project savings of $2 billion over ten years, with over 60 percent of the savings stemming from reductions in labor costs. Interstate Power Company, another investor-owned electric utility serving

Minnesota customers, has filed an application to merge with two other entities: IES Industries and Wisconsin Power and Light. The three merging utilities project total savings of $700 million over ten years.

Dairyland Power Cooperative and Cooperative Power, cooperative electrical associations with member-consumers in four states, have proposed an "Alliance" to integrate their generation resources. Joint dispatch of the combined generation resources will blend Dairyland's lower capital and higher fuel costs with Cooperative Power's higher capital and lower fuel costs. The Alliance also hopes to realize savings from greater purchasing efficiencies and delaying the need for generation facilities beyond 2003. This merger does not require Commission approval.

The Commission is allowed by statute to approve a merger between regulated companies if the Commission finds the merger "consistent with the public interest." The Commission has stated that "[t]his standard does not require an affirmative finding of public benefit, just a finding that the transaction is compatible with the public interest." The statute further provides that the Commission, in reaching its decision, "shall take into consideration the reasonable value of the property, plant or securities to be ... merged and consolidated."

The Department believes that state regulators must answer the following four questions when analyzing a merger:

- By how much, if any, would the merger reduce costs to Minnesota electric customers?

- Would the resulting operational changes affect the reliability, risk or environmental impacts of service to Minnesota electric customers?

- Would the merger allow the new company to exercise excessive market power in the regional markets for electric capacity and energy, thereby restricting output and raising rates?

- Would the merger reduce the regulatory authority of Minnesota agencies, thereby impeding the State's ability to best balance the policy criteria listed above?

The Department believes the third question is of particular importance as we introduce more competition. For example, FERC staff recently concluded that NSP and Wisconsin Energy Corporation need to modify their planned merger to reduce the merged company's potential to exercise undue market power. One suggested remedy is the establishment of an ISO in Wisconsin, Minnesota and Upper Michigan to ensure that smaller utilities have access to the transmission system. The Department supports the establishment of independent bodies that would plan and operate the transmission system for the benefit of all stakeholders, as explained above in our discussion of regional regulation.

F. *ENERGY EFFICIENCY AND FINANCIAL INCENTIVES*

Background. Energy-efficiency measures can delay or eliminate the need for new supply-side resources by reducing or modifying consumer demand for electricity. An example of conservation projects is efficient lighting, while an example of load-management programs is off-peak water heating. Energy efficiency first became a national goal in the 1970s, when energy prices rose significantly and highlighted the nation's dependence on foreign oil.

Current trends. The State promotes efficient electric use in several ways. First, the State funds information programs such as the service provided by the Department's Energy Information Center. Over 650,000 information pieces have been distributed since 1992, and this office fields over 47,000 customer inquiries per year. Since 1981, the Department has evaluated building conservation measures and incorporated changes in the State building code to improve efficiency. Minnesota is a national leader in having a strong and effective building energy code (see Chapter 1). The use of national energy standards for appliances can also promote energy efficiency and reduce the need for new generation capacity and energy.

Second, the State requires electric utilities to invest in energy conservation projects through the IRP and CIP processes. Minnesota Statutes currently require all investor-owned electric utilities without nuclear plants (Interstate Power Company, Otter Tail Power Company, Minnesota Power Company and Northwestern Wisconsin Power Company) to invest 1.5 percent of their gross operating revenues in energy conservation improvements through CIP.

Utilities with nuclear plants (NSP) must invest 2.0 percent of their gross operating revenues. Municipal and cooperative electric utilities, although not subject to CIP, are also required to invest specific percentages in energy conservation: municipal utilities must spend 0.5 percent of their gross operating revenues, while cooperatives must spend 1.5 percent. Municipal and cooperative utilities must submit annual reports on their DSM efforts for review by the Department.

Under the Department's administration of CIP, energy savings have increased from 108,170 MWh in 1991 to 495,552 MWh in 1995. Since 1991, the CIP program has resulted in enough annual energy savings to provide electricity to 181,000 Minnesota households. The energy and demand savings of Minnesota's four large electric IOUs are provided in Figure IV-12 below.

Figure IV-12
CIP Electric Energy and Demand Savings

kW Saved (Demand)

Electric	1991 Actual	1992 Actual	1993 Actual	1994 Actual	1995 Actual	Total
Interstate	37	663	511	1,515	2,419	5,145
Minnesota Power	341	3,089	9,131	9,094	10,008	31,663
NSP	171,896	105,461	168,575	153,024	170,565	769,521
Otter Tail Power	586	1,010	1,903	2,867	3,434	9,800
Total	**172,860**	**110,223**	**180,120**	**166,500**	**186,426**	**816,129**

kWh Saved (Energy Use)

Electric	1991 Actual	1992 Actual	1993 Actual	1994 Actual	1995 Actual	Total
Interstate	421,578	3,568,800	2,837,400	4,052,400	8,347,380	19,227,558
Minnesota Power	4,299,000	30,529,355	68,419,287	112,475,059	44,072,581	259,795,282
NSP	102,679,000	162,010,000	265,480,000	339,152,000	431,162,000	1,300,483,000
Otter Tail Power	770,730	4,284,548	7,371,451	8,930,933	11,970,185	33,327,847
Total	**108,170,308**	**200,392,703**	**344,108,138**	**464,610,392**	**495,552,146**	**1,612,883,687**

In the IRP process energy efficiency is treated as a resource which competes against supply-side resources to meet customers' energy needs. The cost of DSM is weighed against the cost of incremental supply-side additions. The Commission approves DSM goals that meet projected energy needs at the lowest social cost. The utility then provides energy-efficiency services to customers to substitute for or complement supply-side resources such as generation units and transmission lines.

To encourage DSM investments, the PUC has established financial incentives for electric IOUs. These incentives reward utilities for good performance in implementing demand-side programs and compensate them for losses due to reduced sales. Regulators use these incentives to level the playing field between supply- and demand-side resources.

Future Directions. The Department has established an aggressive goal of increasing the efficiency of the State's energy use per real dollar of gross state product by 30 percent, by the year 2020. Consequently, the Department has a strong interest in ensuring that a restructured electric industry promotes energy efficiency. We believe a restructured electric industry can become more efficient; it may simply use different vehicles than those presently used.

In a more competitive industry, whether competition is limited to wholesale transactions or also includes retail transactions, the owners of generation units will have a stronger incentive to operate their facilities efficiently. Their profits will not be based on a regulatory determination of a reasonable return on investment, but on their ability

to provide reliable services at low prices. The Department believes this incentive will have substantial, although inestimable, impacts on energy efficiency. In addition, customers are more likely to pay prices that vary with their time of use; therefore, they are more likely to shift their usage to periods when prices are lower and capacity is not in short supply.

The State may have to rely increasingly on new variations of old mechanisms for delivering energy-efficiency services. Although some stakeholders have cited industry restructuring as a reason for discontinuing state-mandated utility DSM programs, there may still be many barriers to energy efficiency that the State has an interest in overcoming. For example, some customers (e.g., renters who are not separately metered for their electricity) will have little incentive to invest in energy efficiency. In addition, many customers, particularly small businesses, will not be able to afford the up-front investment costs.

To help overcome these market barriers, the State could require all future power marketers (i.e., entities that sell energy to end-use customers) to deliver a certain level of energy-efficiency services. In the meantime, the State could consider allowing utilities to use some of their CIP funds to improve the efficiency of existing generation, transmission and distribution facilities. These investments would foster energy efficiency while preparing utilities for competition.

Energy efficiency is often the most inexpensive way to deliver energy services and improve the State's environmental quality. The Department will continue to explore new ways of promoting energy efficiency.

G. ENVIRONMENTAL CONSIDERATIONS

1. Quantification of Environmental Costs

In 1993 the Minnesota Legislature enacted Minnesota Statutes section 216B.2422, subdivision 3(a). This statute requires the Commission "to quantify and establish a range of environmental costs associated with each method of electricity generation." Utilities must use these values when evaluating various generation resource options in proceedings before the Commission. The fundamental purpose of quantifying environmental costs is to value more precisely and explicitly the impacts of electric generation that are not reflected in the prices of the generator's inputs, but which entail a real cost to society.

The Commission established a range of interim environmental-cost values on March 1, 1995. These interim values are provided in Figure IV-13.

Figure IV-13

Interim Values for Environmental Costs

Emission	Low Value $/ton	High Value $/ton
Sulfur Dioxide (SO_2)	$0.00	$300.00
Nitrogen Oxide (NO_X)	$68.80	$1,640.00
Volatile Organic Compounds (VOC)	$1,180.00	$1,200.00
Particulates (PM-10)	$166.60	$2,380.00
Carbon Dioxide (CO_2)	$5.99	$13.60

This initiative is important *not* because it requires utilities and agencies to consider new impacts -- these same impacts were considered previously on a qualitative basis. The importance of quantifying environmental costs is that it allows stakeholders to compare internal resource costs with other important factors on an "apples-to-apples" or "dollar-to-dollar" basis. By explicitly considering the full social costs of generation resources, the Commission can promote resources that offer the greatest net value to the State. Otherwise, a utility may choose a resource mix that meets a given energy need at the lowest private cost, but is less desirable from a societal perspective.

But the Department recognizes that other means of accounting for environmental impacts may be more appropriate, particularly if non-utility sellers of generation services can bypass the environmental-cost statute by selling directly to end-users. One promising solution is a market-based allowance-trading program, similar to the one presently used for SO_2 emissions. This program is described in more detail below. The Department believes that allowance trading programs can promote emissions reductions at the lowest possible cost. Also, these programs can be applied to all energy providers, not just utilities. Conceivably, a producer of cement, a natural-gas utility and an electric utility could all be required to obtain sufficient allowances to cover their actual emissions. This broad application of environmental regulations would ensure a more appropriate allocation of resources throughout the region.

2. Clean Air Act Amendments

Minnesota's electric utilities must limit emissions of SO_2 and NO_X from their units to comply with Title IV of the Clean Air Act Amendments of 1990 (CAAA). The CAAA's reduction program has two phases. Phase I began in 1995 and Phase II begins in 2000.

The CAAA limits SO_2 emissions from electric utilities to 8.9 million tons annually beginning in 2000. This 8.9 million tons is allocated to affected units based primarily on past operating conditions. The Environmental Protection Agency (EPA) requires utilities to hold one allowance for each ton of SO_2 emitted by their affected units. Minnesota utilities affected by the CAAA estimate that their allowance allotments for

Phases I and II will allow them to cover forecasted emissions levels and maintain a small operating reserve.

In addition, the CAAA limits NO_X emission rates for certain coal-fired boilers. The Act also "bundles" SO_2 and NO_X compliance. If a unit must comply with SO_2 reductions during Phases I or II, then it must also meet the CAAA's NO_X reduction requirements.

The EPA has not yet decided on its process for establishing limits on NO_X emission rates for utility boilers. Consequently, Minnesota utilities affected by NO_X regulations have not completed their compliance plans.

VI. SUMMARY AND RECOMMENDATIONS

The Department projects that the State's use of electricity will expand by 44 percent between 1994 and 2020. Before 2020, the State must wrestle with the issues of how to properly dispose of spent nuclear fuel and meet the growing demand for electricity. During this time, the structure of the electric utility industry will change significantly. Minnesota must plan for these changes to ensure that customers receive low-cost, safe and reliable services, and to account for the environmental and socio-economic impacts of delivering such services.

The Department recommends that Minnesota adopt the strategies and action steps listed below.

Strategy 1 - Timely Removal of Minnesota's Nuclear Waste: Ensure that DOE begins to remove Minnesota's nuclear waste by 2000, and hold DOE to its schedule for operating a permanent nuclear-waste repository by 2010.

To implement this strategy, the Department recommends the following actions steps:

1. Take all viable actions -- including legislative, legal and administrative initiatives -- to hold the federal government to its obligation to store nuclear waste.

2. Develop and implement actions that protect Minnesota consumers from the costs and consequences of delays in the federal nuclear-waste disposal program.

3. Work collaboratively with other affected states, utilities and interest groups to increase the effectiveness of Minnesota initiatives.

Strategy 2 - Nuclear Licensing: Protect a strong state role in future nuclear licensing.

To implement this strategy, the Department recommends the following action steps:

1. Actively participate in federal initiatives and proceedings on nuclear licensing.

2. Oppose actions that weaken Minnesota's right to review and approve major energy facilities located within our borders and serving our residents.

3. Support extending the State's Certificate of Need process to nuclear relicensing.

4. Maintain close contact with Minnesota's congressional delegation and seek support of our initiatives and positions.

5. Work cooperatively with national organizations and other states that support our views.

Strategy 3 - Increased Competition: Promote competition and customer choice in the market for generation services.

To implement this strategy, the Department recommends the following action steps:

1. Support, participate in and help shape FERC's efforts to implement open-access transmission.

2. Support and actively participate in MAPP's efforts to reformulate itself as an RTG, reliability council and marketer of power and energy.

3. Encourage competitive-bidding programs for all electric utilities needing generation resources, for as long as these utilities continue to provide generation services to retail customers.

4. Implement a customer-choice program that will offer customers additional options for generation services while minimizing stranded costs.

5. Support market-based mechanisms for incorporating residual environmental costs -- such as the SO_2 allowance-trading program -- that apply equally to all potential generators.

6. Price utility services at cost to prevent customers from taking power and energy from independent generators when the utility's generation is less expensive.

7. Closely monitor developments in other states and at the federal level.

Strategy 4 - Regional Regulation: Rely more on regional bodies and inter-state cooperation to better coordinate the operations of the regional bulk-power network and the resource planning of multi-state utilities.

To implement this strategy, the Department recommends the following action steps:

1. Pursue regional review of NSP's integrated resource plans with state regulatory commissions in Michigan, Minnesota, North Dakota, South Dakota and Wisconsin.

2. Work with regulators in the Upper Midwest to implement regional solutions to transmission planning and operations and develop joint positions on RTG and ISO issues.

Strategy 5 - Performance-Based Regulation: Provide direct financial incentives for utilities to offer better services in monopolistic markets.

To implement this strategy, the Department recommends the following action steps:

1. Pursue legislative changes and policy initiatives that would allow the development of a pilot PBR plan for at least one electric utility.

2. Ensure that such plans cover not only price, but other public-interest goals such as quality of service, environmental quality and safety.

Strategy 6 - Energy Efficiency: Improve the efficiency of Minnesota's energy use per real dollar of gross state product.

To implement this strategy, the Department recommends the following action steps:

1. Continue to educate Minnesota residents, businesses and industries on the many ways energy efficiency can lower their energy costs and improve the State's environmental quality.

2. Continue to support reasonable and effective DSM incentive programs for utilities.

3. Continue to solicit funding for a state-wide program that provides education on construction techniques to increase energy efficiency and meet applicable State building codes, while maintaining proper indoor air quality.

4. Continue to reassess the most appropriate uses of CIP funds and channel them to areas where potential energy savings are greatest.

5. Actively support periodic updates to federal standards for technologies used by commercial, industrial, residential and agriculture customers.

CHAPTER 5

NATURAL GAS

CHAPTER 5 -- NATURAL GAS

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I. INTRODUCTION

Natural gas is increasing its market share compared to other, traditional fuels. This increase is occurring for many reasons. Because advances in exploration technologies have allowed discoveries of new sources of natural gas, plentiful and expanding supplies are currently available at a comparatively low price. Also, compared to other fossil fuels, there are fewer environmental emissions when using natural gas. Moreover, recent technological advances have expanded uses of natural gas. Examples of new technologies using natural gas include:

- Alternative Fuel Vehicles (AFVs);
- cogeneration;
- combustion turbines and combined-cycle units for electric power generation (baseload, intermediate, and peaking); and
- gas air conditioning, particularly in the Commercial and Industrial sector.

The gas industry has changed dramatically in the last two decades. In the 1970s, the three sectors of the gas industry--production (or supply), transportation, and local distribution--were rigorously regulated. FERC regulated the production and transportation sectors, while individual states regulated the local distribution sector.

In response to natural gas shortages, cost increases and falling reserves in the 1970s and early 1980s, federal reforms were enacted to restructure the production and, to a lesser extent, transportation sectors of the natural-gas industry. These changes allowed the market to work more efficiently. Today all gas supplies flowing on pipelines are purchased from unregulated gas suppliers. Transportation services (interstate pipelines) are still regulated to a large degree, but some services are becoming increasingly competitive. Distribution services (local utilities) remain regulated by individual states.

The traditional ways of selling and transporting gas are being transformed to better meet customers' individual needs. A future challenge for the industry and regulators is ensuring that competition in the supply area is implemented properly, so that it can translate into more choices and greater benefits for customers in Minnesota. Another future challenge is achieving increased efficiencies in the monopolistic local distribution sector by tying a utility's profits to its performance.

II. INDUSTRY AND STATE BACKGROUND

A. *INDUSTRY HISTORY*

Natural gas first became available for residential use in the U. S. and Minnesota in the 1920s and 1930s. National regulation began in 1938. Subsequently, federal price controls created a gap between the amount of gas producers were willing to provide at this controlled price and the amount of gas consumers used at that price. The result was shortages. In the late 1970s, as the production of natural gas declined, Congress enacted the Natural Gas Policy Act to begin the process of decontrolling wellhead prices of natural gas. This initiative allowed the supply sector of the natural gas industry to become more market-driven and competitive. The removal of price controls corrected the previous price distortions. That is, higher prices stimulated exploration and drilling and increased the amount of gas available. Consumers also responded to increasing prices by implementing energy-efficiency and fuel-switching measures, lowering the demand for natural gas. As a result, in the 1980s prices fell as supplies expanded.

At the same time, the federal government introduced more competition at the wellhead by allowing local distribution companies (LDCs) and large retail customers to purchase gas directly from unregulated gas marketers, rather than buy gas solely from interstate pipelines. It is important to note that the production of natural gas--as opposed to the transportation or distribution of natural gas--was never a natural monopoly. A large number of competitive suppliers have historically produced natural gas. However, there were limited numbers of buyers--mostly interstate pipelines. The federal government promoted competition by making it easier for LDCs and large customers to purchase gas directly from suppliers. Predictably, abandoning price controls and introducing more competition eventually yielded more stable supplies and lower prices.

In the mid 1980s, the federal government also began changing the way it regulates the transportation sector. When industry regulation was first implemented in 1938, the transportation of natural gas supply was strictly regulated. Today FERC continues to oversee transportation. But instead of rigorously regulating every aspect of transportation service, FERC sets parameters and guidelines for operating procedures and prices. Pipelines are then free to provide transportation services within these broad parameters.

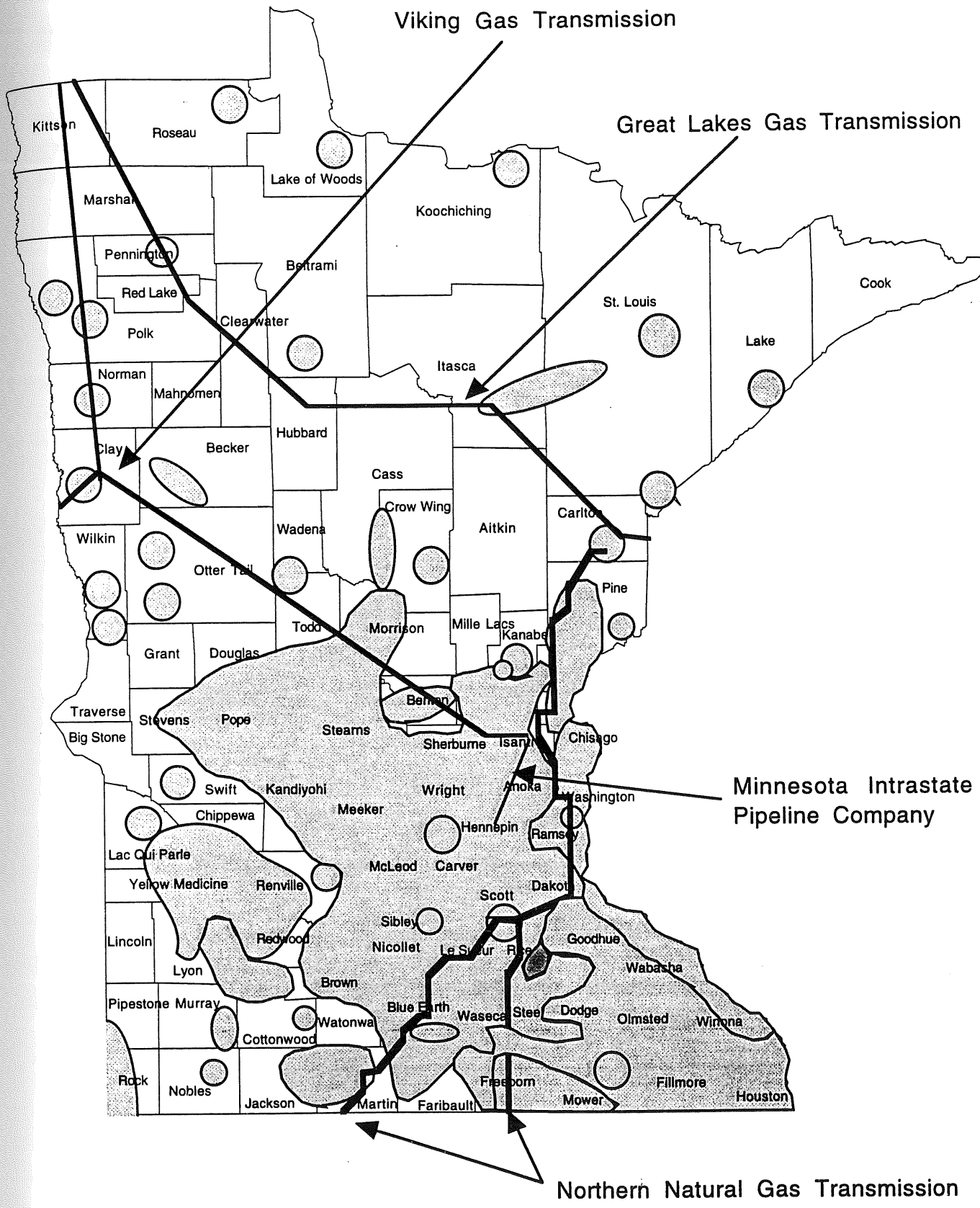
States are responding to these changes in federal regulation by examining changes in the regulation of LDC services. Just as the federal government continues to regulate transportation services, states continue to regulate distribution services. However, states may allow more customers to choose the companies that will provide gas-supply services on an unregulated basis. To some extent, particularly for large LDC customers, this choice already exists.

To summarize, during the past 20 years there have been many changes in how the natural gas industry meets customers' needs. The shift from heavily regulated services to competitive, market-driven services continues. But since local distribution remains a natural monopoly, the impetus in this area is to promote increased efficiencies by establishing appropriate regulatory surrogates for competition.

B. INDUSTRY IN MINNESOTA

Minnesota's supply of natural gas comes from two primary locations: the southern United States (Gulf of Mexico/Texas/Oklahoma) and Canada. Natural gas is transported from production fields through one or more interstate pipeline systems. As discussed above, FERC regulates these pipelines. Northern Natural Gas Company (NNG) is the major pipeline transporter of domestic natural gas to Minnesota, while Viking Gas Transmission Company and Great Lakes Transmission Company transport natural gas into Minnesota from Canada (Figure V-1). NorAm, the parent of Minnegasco, also operates one, small intrastate transportation pipeline called Minnesota Intrastate Pipeline Company (MIPC). Once it reaches Minnesota, natural gas is delivered to the State's seven LDCs, to municipal gas utilities, or directly to end-users. The Minnesota Public Utilities Commission oversees the LDCs and regulates their prices and conditions of service.

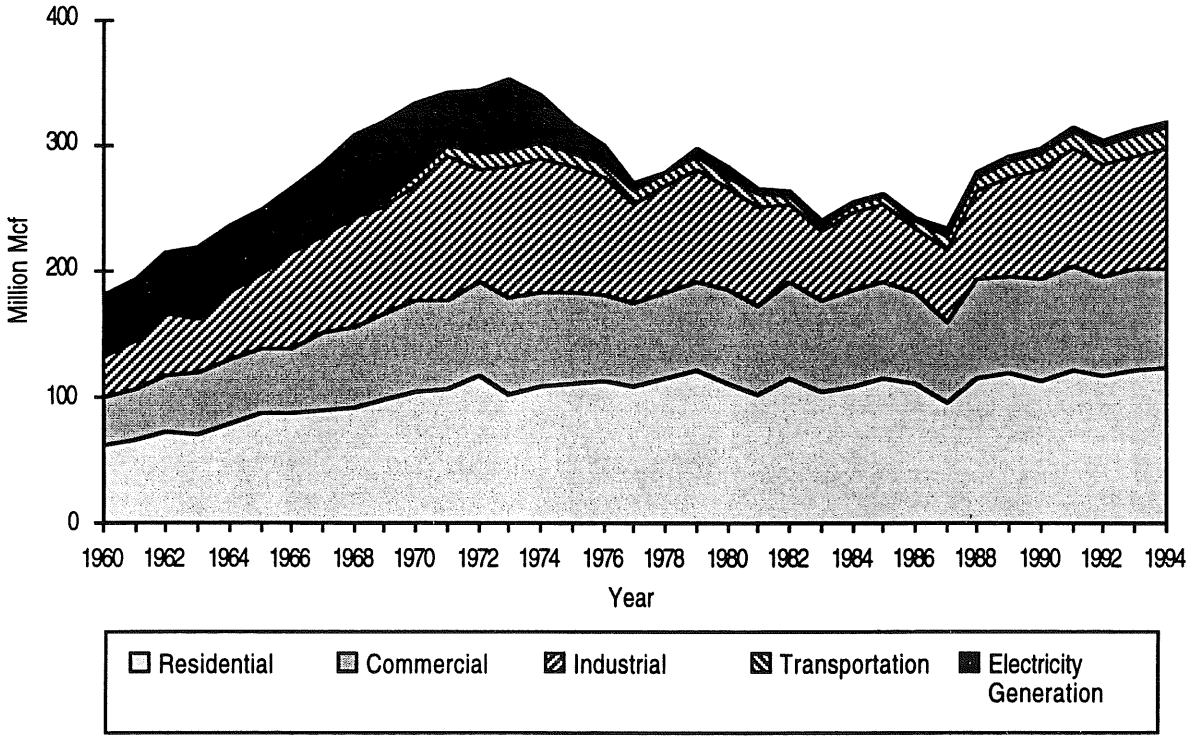
Figure V-1: Major Natural Gas Pipelines in Minnesota



III. NATURAL GAS USE, EXPENDITURES AND PRICES

The consumption of natural gas grew rapidly prior to the mid-1970s. But in the late 1970s consumption dropped sharply, particularly in the industrial and electric generation sectors. Since then, the use of natural gas has slowly increased. Figure V-2 provides historical consumption levels by sector in Minnesota.

Figure V-2: Historical Natural Gas Consumption By Sector 1960-1994



In 1994 Minnesotans used approximately 319 trillion BTUs of natural gas. Residential customers consumed approximately 38 percent of that total, commercial customers approximately 25 percent, and industrial customers approximately 30 percent. Electric utilities and interstate pipeline compressor stations (used to move natural gas into and through Minnesota) accounted for the remaining 7 percent (Figure V-3). Minnesota households and businesses rely on natural gas primarily for primary heating, water heating and cooking (Figure V-4).

Figure V-3: 1994 Natural Gas Consumption by Sector

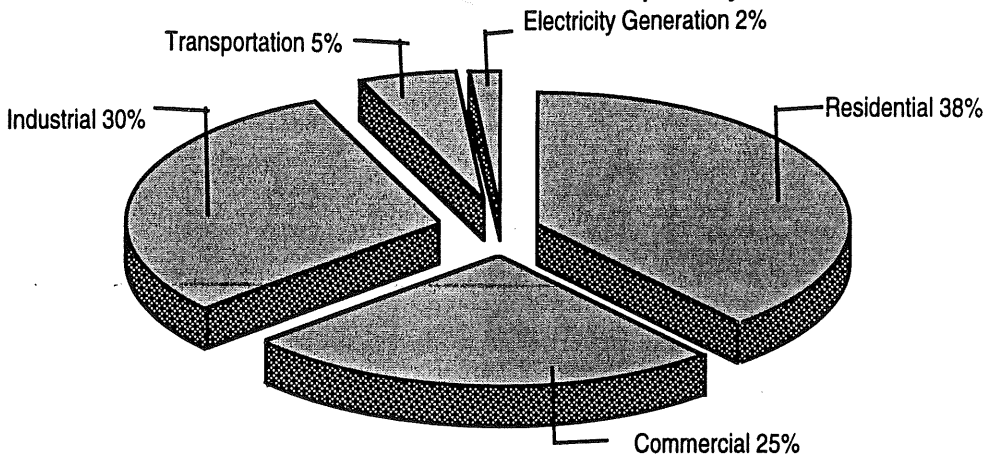
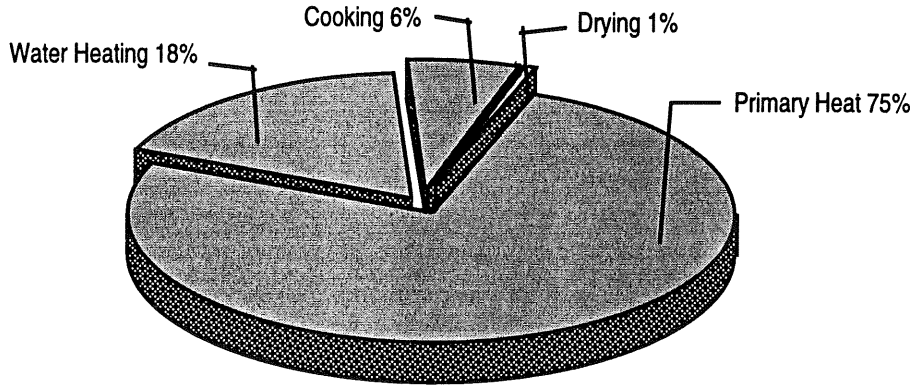


Figure V-4: 1994 Residential and Commercial Demand for Natural Gas by End-Use



Expenditures on natural gas have declined over the last several years due to falling or stable prices (Figure V-5). In 1994 Minnesota expenditures on natural gas were approximately $1.3 billion, or 5 percent lower than peak expenditures in 1984. This decrease is largely due to the decrease in the price of natural gas itself. The expenditures by market sector are presented in Figure V-5, while the real prices for natural gas are provided in Figure V-6.

Figure V-5: Natural Gas Expenditures By Sector 1960-1994 (Nominal Dollars)

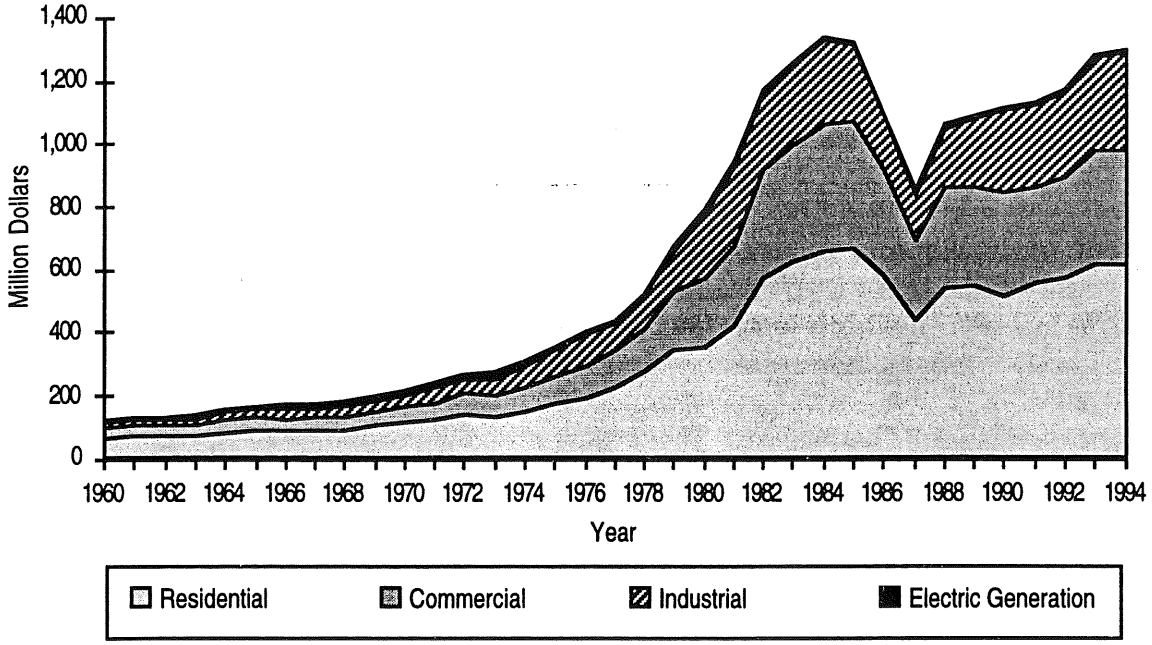
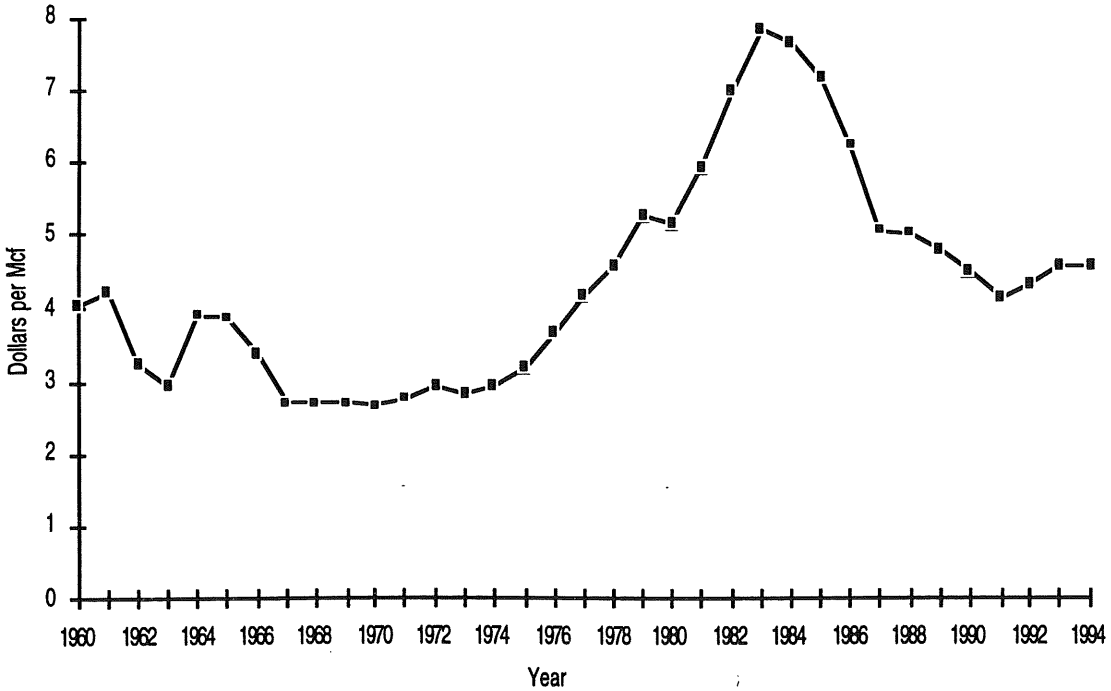


Figure V-6: Real Prices of Natural Gas 1960-1994 (Constant 1994 Dollars)



As illustrated by Figures V-5 and V-6, natural gas has become a competitive energy source in the U.S. and Minnesota.

IV. CURRENT TRENDS AND FUTURE CONCERNS AND DIRECTIONS

A. UNBUNDLED SERVICES

Background. As discussed in the beginning of this chapter, federal regulation of the production of natural gas has changed significantly. To a lesser extent, federal regulation of the transportation sector has also changed. As a result, interstate pipelines no longer provide a package of all gas services to their customers. To illustrate, NNG, the major transporter of natural gas to Minnesota, no longer obtains gas supplies for its customers. Minnesota's LDCs or end-use customers must obtain their own gas supplies, which NNG then delivers through its pipeline at regulated transportation rates.

In the mid-1980s Minnesota's LDCs voluntarily "unbundled" their transportation services from their sales services. In other words, gas supplies and the transportation of gas supplies were provided and priced separately, rather than offered to customers as one combined package. (However, no LDCs *require* large, non-captive customers to take transportation rather than sales service.) Along with providing transportation service, most gas companies offer gas-supply services, along with other gas marketers, on an unregulated basis. In addition, in 1987 LDCs were allowed to use flexible pricing for large customers with alternatives to natural-gas service. (See discussion of flexible rates later in this chapter and in Chapter 8).

Current Trends. Increasing competition in the production sector is prompting changes in the delivery of gas services to retail customers. Changes include the following:

- Separating LDC customers into captive markets (i.e., customers who do not have the ability to choose an alternate fuel or alternate gas supplier) and non-captive markets.
- Allowing LDCs to use flexible pricing to respond, within some established economic safeguards, to changes in market prices.
- Allowing LDCs to offer unregulated commodity gas service to non-captive customers.
- Allowing customers to trade excess and deficient supplies on electronic bulletin boards (and deciding how that revenue is shared between ratepayers and stockholders).
- Using newly developed futures markets and other financial mechanisms to lower gas-supply costs.

- Reassessing the LDCs' obligation to serve non-captive customers.

- Allowing "aggregation services." (Aggregation services allow LDCs and unregulated suppliers to provide gas supplies to groups of small LDC transportation customers, rather than manage each customer separately.)

Minnesota has been addressing the further unbundling of services on a case-by-case basis. This approach has yielded various methods of unbundling costs and services. For example, some companies have unbundled the cost of balancing gas on the pipeline system by imposing separate charges on its customers for such services. One company handles part of the balancing costs by requiring its transportation customers to work directly with the pipeline delivering the gas. Allowing these varying mechanisms should help Minnesota learn the advantages and disadvantages of different approaches to unbundling.

Future Concerns and Directions. The Department supports a recent proposal by Minnegasco for an experimental service wherein unregulated gas suppliers could aggregate service for groups of small customers, thus offering more options to these customers. The Department intends to aggressively support and monitor this service over the next three years.

The Department will also support other unbundling and aggregator proposals that promote customer choice and cost reduction. Potential strategies include the following:

- Allowing LDCs to offer only unbundled (rather than bundled) transportation and sales service to large, non-captive customers.

- Allowing LDCs to provide only transportation service to large customers, thereby causing these customers to rely on competitive providers for their gas supplies.

- Allowing gas suppliers to procure gas for groups of small commercial customers, and perhaps residential customers, if aggregator services can provide additional options for reliable service at reasonable rates.

By testing and monitoring the advantages and disadvantages of small-scale aggregator and unbundling programs, Minnesota can adopt well-reasoned responses to changes in the natural-gas industry.

B. *PERFORMANCE-BASED REGULATION*

1. Gas Purchasing

Background. One approach for inducing increased efficiencies in gas purchasing by local utilities is performance-based regulation (PBR). In essence, PBR simulates a competitive environment for the monopolistic LDCs. PBRs can be developed for gas purchasing, distribution services, or both. However, over the past couple years the Department has focused on developing PBR plans for gas purchasing. The Department decided to concentrate on gas purchasing for three reasons. First, there is a compelling need to encourage gas utilities to lower their gas costs. Gas utilities now have many alternatives for obtaining the best mix of gas supplies. Consequently, they are no longer "price takers." Second, traditional, after-the-fact prudence reviews of gas purchasing are becoming more difficult to conduct. A PBR plan is the best alternative for ensuring reliable and low-cost supply services to customers. Third, gas costs represent about two-thirds of the total costs of a typical LDC. Consequently, the potential benefits to ratepayers of encouraging utilities to aggressively seek low-cost, reliable gas supplies are substantial.

Current Trends and Future Concerns and Directions. During the 1995 Legislative session the Commission, with the support of the Department, the Office of Attorney General (OAG) and utilities, sponsored a bill to explicitly allow and establish criteria for gas-purchasing PBR plans. The Legislature ultimately passed this bill. The Department subsequently worked extensively with Minnegasco in 1995 and 1996 to develop a pilot PBR plan consistent with this legislation. The Commission approved the pilot plan in the spring of 1996. The Department will continue to monitor this plan and support the use of gas-purchasing PBR for all gas utilities.

As PBR is developed and implemented for gas purchasing, regulators will increasingly question whether purchased gas adjustments (PGAs) should be refined or eliminated entirely. State regulators established PGAs in the 1970s when prices escalated rapidly. At that time pipelines were virtually the only suppliers of natural gas, and FERC heavily regulated their rates. Because gas costs were already regulated and LDCs had essentially no control over their gas costs, PGAs appropriately allowed LDCs to pass through changes in gas costs automatically. Consequently, there was no need for lengthy and expensive rate cases every time gas prices rose or fell.

In contrast, federal changes over the past few years have now given LDCs almost complete responsibility for purchasing and managing their gas supplies. It now seems inappropriate to allow the automatic pass-through of all changes in gas costs without at least addressing the LDCs' increased responsibility. The Department will continue to assess the need for PGAs as we gain more experience with PBR mechanisms.

2. Local Distribution Services

Background. Due to the high cost of having competing companies install their own distribution systems in a community, the local distribution of natural gas will continue to be a monopolistic, regulated service. Because natural monopolies have little incentive to provide the best services at the least cost, the Department supports alternative approaches to traditional regulation that further the public interest.

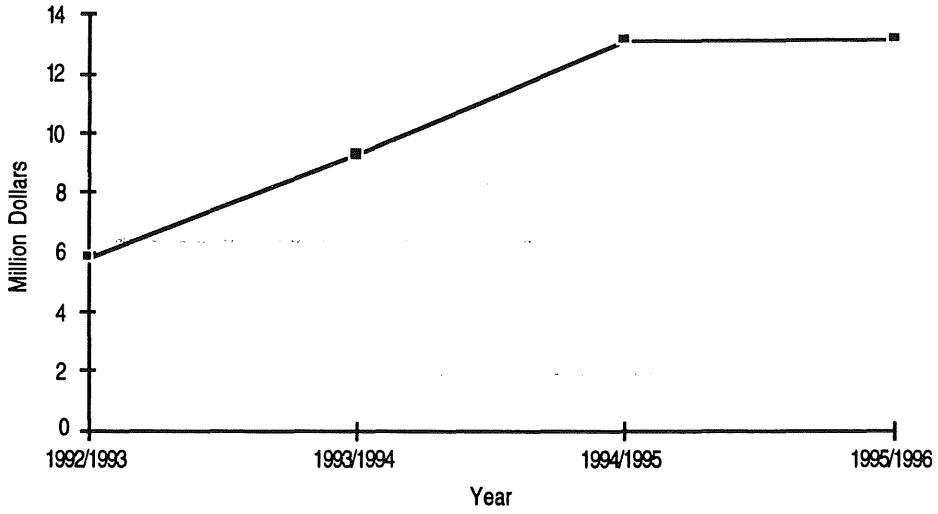
The Department believes that incentive regulation is the optimal alternative to traditional regulation. The weakest aspect of traditional regulation is its questionable ability to encourage operating efficiencies or to stimulate "entrepreneurial-style" responsiveness to customers. Traditional regulation may not stimulate the rapid introduction of new services or add value to existing services. It may also not encourage companies to respond to the particular needs of various sub-markets or to continually test the marketplace to determine the types of value-added services that customers may desire in the changing gas market. The Department believes that an incentive-based regulatory approach would correct this situation; utilities would have a financial incentive to actively pursue least-cost strategies, while maintaining reliable services.

Current Trends and Future Concerns and Directions. The Department supports the continued investigation of PBR plans for the distribution services of all regulated gas utilities. Of course, any such plans must balance a variety of public-interest goals--such as price, reliability, safety, environmental impacts, etc.

C. *ENERGY EFFICIENCY AND FINANCIAL INCENTIVES*

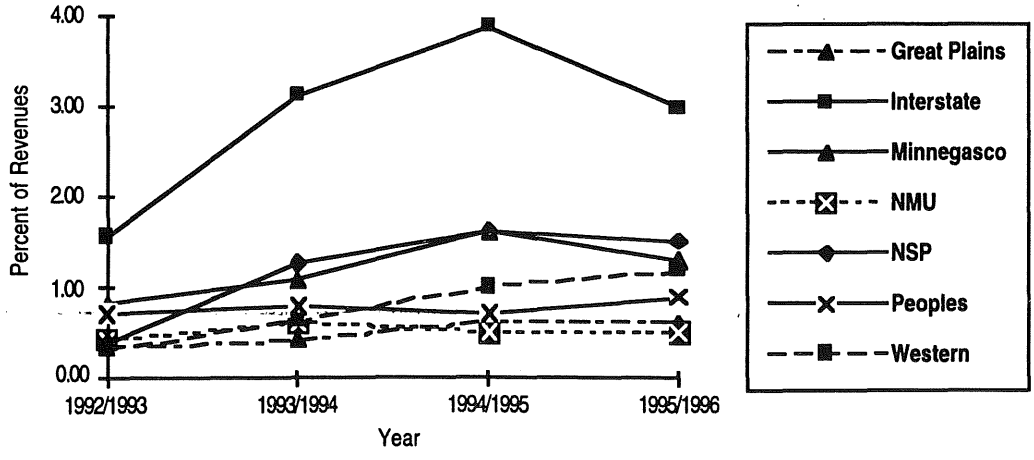
Background. Since 1983 the Legislature has mandated that public utilities participate in CIP. In 1991 this legislation was amended to require utilities to spend a specific amount on CIP. By 1995, all investor-owned gas utilities were required to invest at least 0.5 percent of gross operating revenues on conservation projects. The Legislature placed CIP under the direction of the Department in 1990. The Commissioner is empowered to specify the interest rates, prices and terms under which conservation improvements may be offered. The legislation also directs the Commissioner to give special consideration to projects for low-income customers. Cost-effective projects are mandated, unless special considerations apply.

Figure V-7: Total CIP Expenditures by Minnesota Gas Utilities



Current Trends. As shown in Figure V-7, under the Department's administration of CIP yearly expenditures have increased from $5,840,685 in 1992-1993 to $13,105,465 in 1995-1996--an increase of 125 percent. As illustrated in Figure V-8, all participating gas utilities are meeting or exceeding their spending requirements. Many of the conservation projects are provided to low-income customers to help meet their heating needs. In the last few years, gas savings have increased dramatically as utilities have implemented additional investments in conservation for commercial and industrial customers to help capture the large potential energy savings in those markets.

Figure V-8: Percent of Minnesota Gas Utility Revenues Allocated to CIP Projects



As with the electric utilities, the Department has supported and the Commission has approved CIP financial incentives for Minnesota's LDCs. The purpose of these incentives is to encourage additional cost-effective investment in conservation and demand-side resources, reward good performance in implementing these projects, and compensate the LDCs for revenue losses they experience from effective programs.

Future Concerns and Directions. Conservation, along with financial incentives, will continue to be a vital part of future gas utility service. Conservation projects can lower a utility's costs of obtaining gas supplies and reduce the need for new supplies, thereby providing environmental benefits. Conservation also helps customers manage and lower their utility bills, which may decrease the number of bills in arrears. The Department has participated in a Commission task force to evaluate the effectiveness of financial incentive programs, and has used this forum to offer recommendations regarding the future use and design of incentives for conservation and demand-side management. Encouraging cost-effective conservation in the natural-gas market will be a critical component of any Department effort to achieve our broad policy goal of a 30-percent increase in energy efficiency.

D. EXPANSIONS TO NEW SERVICE AREAS

Background. Unlike electricity, natural gas is not available in all areas of Minnesota. It is often costly to install the necessary pipes to towns that do not already have natural-gas service. In many cases, the incremental cost of expanding to these new areas may exceed the increased revenues from new customers.

Current Trends and Future Concerns and Directions. Since existing utility ratepayers do not receive any direct economic benefit from such expansions, the Department supports surcharges on new customers so that the customers actually receiving the benefits of the services pay for the costs of those services. The Commission has approved such surcharges for several utilities. The surcharge lasts 15 years or until the utility recovers the cost of the expansion, whichever is shorter. Should it take longer than 15 years for the project to pay for itself, then utility shareholders must absorb the remaining costs. In this way, natural gas can be brought to those communities that want it, without placing undue economic burden on existing customers. For this reason, the Department will continue to support new area surcharges.

E. FLEXIBLE RATES

Background. Flexible rates allow natural-gas utilities to respond to market forces and benefit all customers on their systems. Utilities with flexible rates can lower or raise rates within specified limits to meet, in a timely manner, the prices of alternative fuels such as fuel oil, propane and coal. By lowering prices, natural-gas utilities can retain customers who would otherwise be lost to other fuels. Allowing

utilities to retain customers who have alternatives to natural gas ensures their continued contribution to the utilities' fixed costs, thereby reducing rates to all of the utilities' customers.

Current Trends and Future Concerns and Directions. The goals of flexible gas rates are to respond to market forces, minimize the impact of market forces on remaining customers, retain customers when economical, send proper price signals, and promote the environmental benefits of natural gas. Utilities are currently using flexible rates effectively to meet these goals. Consequently, the Department will continue to support the use of flexible gas tariffs.

F. CAPACITY MANAGEMENT

Background. Determining the appropriate role for natural gas in the State's energy portfolio requires efficient management of the natural-gas delivery system.

Current Trends and Future Concerns and Direction. Effective management of the delivery of natural gas remains a critical goal. Increased consumer access to natural gas and the development of new uses for natural gas may increase demand. Meeting this increased demand may require expansion of the pipeline transportation and storage systems. For this reason, the Department will continue its strategy of protecting Minnesota's interest in future siting decisions involving natural-gas pipelines and peaking plants. To accomplish this strategy, we will:

- actively participate in federal initiatives and proceedings on pipeline and peaking-plant siting decisions,
- oppose any actions that weaken Minnesota's right to review and approve major energy facilities located within the State,
- maintain close contact with Minnesota's congressional delegation and seek support of our initiatives and positions, and
- participate in siting proceedings before the Minnesota Public Utilities Commission.

The deregulation of natural-gas prices at the wellhead raises equally important issues. The costs associated with inaccurately estimating the demand for natural gas are rising, but at the same time utilities now have many more options to control such costs through intelligent management of available capacity. Utilities can take advantage of pipeline-provided "insurance," increased use of storage facilities, and short-term trades of capacity between utilities. These options can help utilities reduce the costs associated with large shifts in demand due to weather or other uncertainties. In some cases, utilities can also capitalize on longer-term capacity-trading options to guarantee lower prices for future capacity.

This analysis shows that the fuel or technology that appears most attractive today may in fact have only temporary advantages. This uncertainty must be accounted for when we make long-term energy decisions based on today's forecasts.

Figure V-10: Average Natural Gas Prices 1976-2020 (Constant 1994 Dollars)

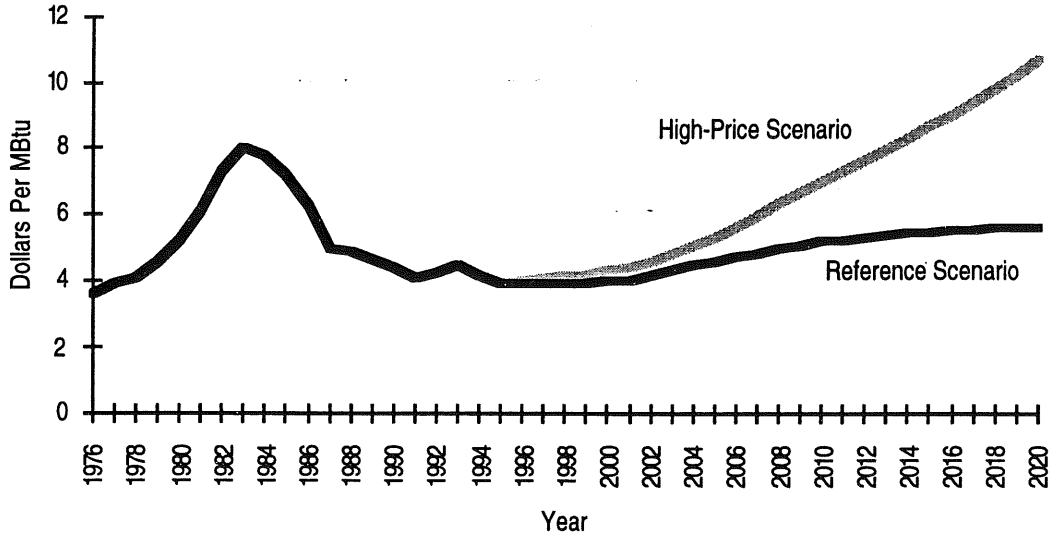
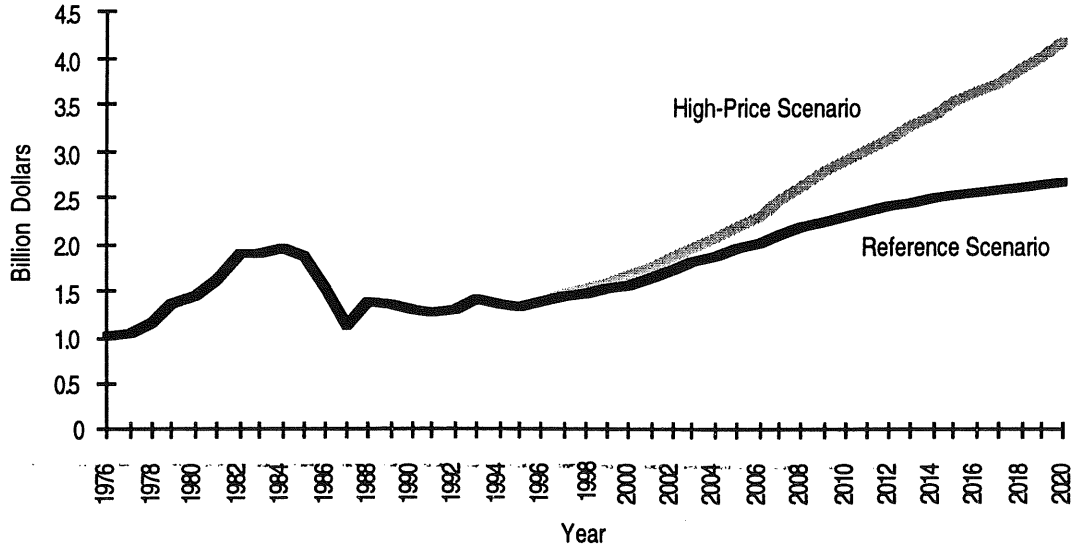


Figure V-11: Natural Gas Expenditures 1976-2020 (Constant 1994 Dollars)



VI. SUMMARY AND RECOMMENDATIONS

The natural-gas industry is undergoing significant changes as it adapts to new procurement and cost-control strategies, emerging financial tools and new industry structures encouraged by regulatory changes. All of these changes should be factored into the development of a sound energy policy for Minnesota's future.

The Department recommends that Minnesota adopt the strategies and action steps listed below.

Strategy 1 - PERFORMANCE-BASED RATES: Ensure that gas utilities have incentives to provide the best services at the least cost by simulating competition for LDCs. These initiatives should begin with gas-purchasing PBR plans for all utilities, followed by PBR plans for distribution services.

To implement this strategy, the Department recommends the following action steps:

1. Take all viable actions -- including legislative and administrative initiatives -- to ensure that PBR plans for gas purchasing are implemented for all utilities.

2. Work cooperatively with gas utilities and other affected interest groups to monitor and improve the effectiveness of PBR plans for gas purchasing.

3. Investigate the use of PBR plans for distribution services. These plans should balance a variety of public-interest goals, such as price, reliability, safety, environmental impacts, etc.

4. Work cooperatively with gas utilities and other affected interest groups to implement a pilot PBR plan for distribution services.

Strategy 2 - UNBUNDLING: Encourage competition where it is a viable option by supporting new methods of providing gas services to customers. Examples include allowing LDCs to offer unregulated commodity gas service to non-captive customers; allowing customers to trade excess and deficient supplies on electronic bulletin boards; and allowing unregulated gas suppliers to provide aggregate services for groups of small customers.

To implement this strategy, the Department recommends the following action steps:

1. Monitor new approaches to supplying gas developed in other states.

2. Work cooperatively with gas utilities and other interest groups to develop pilot programs for new services.

3. Work cooperatively with gas utilities and interested parties to monitor and increase the effectiveness of these pilot programs.

Strategy 3 - PIPELINE AND PEAKING PLANT SITING: Protect a strong State role in future pipeline and peaking plant siting decisions.

To implement this strategy, the Department recommends the following action steps:

1. Actively participate in any federal initiatives and proceedings on pipeline and peaking-plant siting decisions.

2. Oppose all actions that weaken Minnesota's right to review and approve major energy facilities located within the State.

3. Maintain close contact with Minnesota's congressional delegation and seek support of our initiatives and positions.

4. Participate in siting proceedings before the Minnesota Public Utilities Commission.

Strategy 4 - ENERGY EFFICIENCY: Improve the efficiency of Minnesota's energy use per real dollar of gross state product.

To implement this strategy, the Department recommends the following action steps:

1. Continue to educate Minnesota residents, businesses and industries on the many ways energy efficiency can lower energy costs and improve the State's environmental quality.

2. Continue to support reasonable and effective DSM incentive programs for utilities.

3. Continue to solicit funding for a state-wide program that provides education on construction techniques to increase energy efficiency and meet applicable State building codes, while maintaining proper indoor air quality.

4. Continue to reassess the most appropriate uses of CIP funds and channel them to areas where potential savings are greatest.

To implement this strategy, the Department recommends the following action steps:

1. Continue to educate Minnesota residents, businesses and industries on the many ways energy efficiency can lower energy costs and improve the State's environmental quality.

2. Continue to support reasonable and effective DSM incentive programs for utilities.

3. Continue to solicit funding for a state-wide program that provides education on construction techniques to increase energy efficiency and meet applicable State building codes, while maintaining proper indoor air quality.

4. Continue to reassess the most appropriate uses of CIP funds and channel them to areas where potential savings are greatest.

Chapter 6

Petroleum

CHAPTER 6 -- PETROLEUM

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I. INTRODUCTION

The petroleum sector is a large piece of the State's energy picture and poses several unique policy challenges.

First, crude oil is a commodity whose price is set by the world market. The State of Minnesota is a "price-taker," meaning our policies have little effect on the price of crude oil. The same holds true for the nation as a whole. While the U.S. can help ensure the availability of foreign petroleum supplies through trade negotiations, diplomacy and military action, prices are inevitably based on global supply and demand. Of course, prices to Minnesota end-users for petroleum products include transportation and refining costs, which do depend on regional factors. In addition, the nation or State can and does affect the price to end-users through taxes or fees at the gasoline pumps, environmental requirements imposed on refineries, and other initiatives. Regardless, the State and nation have relatively few tools for influencing petroleum prices and availability, particularly in comparison to other heavily regulated energy services such as electricity and natural gas. Not only are electricity and natural-gas prices heavily regulated, but the cost structures of the utility providers of these services depend much more on regional and national factors.

Second, the high use of motor vehicles significantly influences our urban areas and infrastructure. Over the past 100 years the nation has built an elaborate network of roads and highways designed to meet the demands of an ever-increasing number of motorists. State and federal taxes on gasoline and diesel fuel maintain this network. Decommissioning an electric power plant is a small task compared to redesigning the vast transportation infrastructure catering to millions of vehicles. Any energy policy must recognize this existing infrastructure, and attempt to make changes that will influence future decisions regarding additional road construction and urban planning.

Third, since petroleum is primarily a transportation fuel, the State's approach to petroleum is not solely an energy-policy issue. The use of petroleum as a motor fuel must also be considered in the context of a broad transportation policy.

These cautionary notes are not a prescription for paralysis. We can certainly adopt or encourage sound energy policies affecting the use of petroleum products. Yet we must also be pragmatic and recognize limits on the range of effective energy policies at the state level.

In the following sections of this chapter we will identify historical trends in petroleum consumption and prices, as well as anticipated future trends. We will then discuss several key industry issues.

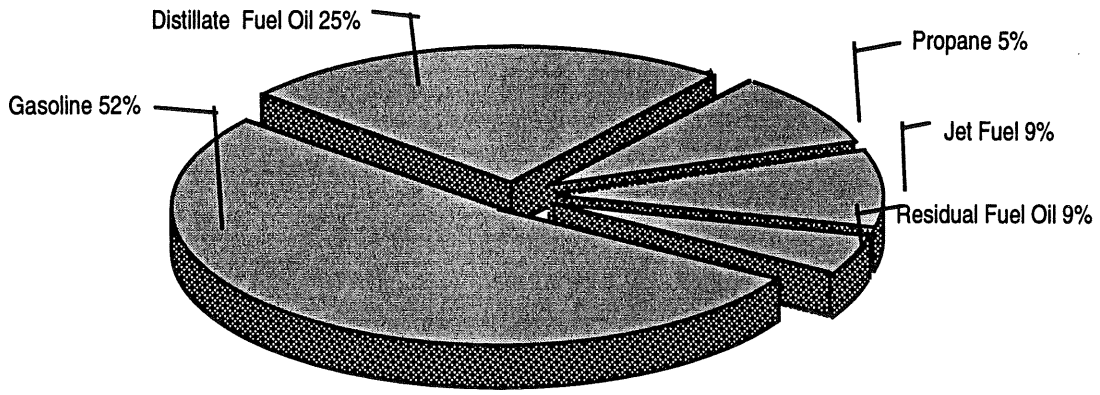
II. PETROLEUM USE AND EXPENDITURES

A. PETROLEUM PRODUCTION, CONSUMPTION AND EXPENDITURES BY PRODUCT

Petroleum products -- including gasoline, fuel oil, jet fuel and propane--are the largest sources of energy used within the State of Minnesota. In 1994 petroleum products accounted for 30 percent of the State's total primary energy consumption and 36 percent of the State's total expenditures on primary energy. By 2020 petroleum use is expected to grow by 57 percent, accounting for 32 percent of the State's primary energy consumption and 45 percent of the State's energy expenditures.

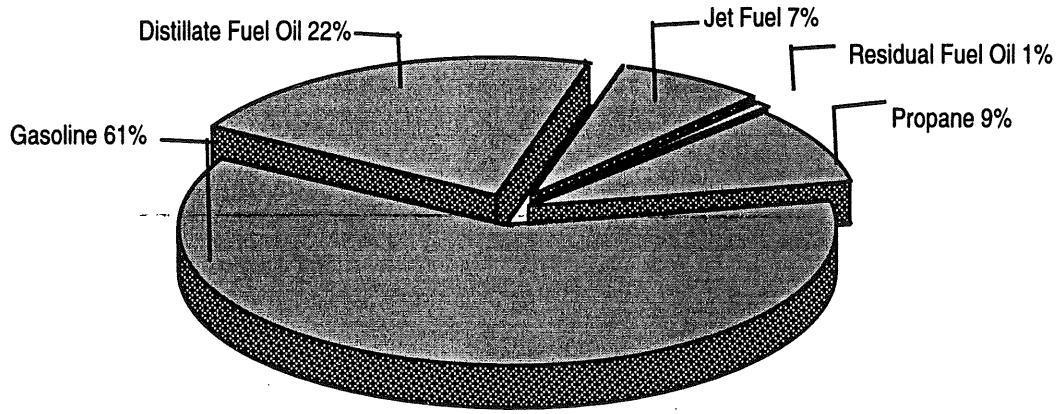
In 1994 gasoline accounted for the largest share of petroleum products in terms of both consumption and expenditures (Figures VI-1 and VI-2). These percentages have remained relatively constant since 1960 (Figures VI-3 and VI-4).

Figure VI-1: 1994 Petroleum Product Consumption



Total = 545 Trillion Btus

Figure VI-2: 1994 Petroleum Product Expenditures



Total = $2,721 Million

Figure VI-3: Petroleum Product by Consumption by Fuel 1960-2020

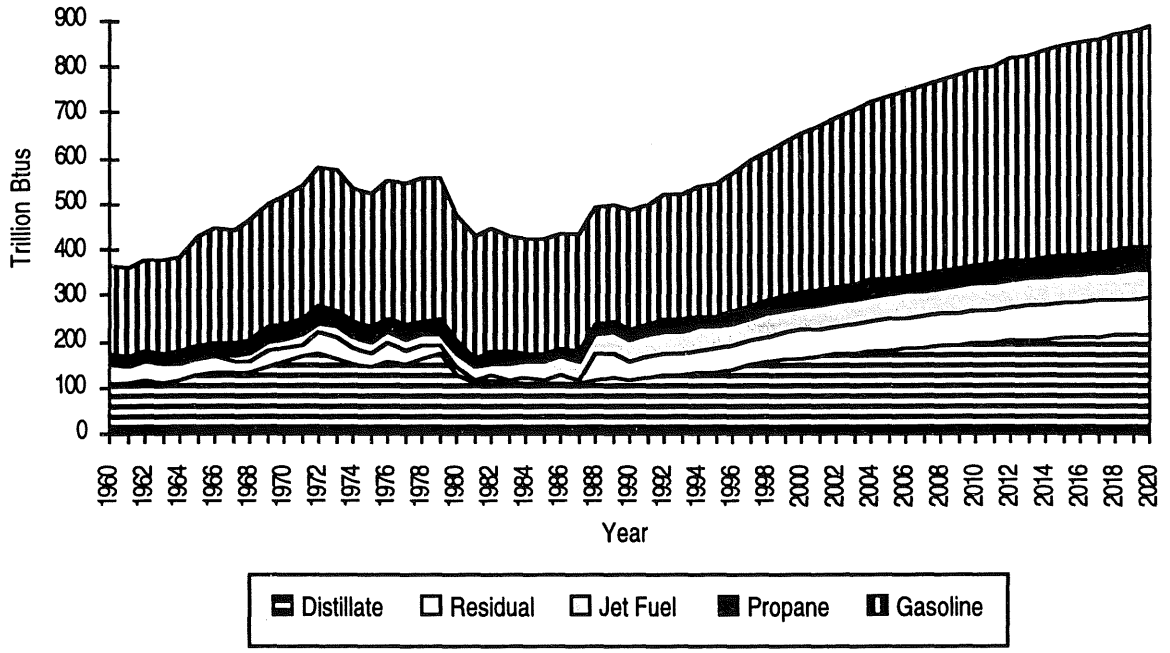
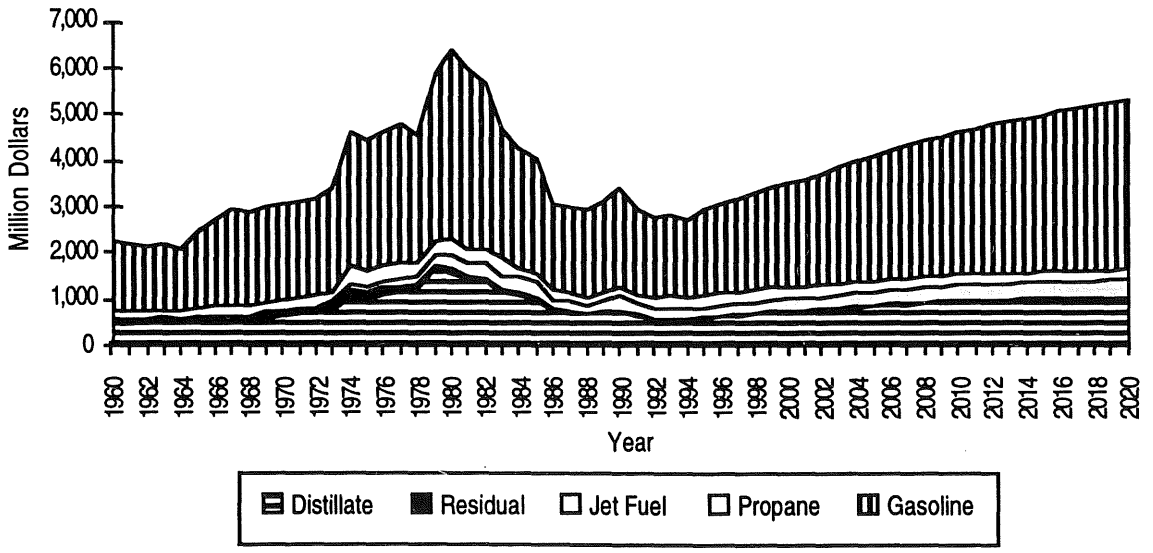


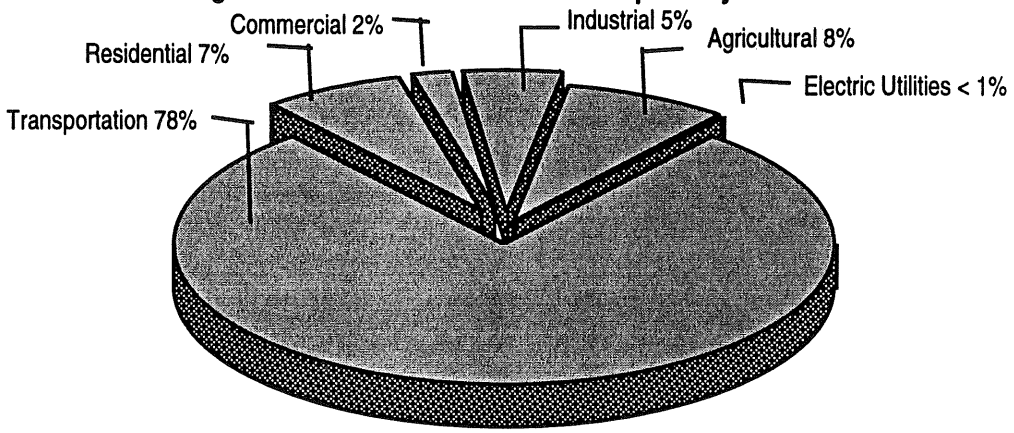
Figure VI-4: Petroleum Product Expenditures by Fuel 1960-2020 (Constant 1994 Dollars)



B. *PETROLEUM PRODUCTION, CONSUMPTION AND EXPENDITURES BY SECTOR*

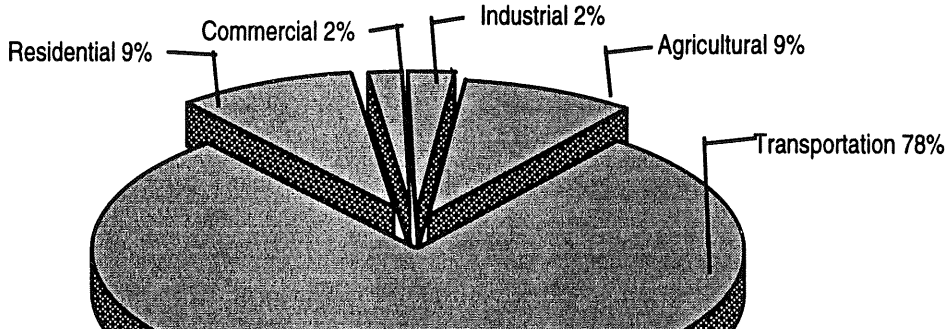
The transportation sector has historically been the largest user of petroleum. In 1994 this sector accounted for 78 percent of the State's total petroleum consumption and expenditures (Figures VI-5 and VI-6). By 2020 these percentages are expected to increase to 90 percent (Figures VI-7 and VI-8). This trend underscores the need to focus on transportation when developing policies for the petroleum industry.

Figure VI-5: 1994 Petroleum Consumption by Sector



Total = 545 Trillion Btus

Figure VI-6: 1994 Petroleum Expenditures By Sector



Total = $2,721 Million

Figure VI-7: Petroleum Product Consumption by Sector 1960-2020 (Excludes Government and Oil Company Uses)

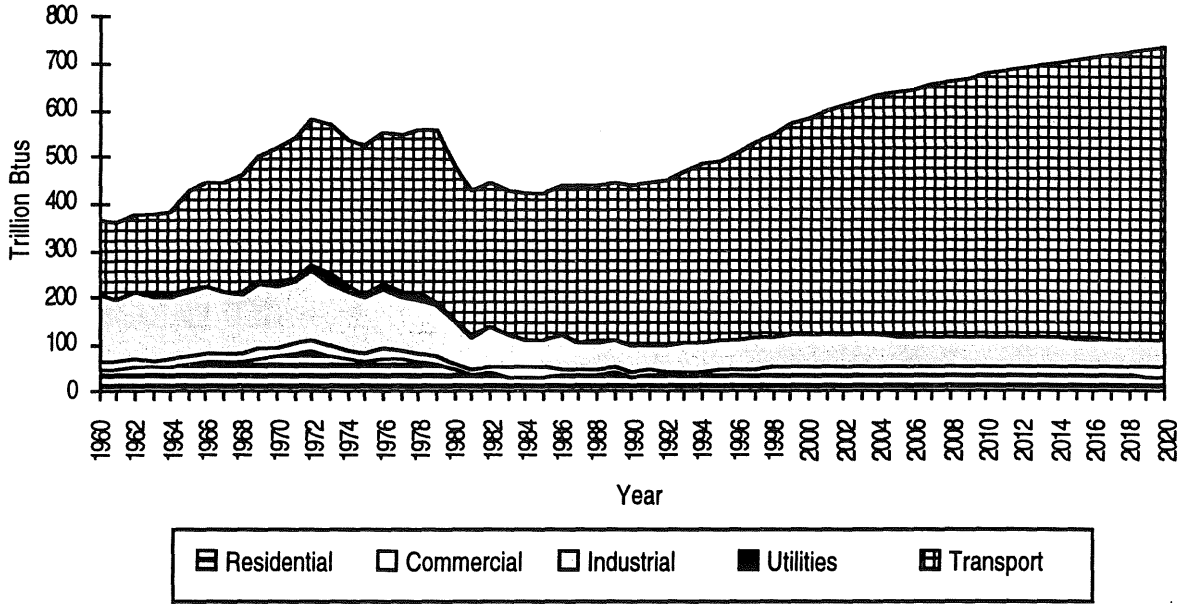
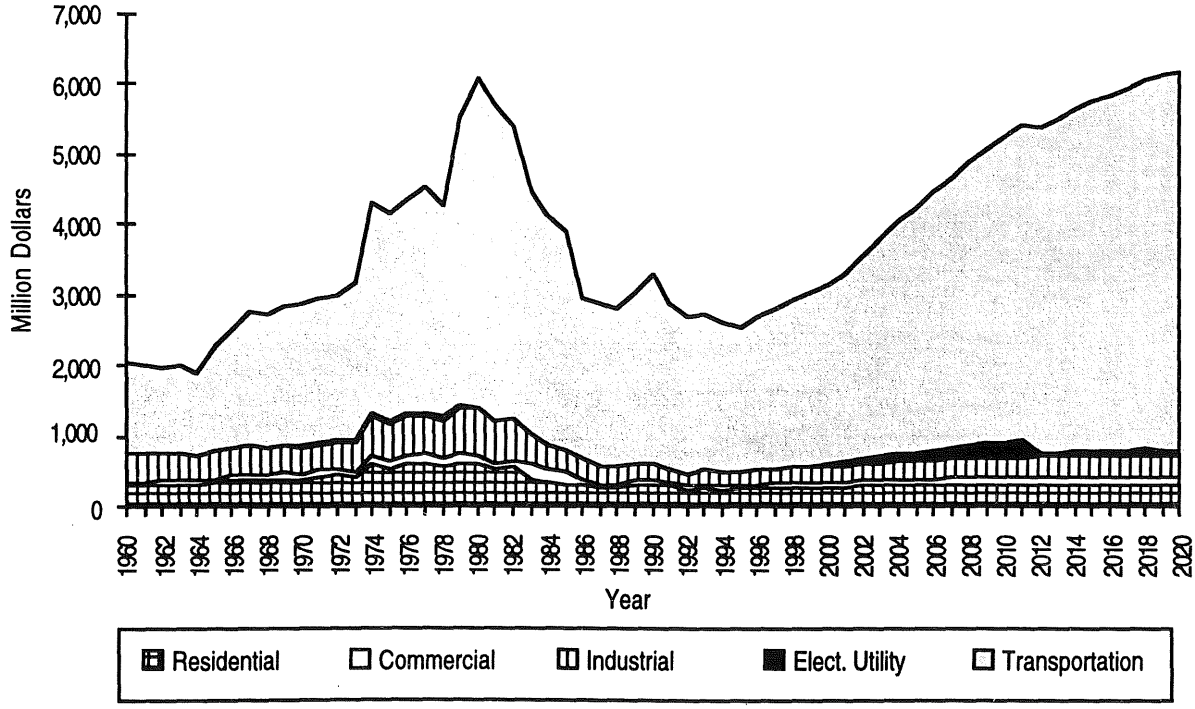


Figure VI-8: Petroleum Expenditures by Sector 1960-2020 (Constant 1994 Dollars)



C. *REFINING AND TRANSPORTATION*

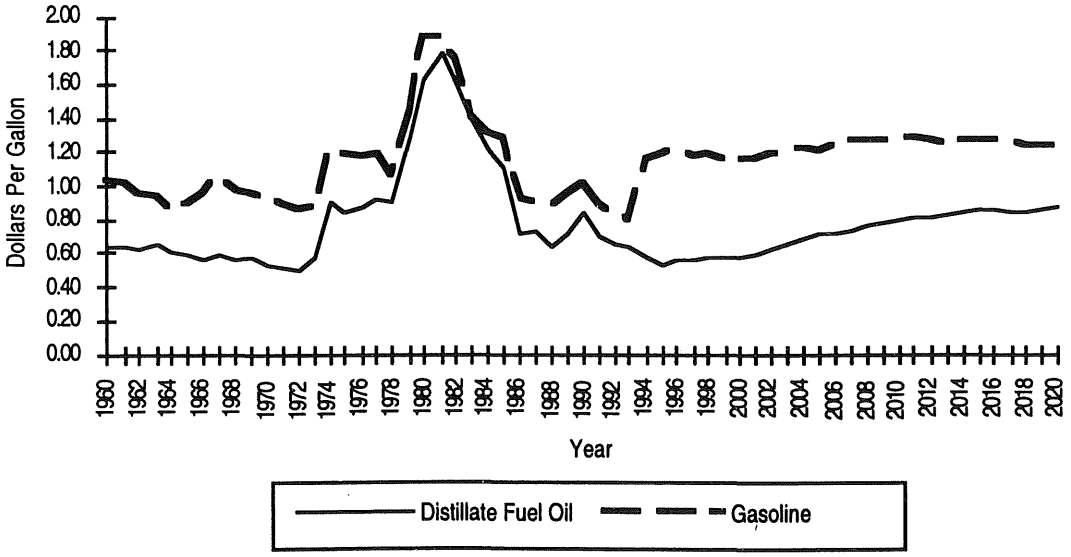
Minnesota receives refined petroleum products from the Williams Brothers and American pipelines operating in Minnesota, as well as from the Kanebec, Mobil and other pipelines operating just outside of the State. Area refineries include Ashland and Koch in the Twin Cities, Murphy in the Duluth area, and AMOCO in Mandan, North Dakota. Petroleum products are shipped by truck all year, as well as by barge or tanker on the Mississippi River and Great Lakes during the summer. Finally, rail shipments of residual fuels and liquid petroleum gas are common during the winter.

III. CURRENT TRENDS AND FUTURE CONCERNS AND DIRECTIONS

A. *PRICE AND SUPPLY VOLATILITY*

One of the most striking characteristics of petroleum is its price volatility. As mentioned before, the price of crude oil is subject to the vagaries of the world market. The fact that the production of crude oil has been concentrated in a politically unstable region -- the Middle East -- has only exacerbated this volatility. Most people are familiar with the shortages and dramatic price increases of the 1970s, although prices have stabilized during the past 15 years. Historical and projected petroleum prices are provided in Figure VI-9. Obviously, predicting petroleum prices over more than a few months is a risky undertaking. These projections are simply our best estimates at this time.

Figure VI-9: Average Real Petroleum Product Prices 1960-2020 (Constant 1994 Dollars)



Minnesota consumers can do little to reduce this price and supply volatility on the world market. They can, however, mitigate their own price and supply risk by conserving, expanding fuel-oil inventories when petroleum prices are low, and maintaining the option to burn alternative fuels when possible.

The federal government also attempts to mitigate supply risks by maintaining a Strategic Petroleum Reserve of crude oil. Based on 1995 data, this reserve represents about 42 days of our total national consumption of petroleum or 81 days of our total petroleum imports.

One positive trend is that the U.S. dependence on oil from Arab nations in the Middle East is declining. This development may seem counter-intuitive, given recent reports of the nation's increasing reliance on imported oil. But while the U.S. is indeed relying more on oil imports, a greater percentage of these imports is coming from countries outside of the Middle East, primarily Venezuela and Canada. Consequently, the nation's increasing reliance on imports is occurring at the same time as we are reducing our reliance on supplies from the Middle East. These trends are illustrated in Figure VI-10.

Figure VI-10

Imports as Percentage of U.S. Use of Crude Oil

Year	Percentage of Crude Oil Imported From All Countries	Percentage of Crude Oil Imported From Arabic OPEC Countries	Percentage of Crude Oil Imported From Other OPEC Countries	Percentage of Crude Oil Imported From Non-Opec Countries
1990	44	14	12	18
1991	43	13	12	19
1992	45	12	13	20
1993	50	12	15	23
1994	51	12	15	24
1995	52	11	15	26

Sources: *Petroleum Supply Annual* and *Petroleum Supply Monthly.*

B. ENVIRONMENTAL IMPACTS

1. Introduction

The use of petroleum products imposes a variety of environmental impacts. Perhaps the most important and visible impact is harmful emissions from automobiles. While emission levels from a single automobile are much less than emission levels from

a typical smokestack, there are many more motor vehicles than smokestacks. For some types of emission, the cumulative effect of all these motor vehicles dwarfs the combined effects of all other energy uses.

Among the emissions attributable to the use of petroleum products are carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides, suspended particulates, volatile organic compounds, nitrous oxides and methane. Figure VI-11 lists the estimated statewide levels of these emissions in 1994. This figure also breaks down these estimates into emissions from the use of petroleum products in transportation, emissions from other uses of petroleum, and emissions from sources other than petroleum uses.

Figure VI-11

1994 Minnesota Estimated Pollutants (in Short Tons)

	Transportation	Other Petroleum	All Petroleum	Other Fuels	All Fuels
Sulfur Dioxide	40,067	8,420	48,487	21,415	69,902
Nitrogen Oxides	179,631	4,774	184,405	25,721	210,126
Total Suspended Particles	8,294	770	9,064	31,603	40,667
Volatile Organic Compounds	141,274	354	141,628	50,794	192,422
Nitrogen Oxides	0	493	493	719	1,212
Carbon Monoxide	716,695	1,085	717,780	139,003	856,783

As illustrated in Figure VI-11, emissions of carbon monoxide are a particularly serious concern in the petroleum sector. Transportation sources alone emitted 716,700 tons of carbon monoxide in 1994, which is *84 percent* of total statewide emissions. These emissions are most worrisome in the Twin Cities; in 1994 the U.S. Environmental Protection Agency again included Minneapolis/St. Paul on its list of non-compliance areas for carbon monoxide.

The federal government and the State have enacted a variety of regulations to address negative environmental impacts in the petroleum sector. A description of some of the most important regulations is provided below.

2. Federal Clean Air Act and 1990 Clean Air Act Amendments

a. Introduction

The federal Clean Air Act (CAA), including the 1990 amendments to the CAA, impose a variety of environmental regulations affecting a wide range of industries. The petroleum sector is affected by a variety of provisions designed to:

- improve the fuel efficiency of the nation's fleet of motor vehicles (CAFE standards),
- reduce the evaporation of fuel in motor vehicles,
- reduce emissions of various pollutants from motor vehicles (tailpipe emissions),
- phase out leaded gasoline, and
- improve emissions controls in the engine (e.g., catalytic converters and ERG valves).

b. CAFE Standards

The federal government began establishing fuel-efficiency standards for motor vehicles in 1977. These standards have improved the efficiency of passenger cars by approximately 50 percent since 1970. Current Corporate Average Fuel Efficiency (CAFE) standards require automobile manufactures to achieve an average fuel efficiency of about 27.5 miles per gallon. No increase in these standards is projected. (A separate set of CAFE standards apply to light-duty trucks such as sport utility vehicles, vans, and mini-vans. These standards are more lenient.)

c. Limits on Evaporation Rate of Gasoline

Federal law requires a lower Reid Evaporation Pressure (RVP), or evaporation rate, for gasoline sold during the summer. While winter gasoline can be as high as 13.5 RVP, summer gasoline must be below 9.0 RVP. (The government has granted a waiver to some alternative-fuel options because they could not meet this standard.)

d. Reductions in Tailpipe Emissions

Since the 1970s, the CAA has required motor-vehicle manufacturers to install catalytic converters and ERG valves to ensure complete combustion of petroleum fuels.

e. Phase-Out of Leaded Gasoline

The CAA has led to the gradual phase-out of leaded gasoline. No leaded gasoline has been sold in Minnesota since July 1, 1993.

f. Federal Requirements for Low-Sulfur Diesel Fuels

The CAA has required reduced-sulfur diesel fuel for all on-road use since 1993. This fuel contains less than 0.5 percent sulfur by weight, which lowers the sulfur content to 25 to 30 percent of the sulfur content normally found in fuel oil.

3. Federal and Minnesota Requirements for Cleaning Up Leaking Underground Storage Tanks

Federal law requires owners to clean up leaking underground storage tanks. To finance this clean-up the State of Minnesota imposes a periodic fee of 1.5¢ to 2.0¢ per gallon on all gasoline sold in Minnesota.

4. Minnesota Oxygenate Requirement

Under Minnesota statutes all gasoline sold in the State in a non-compliance area for carbon monoxide must contain at least 2.7 percent oxygen by weight. (The Twin Cities is currently the only non-compliance area in Minnesota.) After October 1, 1997, all gasoline sold in Minnesota must meet this requirement. The Department's Division of Weights and Measures operates a petroleum testing laboratory that regularly tests samples obtained by Department inspectors. The objectives of this testing are to ensure fuel quality and compliance with the State's oxygenate requirement.

5. Conclusion

In total these programs significantly reduce the environmental costs attributable to the petroleum sector. But these gains must be placed in perspective. For instance, while the average fuel efficiency in the U.S. has increased by about 50 percent since 1970, the number of vehicle-miles in Minnesota has increased by about 44 percent over the same period. In other words, in Minnesota additional driving has almost completely offset the improved fuel efficiency per vehicle.

C. *TRANSPORTATION*

The transportation sector currently accounts for 78 percent of the State's use of petroleum products. This share will increase in the future. By 2020 the Department projects that transportation's share of the petroleum market will increase to 90 percent. This projected increase is based on several factors. First, from 1970 to 1994 vehicle-miles in Minnesota increased by an average annual rate of 2.3 percent. Second, vehicle registration numbers show a decrease in regular passenger vehicles, but a sharp

increase in light-duty trucks (sport utility vehicles, mini vans and full-sized vans). Therefore, it is less likely that we will achieve the goals of the more stringent fuel-economy standards. Third, the use of petroleum products for residential space heating, cooking, drying and water heating is expected to remain fairly constant, in total, over the same period.

Meeting the statewide goal of increasing energy efficiency by 30 percent by 2020 will require some efficiency improvements in transportation. As mentioned above, the federal government currently imposes standards for fuel efficiency on automobile manufacturers. These standards have contributed significantly to increased efficiency. But with the price of gasoline at relatively low levels over the past few years, there is dwindling governmental support for more stringent efficiency standards. Given current trends, the Department estimates that fuel efficiency in the transportation sector will improve by approximately 3.1 percent from 1990 to 2020. (This estimate includes residential automobiles only. Vans, trucks, and other vehicles registered as "commercial" vehicles, regardless of their actual use, are not included in this estimate.) Our Baseline forecast does not assume more stringent CAFE standards.

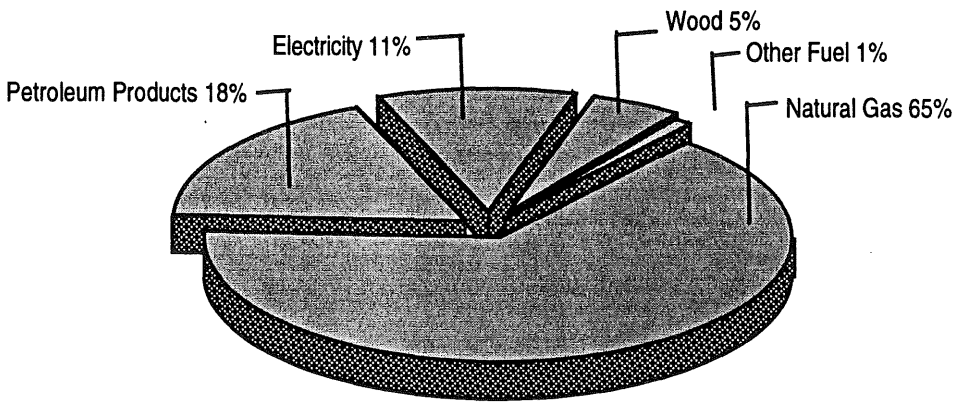
D. SPACE HEATING

Petroleum fuels are often used for space heating. Residential users are primarily located in small towns or rural areas that do not have access to natural gas. Commercial and industrial consumers often use fuel oils or residual oils as a backup to their natural-gas service. These customers are willing to have their natural-gas service interrupted in return for lower rates.

The current percentage of Minnesota residential customers depending on natural gas, electricity and petroleum products for their primary space-heating needs is provided in Figure VI-12. The use of fuel oil for space heating is expected to decline over time. Residents of towns without natural-gas service have demonstrated a willingness to pay natural-gas utilities for the additional costs of expanding their gas distribution system into these towns. (See Chapters 5 and 8 for more discussion of this issue.) Consequently, natural gas will make further inroads into the residential market.

Commercial and industrial customers are expected to continue to burn fuel oil as a backup to natural-gas or electric service, although the more stringent requirements on underground tanks may deter some consumers from using fuel oil for this purpose.

Figure VI-12: Percentage of Minnesota Households Using Various Fuels for Primary Heating in 1994



IV. SUMMARY AND RECOMMENDATIONS

The transportation sector is the dominant user of petroleum products, and will only increase this dominance in the future. This sector will largely determine our statewide use of petroleum products, which will in turn affect our infrastructure, environmental quality and overall state energy efficiency.

The most powerful determinant of usage is price. We cannot predict or control the price of petroleum. We can only reiterate that large swings one way or another can dramatically affect consumption. If prices rise significantly, Minnesotans will reduce the number and duration of their trips. If the price increase is sustained, they will demand more fuel-efficient vehicles.

At the State level the Department's recommended focus is on promoting alternatives to gasoline. There appear to be promising options for alternative-fuel vehicles, which are discussed in the next chapter. Over the long run these options could significantly benefit the environment and mitigate the risk of excessive reliance on one fuel. The specific strategy and action steps for alternative vehicles are also included in the next chapter.

In addition, businesses and households can take steps to protect themselves against supply and price volatility. These steps require no State intervention, but are simply steps consumers can take directly to improve their energy security. They are detailed in the following strategy and accompanying action steps.

Strategy 1 - CONSUMER PROTECTIONS: Encourage Minnesota consumers to take steps to protect themselves against supply and price volatility.

To implement this strategy, the Department recommends the following action steps:

1. Commercial and industrial consumers can hedge against price fluctuations through futures contracts.

2. Commercial and industrial consumers can develop and maintain the capability to use alternative fuels.

3. Commercial and industrial consumers can maintain inventories of petroleum products.

4. Individual consumers can use alternative travel options such as bicycling or walking when possible.

5. Individual consumers can use car pools, van pools and mass transit.

6. All consumers can keep vehicles and furnaces tuned and maintained.

7. Individual consumers can telecommute when possible.

CHAPTER 7

ALTERNATIVE ENERGY SOURCES

CHAPTER 7 -- ALTERNATIVE ENERGY SOURCES

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I. INTRODUCTION

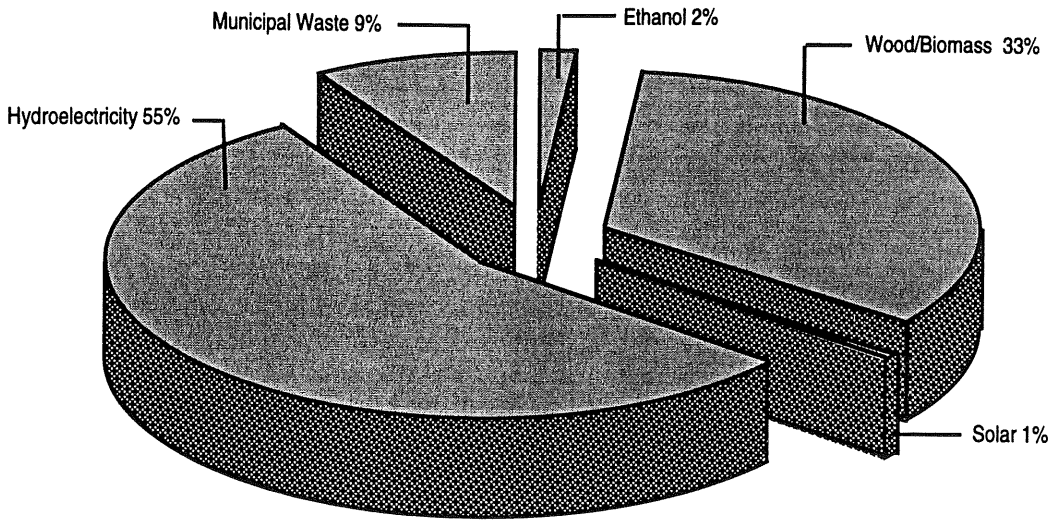
Fossil fuels and nuclear energy account for a majority of energy use in Minnesota and the world. This chapter explores alternative energy sources, that is, energy sources that are alternatives to fossil fuel and nuclear energy. Renewable energy sources are an important subset of alternative energy sources. Renewable energy sources are alternative energy sources that can be replenished. Unlike coal, natural gas and petroleum, their source is infinite.

Alternative energy is important to Minnesota's energy mix for several reasons. First, increasing Minnesota's use of alternative energy helps diversify our fuel mix. Diversification can help insulate against market fluctuations, including fluctuations in price and availability. Alternative transportation fuels in particular help hedge Minnesota's economy against increasing dependence on imported oil. Second, alternative energy sources, particularly renewable energy sources, generally produce fewer harmful air emissions than fossil fuels. Wind turbines can produce electricity with negligible air emissions; biomass combustion and gasification processes can produce electricity with very low net emissions of greenhouse gas, because the carbon dioxide released from the biomass can be re-sequestered in new biomass crops. Third, alternative energy sources can, if developed properly, create jobs in Minnesota. Thus, NSP's wind projects in western Minnesota could have a beneficial impact on employment in that area of Minnesota if they prove to be relatively low-cost options.

Minnesota is uniquely positioned to increase its use of alternative energy. First, the State has some of the best wind resources in the world. NSP's purchase of at least 425 MW of wind will make Minnesota and the surrounding region the largest producer of wind-generated electricity in the U.S. outside of California. Second, Minnesota's proximity to the Canadian border enables the State to take advantage of Canadian hydroelectric resources. Third, Minnesota has ample crops and forests to serve as biomass fuels and will be adding at least 125 MW of biomass-powered electricity and producing 200 million gallons of ethanol per year by 2002. Fourth, despite our cold climate, Minnesota has opportunities to install photovoltaics (solar energy) in niche markets and to properly site residential and commercial buildings to take advantage of the winter sun as a supplementary heating source.

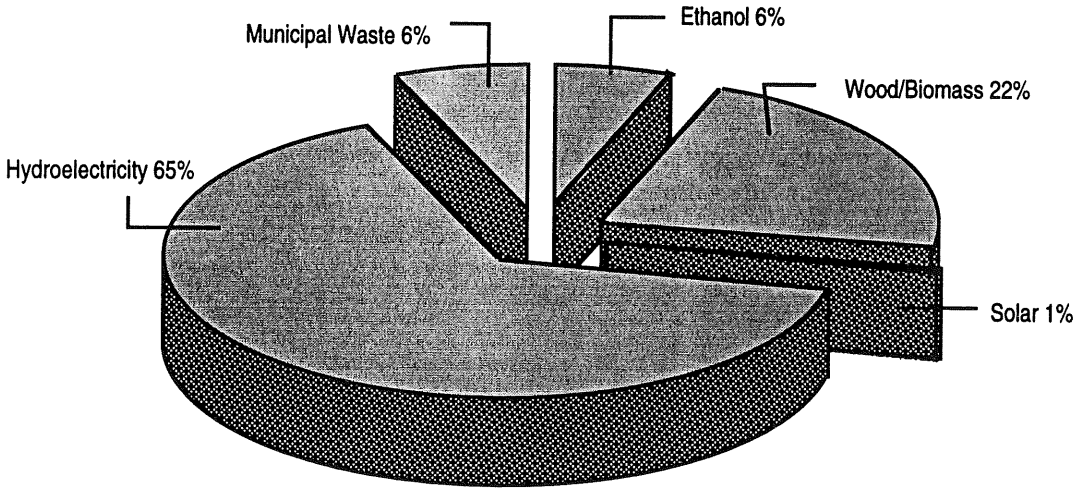
Minnesota's major alternative energy sources include wind, wood/biomass, hydroelectricity, solar, municipal waste and ethanol. In 1994 Minnesotans consumed 177 trillion Btus (TBtus) of energy from these resources, a total of 12 percent of the primary energy used within the State, and 50 percent more alternative energy than in 1990. A comparison of Figure VII-1 with Figure VII-2 shows how the relative shares of different alternative energy sources have changed since 1990, with hydroelectric energy increasing its dominance of the alternative energy mix. The relative shares will continue to change as wind and biomass development accelerates in the State.

Figure VII-1: Minnesota's Consumption of Alternative Energy Sources in 1990



Total = 118.18 TBtus

Figure VII-2: Minnesota's Consumption of Alternative Energy Sources in 1994



Total = 176.69 TBtus

This chapter first discusses Minnesota's most promising alternative energy resources, then concludes with the Department's recommendations.

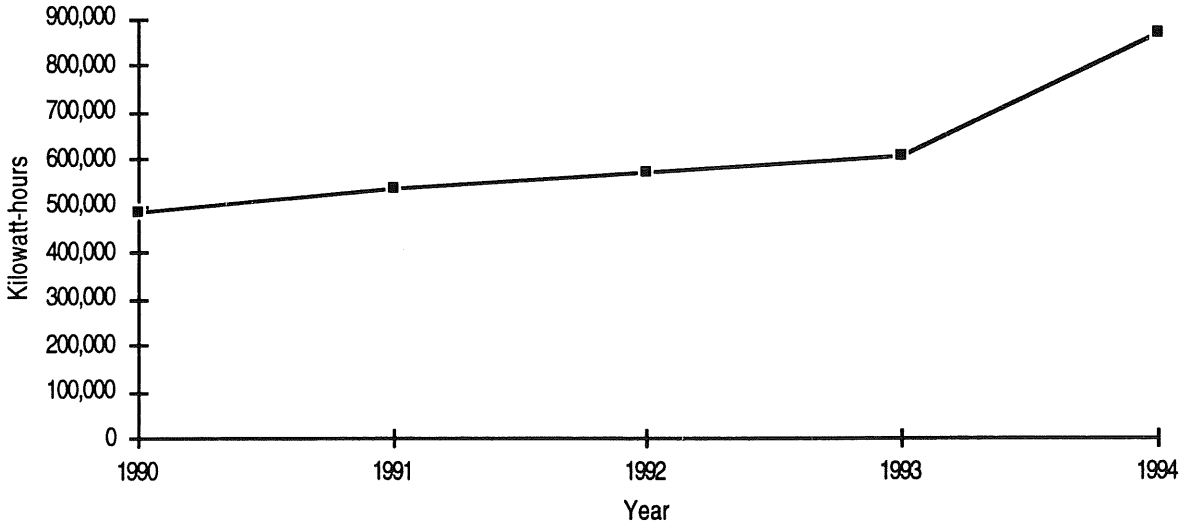
II. WIND

When the Department released its 1992 Quadrennial Report, advocates of wind energy were anticipating NSP's public commitment to install or purchase 100 MW of wind capability by the year 2000. At that time, the costs for wind were approximately 6¢ to 8¢ per kWh, with projections that prices would decline to 5¢ per kWh.

NSP is now well on its way to installing 425 MW of wind capability by 2002, with the latest competitive bid coming in at an average rate close to 3¢ per kWh (after taking into account the federal renewable energy production tax credit of 1.5¢/kWh). This 425 MW was mandated by a legislative compromise that allows NSP to store spent nuclear fuel at the Company's Prairie Island plant.

Wind energy from turbines smaller than 40 kW has also increased steadily, with 485,577 kWh sold to Minnesota utilities in 1990 and 868,449 kWh sold in 1994 (Figure VII-3).

Figure VII-3: Purchases of Wind Energy from Turbines in Minnesota Smaller Than 40 KW



Although wind resources provided less than 0.1 percent of Minnesota's electrical energy use in 1994,[1] programs initiated by the Department have identified significant future potential for wind resources in Minnesota.

[1] 1994 data includes limited purchases by NSP from the 25-MW wind farm in Lake Benton, Minnesota. The remaining energy is attributable to turbines under 40 kW and a 600-kW wind project in Marshall.

Minnesota has taken several aggressive steps, particularly favorable tax policies, to increase the use of wind energy. For example, Minnesota exempts wind conversion systems that produce 2 MW or less from property taxes. For larger systems, only the foundation and support pads are taxable for the first five years. After five years, only the foundation and support pads and 30 percent of tower structures are taxable.

In addition, Minnesota Statutes award a production incentive payment to qualifying wind energy conversion facilities of 1.5¢ per kWh. These facilities must be less than 2 MW, owned and operated by either a person who owns the land where the facility is sited or by an agricultural cooperative organization, and put into service between June 30, 1997, and January 1, 2005. A facility may receive such incentive payments for ten years. These facilities also are eligible for low-interest loans through the Minnesota Department of Agriculture's Value-Added Agricultural Loan Program.

Wind-energy conversion systems smaller than 5 MW do not require a siting permit from the Minnesota Environmental Quality Board. Instead, applicants can work with their counties. For systems larger than 5 MW the permitting process has been streamlined to require a decision no later than 180 days after a complete application is submitted. Moreover, wind turbines under 40 kW receive the average retail rates for the energy they generate and sell back to utilities. These smaller turbines are typically sited on individual farms.

In addition to these state policies, wind systems installed by June 30, 1999, are eligible for a federal renewable energy production tax credit of 1.5¢ per kWh for ten years. The Department believes that these incentives are appropriate vehicles to promote further wind energy development in the State, and would support a legislative effort to reinstate the sales-tax exemption that expired in June 1996.

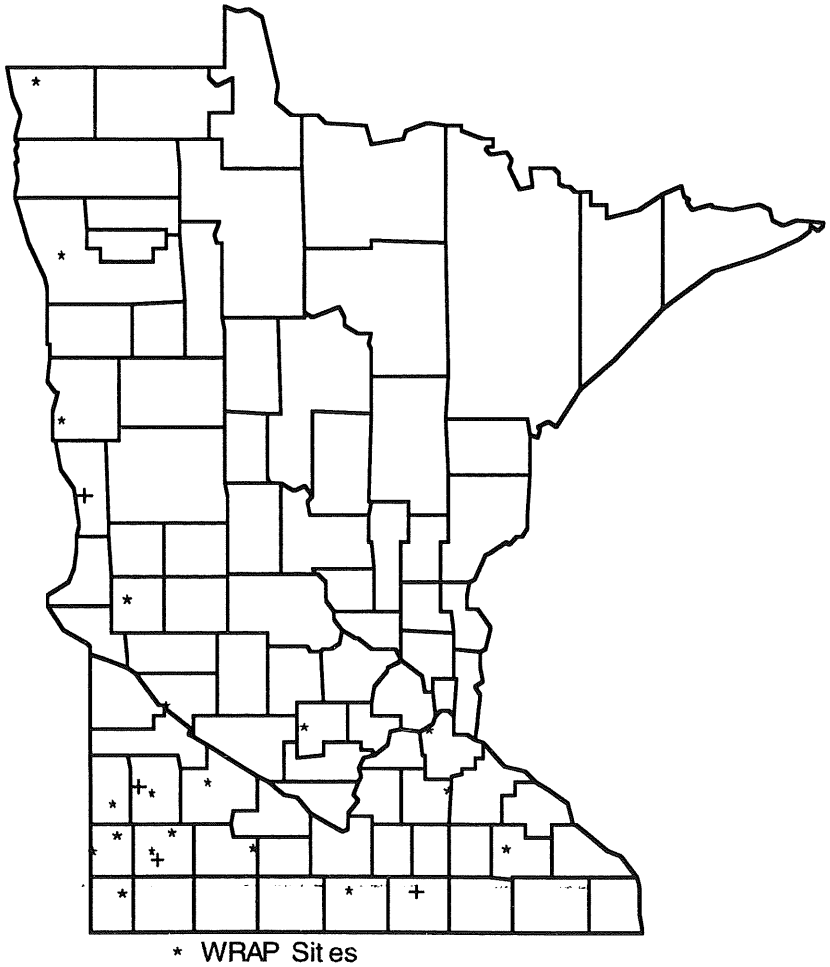
State and Federal Policies Promoting Wind Energy

- Exemption from or reduction in property taxes.
- Payment of 1.5¢ per kWh for 10 years if produced on agricultural lands.
- Low-interest loans for wind installations on agricultural lands provided by Minnesota Department of Agriculture.
- Streamlined State siting process.
- Federal production tax credit of 1.5¢/kWh for 10 years.

To help identify the most promising wind sites, the Department has upgraded its Wind Resource Assessment Program (WRAP) by purchasing and installing new monitoring equipment, including advanced cellular data loggers, to monitor wind speeds and directions at three heights: 30, 50 and 70 meters. These new sites are more ideally positioned than most of the Department's older sites and will provide much more detailed information than previously possible. Wind developers are now able to obtain wind information on land areas as small as 40 acres. Figure VII-4 shows the location of the Department's operating wind monitoring sites as of 1996. A description of the Department's WRAP program is included as Attachment 5.

Figure VII-4

State of Minnesota
Wind Resource Assessment Sites



* WRAP Sites
\+ DPS / DOE Tall Tower Study

The Department has also received grants from DOE for three additional resource-monitoring programs. Through the Wind/Solar Study the Department monitored the wind and solar resources in the southwestern part of the State from September 1993 to December 1995. The Department will release its analysis of the data by the end of 1996.

Through the Tall Tower Wind Shear Study, the Department has established four sites to conduct a detailed analysis of how wind energy increases with increasing heights above ground (wind shear).

In addition, Otter Tail Power is monitoring the wind resource at five locations in northwestern Minnesota. This information will be used to determine the feasibility of establishing a commercial wind farm in the Red River Valley area of Minnesota.

Northern Iowa, South Dakota and North Dakota also are good potential sites for wind installations that could serve Minnesota consumers. For example, five utilities serving Minnesota (NSP, Otter Tail Power, Cooperative Power Association, Minnkota Power Cooperative and United Power Association) are participating in a two-year study of wind potential in North Dakota. Minnesota may eventually become a consumer of wind energy generated in North Dakota, which is projected to have vast resources.

III. WOOD/OTHER BIOMASS

Biomass can be converted into energy through several methods, including direct combustion gasification. One example of direct combustion is the burning of stickwood and wood pellets in residential wood-burning stoves. In commercial applications, waste wood is directly combusted to produce steam to drive a generator. The burning of whole trees is another potential application of direct combustion in the commercial sector. Still another commercial application of direct combustion is co-firing, which involves the combustion of wood with another fuel, such as coal. Gasification involves the conversion of biomass into a gas that can be used as a fuel source for gas turbines, boilers and engines.

This section of the Report considers the use of wood and other forms of biomass separately. The use of biomass to produce ethanol is considered in Section VII -- Alternative Energy for Transportation.

A. *WOOD AS AN ENERGY SOURCE*

The State currently has 15 million acres of forests available for harvest. However, most of Minnesota's timber is used to manufacture various board products and paper, not to produce energy. The high demand for wood in wood products will continue to keep the cost of wood high, thus limiting its use for energy production.

Nevertheless, wood represents approximately 22 percent of the alternative energy used in the State, second only to hydroelectric energy. Wood is generally used as a fuel in the following forms:

- firewood logs;
- wood chips;
- wood pellets;
- sawdust; and
- agricultural residue.

The high cost of disposing of wood waste provides a financial incentive for finding new uses for this waste. Studies by two State agencies have identified a large amount of wood waste in the seven-county Twin Cities metro area alone. A 1994 survey by the Minnesota Department of Natural Resources has identified a potential (currently unused) average statewide supply of wood waste of 2,045,050 dry tons per year. This supply has an energy content of 31.9 TBtus per year (assuming 7,800 Btu per dry pound). The Department anticipates an increase in the use of wood waste as an effective means of reducing the costs of waste disposal.

Residential consumers use wood in two forms: wood pellets (waste wood processed to be used in pelletized wood stoves) and stick wood. Both forms of wood use have declined significantly since the winter of 1993-1994. The Department believes this decline is due to the relatively low prices of natural gas and consumer resistance to removing the ash by-product of wood stoves.

Commercial waste-wood applications use wood chips or wastewood. For example, the paper industry co-fires waste wood with coal. This energy is used to produce steam for industrial processes, and in some cases is used for cogeneration.

The concept of using whole trees as a fuel for electric generators has not resulted in commercial application to date. Although 5,000 acres of short-rotation tree crops to fuel whole-tree boilers have been planted, these trees may be used by the paper and board industry rather than as fuel for power plants. As explained earlier, the high price of wood is a deterrent to its use as a fuel.

B. *OTHER BIOMASS CROPS*

Other biomass crops that are used (or have been proposed to be used) for energy production include crop residues, switchgrass, sorghum and alfalfa. For example, a plan to grow alfalfa as an energy crop has been proposed for western Minnesota. The alfalfa leaves would be separated from the stems. The leaves would be used as a protein supplement for animals, while the stems would be used as a feed stock for a gasifier. The gas produced in the gasifier would then be burned in a gas turbine, which would drive an electric generator. As with many integrated biomass power systems, the technology's cost-effectiveness depends on the value of the co-products. Therefore, the higher the value of the alfalfa feed (the co-product), the more likely that alfalfa gasification will become a viable energy source for Minnesota. The Electric Power Research Institute projects that biomass gasification in general will be more viable after the turn of the century due to cost reductions from continued research.

Crop residues are also used as a thermal source of energy in Minnesota, primarily by public schools. The two major crop residues being burned for heating are sunflower hulls and sugar beet seeds.

C. *NSP MANDATE*

In 1993 the Minnesota Legislature authorized NSP to incrementally increase its storage of spent nuclear fuel in dry casks as long as the Company, among other requirements, invested in additional biomass power: 50 MW by the end of 1998 and an additional 75 MW by the end of 2002. NSP is using a competitive-bidding process to procure these resources. Whole-tree burning and alfalfa biogasification are two of the technologies that meet the biomass requirements. Although neither of these technologies is currently competitive with other generation resources, even when environmental costs are considered, early demonstration plants could help identify and answer questions and make these technologies cost-effective in the future.

IV. HYDROELECTRIC ENERGY

Minnesota has used hydroelectric energy for more than 100 years. A hydroelectric plant built in 1883 and operating on Upton Island, below St. Anthony Falls, was one of the first such plants in the Western Hemisphere.

Minnesotans currently use hydroelectric energy that is produced within the State, in surrounding states, and in Canada. There are currently 32 hydroelectric plants operating in Minnesota, with a combined capacity of about 202 MW (Figure VII-5).

Figure VII-5
Minnesota Hydroelectric Units

Name of River	Number of Units	Capacity (MW)
Minnesota	1	1.4
Mississippi	10	72.2
St. Louis	5	95.1
Crow Wing	2	3.4
Kawishiwi	1	4.0
Prairie River	1	1.1
Otter Tail	5	3.5
Redwood	1	0.3
Zumbro	1	2.6
Red Lake	1	0.6
Rainy	1	10.1
Root	1	0.2
Blue Earth	1	5.0
Cannon	1	2.6
TOTAL	**32**	**202.1**

These 32 plants produced approximately 1,121,165 MWh in 1994. About 1,012,497 MWh of this hydroelectricity was consumed in Minnesota, which represents 16 percent of Minnesota's production of alternative energy in 1994 and 2 percent of Minnesota's total 1994 electric consumption. Figure VII-6 shows the amount of hydroelectric energy Minnesotans consumed from different sources in 1994. A significant amount of Minnesota's imported hydroelectricity comes from Manitoba Hydro.

Figure VII-6
Sources of Minnesota's Hydroelectric Consumption in 1994

	MWh
Minnesota Hydroelectric Plants	1,012,497
Wisconsin Hydroelectric Plants	646,010
Energy from Western Area Power Administration	2,755,834
Other Purchases (Primarily Manitoba Hydro)	6,536,326
Total Minnesota Consumption	**10,950,667**

Construction of new hydroelectric facilities in Minnesota is limited by high initial construction costs, environmental concerns, and relatively low purchase prices for the electricity generated. Also, new sites for hydroelectric facilities are becoming increasingly scarce. Consequently, most additional hydroelectric capacity will probably be obtained through needed dam repairs and the refurbishment of existing facilities.

The Department supports the continued operation and/or refurbishment of a hydroelectric facility when the direct and indirect economic benefits and other social benefits more than offset the social cost of the facility's operation. Hydroelectric facilities avoid the air pollution and solid-waste disposal associated with many other sources or electric generation. The Department supports the consideration of all environmental impacts when making relicensing decisions, including the environmental costs of replacing hydroelectric plants with other generation resources.

The state promotes hydroelectric investments in two ways. First, the State offers a production incentive of 1.5 cents per kWh for 10 years for hydroelectric energy generated at the site of a dam that was in existence as of March 31, 1994, and begins generating electricity after July 1, 1994. In addition, real or personal property used for producing hydroelectric power on a site owned by a state or local government unit is exempt from property taxes.

During the next decade, many hydroelectric sites in the State will come up for relicensing. The Department will continue to participate in these proceedings and support these facilities as long as they produce net benefits to Minnesota. Further, Manitoba Hydro will continue to be a potential supplier of cost-effective renewable energy and capacity to NSP and other Minnesota utilities. Manitoba Hydro estimates additional, economical hydroelectric potential on its major river systems of about 5,000 MW, all located in northern Manitoba. Electricity from Manitoba Hydro has proven to be cost-effective in the past. Its contribution to Minnesota's future energy needs will depend on the Province's own energy needs and its ability to continue to develop new sites in a timely manner and at a competitive price.

V. SOLAR

The sun's energy can be captured for use as an energy source in Minnesota in one of two ways: It can be converted into electricity through photovoltaics (PV) or directly used as a source of thermal energy. In this section of the Report, the two forms of solar energy use are discussed separately.

A. PHOTOVOLTAICS

There are many cost-effective applications for commercial and residential PV systems. For example, photovoltaics are used in many remote locations where a service-line extension would be prohibitively costly. Examples include:

- power for telecommunications equipment,
- power for corrosion protection of pipelines, and

- power for remote cabins.

The primary concerns related to photovoltaics are reliability and cost. American consumers expect energy to be available on demand, any time of day or night during any season. Solar energy by its nature is available only at specific times. To have energy available when the sun does not shine requires an energy-storage system, a backup system, or interconnection with a public utility. All of these requirements significantly increase the cost of using photovoltaics.

The Utility Photovoltaic Group (UPVG), a national utility organization, estimates that the market for grid-connected PV systems in the United States is over 7,000 MW. Minnesota ranks eleventh among the 50 states in estimated potential with 250 MW. The UPVG promotes PV demonstration projects and cost-effective applications, because it believes that PV costs will decline when increased demand fosters economies of scale in the manufacturing of photovoltaic systems. The Department shares this belief and has recommended or approved photovoltaic installations by electric utilities through our comments on IRPs and our CIP Decisions. For example, NSP is evaluating:

- the use of PV systems in building roofs and walls;
- the performance of small (2 to 4 kW) grid-connected systems installed at NSP's residential customer sites; and
- remote PV applications, such as for street lighting, distribution sectionalizing switches and water pumps.

Amoco and Enron, two large energy corporations, apparently agree that the future of PV systems is promising. They recently formed a joint venture to manufacture and sell 10 MW of PV generating capacity per year.

Cost reduction has been the key to the increase in photovoltaics installations: Prices have fallen by an average of more than 50 percent every five years. Prices are expected to continue to decline through 2000.

B. THERMAL

There are also many examples of thermal solar installations in Minnesota. For example, one manufacturer has developed a simple system to preheat the ventilation air in buildings. A perforated Solar Wall™ is installed over a building's existing wall, creating a 4-inch air space. Sunlight striking a black wall heats the air being pulled through the perforation as much as 50 degrees above the outside temperature. The heated air sandwiched between the two walls is then drawn into the building's existing ventilation system. Such a system installed in Blaine, Minnesota, has an estimated payback period of 5.2 years.

Another important example of solar thermal energy in Minnesota is proper residential siting that enables homes to capitalize on heat from the winter sun. Several electric utilities and one gas utility have programs for new residential construction projects that promote proper siting.

C. STATE AND FEDERAL INCENTIVES FOR SOLAR ENERGY

The State of Minnesota stimulates investments in solar energy by exempting solar systems from property and sales taxes. Also, State law requires that plans for new State building construction, or plans to renovate 50 percent or more of an existing State building, must include designs that use solar energy systems where feasible. The federal government awards a 10-percent tax credit on investments in solar energy for non-utility commercial entities. In addition, the Internal Revenue Service allows companies to use accelerated deprecation for investments in solar energy.

VI. MUNICIPAL WASTE

Municipal waste is Minnesota's third largest alternative source of energy. In 1994 Minnesota used 11.27 TBtus of energy from municipal waste, or approximately 6 percent of the alternative energy used in the state.

Two types of waste-to-energy facilities are currently being used. The first is a mass-burn facility, which burns unprocessed waste without any separation or processing. The second type of facility receives and processes the waste. Recyclable materials are removed when possible. The waste is then either densified into pellets or passed through a hammer mill to produce fluff. In both cases the fuel is then shipped to another facility for burning.

There are 13 municipal waste-to-energy facilities currently operating in the State. However, no new facilities have been developed since 1989. The Department expects that no additional facilities will be built in the near future for two reasons. First, there has been strong opposition to such facilities due to their potential emissions of toxic pollutants when the waste is burned. Second, not as much municipal waste is being generated due to increased recycling efforts, which reduces the stability and amount of the fuel stream.

Another way to use municipal waste to produce energy is to capture landfill gases that are created as landfill materials decompose. This low-Btu methane can then fuel engine-generator sets to generate electricity. NSP and Waltek, a privately-held company, are using landfill gas in this way. Another process uses the captured gas as a fuel source for a fuel cell that generates electricity. United Power Association recently determined through testing that landfill gases can be adequately cleansed of particular elements to allow the use of these gases in a fuel cell. The Department projects that these two uses of landfill gas may increase in the future.

The federal government currently offers a tax credit for using landfill gas to generate electricity. The facility must be placed in service before January 1, 1997, pursuant to a binding written contract in effect before January 1, 1996. The credit will be in effect until January 1, 2008. The amount of the credit varies with the Btu content of the landfill gas and an inflation index. In 1994 it was worth about $0.85 per MBtu of landfill gas.

VII. ALTERNATIVE ENERGY FOR TRANSPORTATION

A. ALTERNATIVE-FUEL VEHICLES

Alternative-fuel vehicles (AFVs) are highway motor vehicles that use fuels other than gasoline or diesel. In 1993 the Minnesota Legislature clearly articulated its reasons for developing AFVs in Minnesota Statutes section 216C.40:

> It is in the long-term economic, environmental, and social interest of the state of Minnesota to promote the development and market penetration of alternative fuel vehicles that reduce harmful emissions from motor vehicles ... so as to assist in attaining and maintaining healthful air quality, to provide fuel security through diversity of alternative fuel supply sources, and to develop additional markets for indigenous crop-based fuels.

Minnesota Statutes specify the following fuels as alternative transportation fuels:

- ethanol at concentrations of 85 percent or greater,
- methanol at concentrations of 85 percent or greater,
- biodiesel (concentration level yet to be specified),
- natural gas in both the compressed and liquefied states,
- liquefied petroleum gas (commonly referred to as propane),
- hydrogen, and
- electricity.

Vehicles that run on virtually pure ethanol, electricity, propane, and compressed and liquefied natural gas are all technically feasible. Thousands of these vehicles now operate across the country. They range from small commuter vehicles to sedans, pickups, vans, buses and heavy-duty trucks. The Department estimates that over 2,300

of these vehicles are currently used in Minnesota, and their use is expected to increase. For example, the City of Minneapolis recently received a $100,000 grant from the Gas Research Institute to help defray the cost of purchasing 20 buses fueled by compressed natural gas (CNG). Expanding AFV use will improve our urban air quality, benefit the State's agricultural economy, and help Minnesota and the nation significantly reduce their dependence on imported petroleum.

This potential cannot be reached, however, until AFVs become a significant part of our transportation mix. AFV growth poses significant challenges for the State. The fundamental challenge during initial development and implementation is that almost all AFVs are more expensive than traditional vehicles. In many cases the vehicles are more expensive to own and operate; in some cases the fuels are more expensive; and in some cases the fueling facilities are more expensive. In addition, alternative fuels and vehicles must capture a share of a transportation market that has been dominated by gasoline and diesel fuel for nearly 100 years. AFVs must compete with a petroleum infrastructure that includes a gas station on virtually every corner.

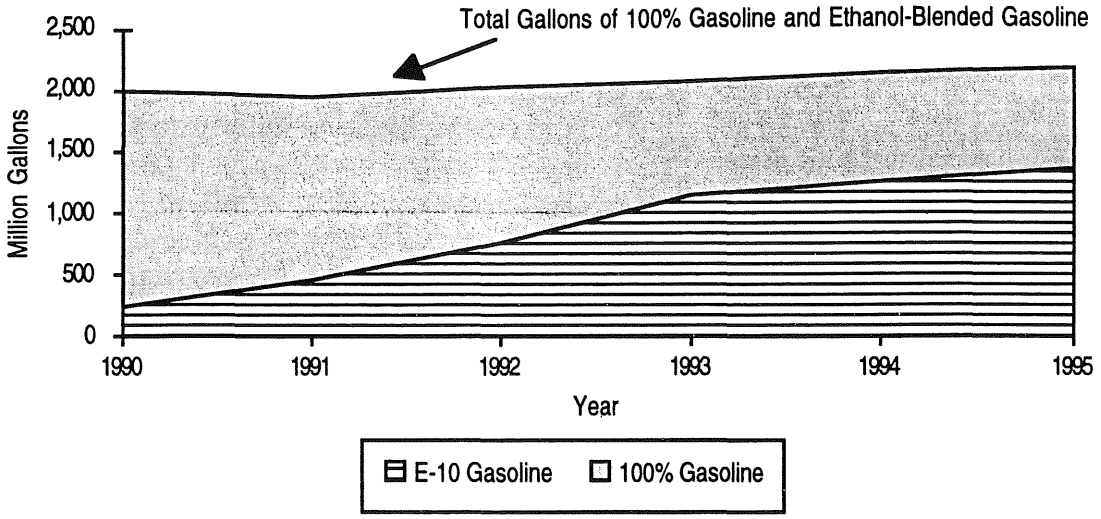
In February 1995 the Department issued a report entitled *Development of Alternative Fuel Vehicles in Minnesota: A Report to the Legislature.* This report concluded that the State Legislature should consider adopting one or more financial incentives for AFVs. The report also concluded that regulated utilities should be allowed to recover AFV development costs from ratepayers only when demonstration projects are cost-effective or the costs arise from unfunded federal mandates. The risks associated with a utility's full entry into the competitive transportation fuel market must be assumed by shareholders.

B. ETHANOL

Ethanol, commonly called grain alcohol, is a renewable, high-grade liquid fuel produced from biomass, usually the fermentation of corn. Most fuel ethanol is consumed as a 10-percent "oxygenate" blend in unleaded gasoline. In a 10-percent blend, ethanol reduces the emissions of carbon monoxide typically associated with gasoline vehicles. Ethanol production offers a substantial economic-development opportunity for rural Minnesota.

The State's clean-air regulations currently require a 10-percent blend of ethanol (the blended product is called E-10 or gasohol) in metropolitan counties during the winter months. By October 1997, the 10-percent oxygenate requirement will apply statewide and year-round, with minor exceptions. The Department estimates that the ethanol oxygenate market in Minnesota will eventually exceed 230,000,000 gallons annually. The projected growth in the use of ethanol-blended gasoline (E-10) between 1990 and 1995 is provided in Figure VII-7.

Figure VII-7: Growth in Minnesota's Use of Ethanol-Blended (E-10) Gasoline



In 1996 there were six ethanol production plants operating in Minnesota and four more under construction. Their estimated annual production capacity is approximately 100 million gallons. Up to seven additional plants are being developed. Ethanol production offers a substantial economic-development opportunity for rural Minnesota.

While the market for ethanol as a gasoline oxygenate is growing in Minnesota, so too is its potential as a gasoline "replacement" or "alternative" automotive fuel. New E-85 flexible-fuel automobiles capable of burning any gasoline/ethanol blend up to 85-percent ethanol have been introduced in Minnesota and the Upper Midwest. The State will operate approximately 100 of these vehicles by January 1, 1997, the federal government will operate 175 vehicles within the State, and several local governments will own and operate additional vehicles. At the end of 1996 there will be nine public E-85 fueling sites in Minnesota. Ford now manufactures an E-85 flexible-fuel Taurus. By 1997 all of General Motors' four-cylinder S-10 pickup trucks will be E-85 flexible-fuel vehicles. The federal government will operate 200 of these vehicles in Minnesota. While the amount of ethanol consumed by these vehicles in Minnesota is still limited, approximately 165,000 thousand gallons of ethanol will be used for E-85 vehicles in 1997. These volumes will continue to grow as more E-85 vehicles become available.

Before ethanol can compete with gasoline and grow beyond mandates and demonstrations, its production cost must decline. Ethanol production and use is currently subsidized at both the State and federal levels. Even with this support, ethanol is more expensive than gasoline when compared on an energy-content basis. Ethanol supporters are quick to point out that gasoline and the existing petroleum industry are also the beneficiaries of several past and current subsidies. Regardless of this debate, ethanol cannot currently compete economically with gasoline. There is little

likelihood that current ethanol subsidies will be expanded; there is even some indication that they will be reduced. Consequently, ethanol production costs must decline if ethanol is to compete economically with gasoline. The Department believes that the following two initiatives could reduce production costs:

- New feed stocks to create less costly inputs.
- New enzymatic processes that convert cellulose directly to ethanol. These processes use more than just the starch component of the corn kernel and open up the process to new feed stocks such as corn stalks, grasses, wood waste and even waste paper. These new enzyme processes are currently being researched at the National Renewable Energy Laboratory in Golden, Colorado.

VIII. FORECAST OF STATEWIDE ALTERNATIVE ENERGY USE AND PRODUCTION

A. OVERVIEW

The Department's Baseline forecast projects that Minnesota's consumption of alternative energy will increase by 26 percent between 1994 and 2020, and 89 percent between 1990 and 2020 (Figure VII-8). The increase between 1994 and 2020 is largely propelled by increases in the use of wind, ethanol and wood/biomass. Note that there was a significant increase in the use of alternative energy between 1990 and 1994 (50 percent). This increase is largely attributable to the greater the use of ethanol and hydroelectricity. Ethanol use increased due to State mandates. Hydroelectric use increased due to additional purchases from Manitoba Hydro and the fact that 1994 was a wetter year than 1990 (allowing more hydroelectricity to be generated in the State in 1994).

Figure VII-8
Minnesota Consumption of Alternative Energy
(TBtus)

Alternative Source	1990 Consumption	1994 Consumption	2020 Consumption	% Change 1994-2020	% Change 1990-2020
Wind	0.01	0.31	10.40	3,254%	103,883%
Wood/Biomass	39.36	38.91	66.88	72%	70%
Hydroelectric	65.43	114.98	114.98	0%	76%
Solar	1.13	0.64	1.71	168%	52%
Municipal Waste	10.19	11.27	11.27	0%	11%
Ethanol	2.06	10.58	17.97	70%	771%
TOTAL	**118.18**	**176.69**	**223.21**	**26%**	**89%**

The Baseline forecast projects an increase in the production of alternative energy in Minnesota from 75 TBtus in 1994 to 126.87 TBtus in 2020, or an increase of 69 percent (Figure VII-9). As with the consumption of alternative energy, the largest increases will come from wind, wood/biomass and ethanol.

Figure VII-9
Minnesota Production of Alternative Energy
(TBtus)

Alternative source	1990 Production	1994 Production	2020 Production	% Change 1994-2020	% Change 1990-2020
Wind	0.01	0.40	13.68	3,321%	136,720%
Wood/Biomass	39.36	38.98	69.09	77%	76%
Hydroelectric	8.85	11.77	11.77	0%	33%
Solar	1.13	0.64	1.71	168%	52%
Municipal Waste	11.44	12.64	12.64	0%	10%
Ethanol	2.06	10.58	17.97	70%	771%
TOTAL	**62.85**	**75.00**	**126.87**	**69%**	**102%**

Forecasting the use of alternative energy is very difficult, because its future development depends largely on speculative technological improvements and public subsidies. The Department's Baseline forecast assumes only incentives and mandates that are already in place. It assumes no dramatic changes in technology, legislation or prices for alternative energy.

Obviously, the use of some alternative energy resources could increase dramatically compared to the increases projected in the Baseline forecast. For example, the costs of wind energy could continue to decline to the point that wind becomes a major contributor to the State's energy mix. Moreover, State financial incentives for wind production could significantly increase the amount of wind generation on agricultural lands. Then again, public subsidies for ethanol production could be reduced or entirely eliminated, greatly reducing the future use of ethanol. The Department will continue to update its forecast as conditions change.

B. INDIVIDUAL ALTERNATIVE ENERGY SOURCES

1. Wind

NSP's purchase of energy from a 25-MW wind project in Lake Benton began in the fall of 1994, a year in which the State used only 0.31 TBtus of wind energy. NSP is required by State law to install or purchase 425 MW of wind capacity by 2002. Although the Department anticipates significant growth in small wind farms between 1994 and 2020, the Department's forecast of wind energy is conservatively based solely on NSP's mandated additions, assuming an average capacity factor of 35 percent. (This assumption should not skew the projection significantly, as the total energy from small wind turbines is much less than the total energy generated by large projects.) The

Department projects that Minnesota's consumption of wind energy will increase from 0.31 TBtus in 1994 to 10.40 TBtus in 2020. By 2020 wind will account for almost 5 percent of the State's alternative energy use.

2. Wood/Biomass (other than ethanol)

The use of non-ethanol-producing biomass is projected to increase by 72 percent, from 38.91 TBtus in 1994 to 66.88 TBtus in 2020. By 2020 this category will account for 30 percent of the State's alternative energy use. The Baseline forecast is based primarily on the extrapolation of trends in past wood use and NSP's mandate to install 125 MW of biomass generation by 2002. This forecast may be too high, if the trend has "topped out." However, it is also possible that the use of biomass in electric generation will increase significantly, primarily due to wood co-firing at coal plants.

3. Hydroelectric

The Department projects that the State's consumption of hydroelectric energy in 2020 will approximate the State's 1994 consumption, 114.98 TBtus. This projection assumes that purchases of hydroelectricity from Manitoba Hydro, Western Area Power Association and other out-of-state sources will be renewed at current levels. By 2020 hydroelectricity will account for 52 percent of the State's alternative energy use.

4. Solar

Solar energy use in Minnesota is projected to increase by 168 percent--from 0.64 TBtus in 1994 to 1.71 TBtus in 2020. By 2020 solar energy will account for 1 percent of the State's alternative energy use. There is not enough data to model economic and/or price impacts at this point, so the increase is simply a linear extrapolation of recent trends.

5. Municipal Waste

The Department estimates that municipal waste provided 11.27 TBtus of energy in 1994. The Department assumes no additional municipal-waste facilities that combust waste between now and 2020, due to environmental concerns and public opposition. But we anticipate additional use of landfill gases over the same period. To estimate the energy contribution of municipal waste in 2020, the Department assumes that the additional energy from landfill gas will offset reductions in energy from other municipal-waste facilities. Therefore, the Department estimates that municipal waste will provide 11.27 TBtus of energy in 2020, or 5 percent of the State's alternative energy use.

6. Ethanol

Ethanol use in Minnesota is projected to rise by 70 percent, from 10.58 TBtus in 1994 to 17.97 TBtus in 2020. By 2020 ethanol will account for 8 percent of the State's alternative energy use. Current ethanol subsidies (tax reductions) encourage a 10-percent ethanol mix in gasoline (E-10). The Baseline forecast assumes these subsidies will continue. The increase in ethanol use predicted by the model is due to a projected increase in gasoline use in general.

C. *MODELING ADDITIONAL INCREASES IN ALTERNATIVE ENERGY*

The Department has modeled an alternative scenario that assumes greater increases in both ethanol and wind energy. This alternative scenario includes the following two assumptions. First, the State institutes policies that lead to an increase in the amount of ethanol used in a gallon of gasoline of 1 percent per year for five years, from the current level of 10 percent (E-10) to 15 percent (E-15). This 15-percent level is then maintained through 2020. Second, an additional 400 MW of wind capacity are installed in annual increments of 100 MW beginning in 2003. The assumed average capacity factor of these wind projects is 37 percent.

The Department projects that this alternative scenario would result in an increase of 9 percent in Minnesota's consumption of alternative energy by 2020 compared to the Baseline scenario. Ethanol use would increase by 60 percent and wind energy by 99 percent. Note that under this alternative scenario the use of alternative energy doubles between 1990 and 2020 (Figure VII-10).

Figure VII-10
Wind/Ethanol Alternative Scenario
Minnesota Consumption of Alternative Energy
(TBtus)

Alternative Source	1990 Consumption	1994 Consumption	2020 Consumption	% Change 1994-2020	% Change 1990-2020
Wind	0.01	0.31	20.74	6,592%	207,342%
Wood/Biomass	39.36	38.91	66.88	72%	70%
Hydro	65.43	114.98	114.98	0%	76%
Solar	1.13	0.64	1.71	168%	52%
Municipal Waste	10.15	11.27	11.27	0%	11%
Ethanol	2.06	10.58	28.77	172%	1,295%
TOTAL	**118.14**	**176.59**	**244.36**	**38%**	**107%**

IX. SUMMARY AND RECOMMENDATIONS

The Department projects expanded use of alternative energy for several reasons. First, the reduced costs of wind energy and the federal energy production tax credit have made wind generation more competitive with fossil-fuel generation. One indication is the low cost of the winning bid for Phase II of NSP's legislative mandate to procure 425 MW of wind resources by the end of 2002. The State production incentive beginning in 1997 will also promote wind development on agricultural lands.

Second, the consideration of all social costs, including environmental costs, in the State's decisions on energy resources should significantly increase the contribution of alternative energy to the State's energy mix.

Third, if retail competition develops in the electric industry, some customers may choose to purchase electricity generated from alternative energy sources, and may be willing to pay a premium to do so.

The Department has promoted the research, development and use of alternative energy resources for many years, because alternative energy can help advance the public-policy goals of environmental quality, risk mitigation and economic development. (For more on these goals, see Chapters 1 and 3.) The Department's support of competition in the electric utility industry has not reduced our support for using alternative energy for electrical generation; we recognize alternative energy's important role in obtaining the aforementioned goals.

The procurement of alternative energy sources is currently promoted through production tax credits, tax exemptions, federal mandates for AFVs and IRP for electric utilities. Alternative energy can survive in a competitive energy market as it continues its impressive track record of increased cost-effectiveness. The Department supports the research and development of alternative energy. We will continue to evaluate competitively neutral, market-based approaches for incorporating the social costs of generation, including environmental costs, in resource decisions.

The Department believes new mechanisms could also be considered. For example, a renewable energy standard could ensure that renewables play an important role in our mix of electric generation resources. The standard may require every power supplier to purchase a percentage of its energy needs from renewable resources. Individual requirements could be tradable, which would ensure that not every power supplier would have to become a renewable energy developer and allow the standard to be met in the most cost-effective way. The Department will consider this and other proposals as means of promoting the development of cost-effective renewable energy.

One of the Department's primary energy goals is to promote an innovative energy industry with emphasis on renewable energy development in Minnesota. At this point, evolving renewable energy technologies have difficulty competing with established fossil-fuel technologies that have an infrastructure geared to their needs.

The Department recommends that Minnesota adopt the strategies and action steps listed below.

Strategy 1 - RESEARCH AND DEVELOPMENT: Promote private- and public-sector research and development of renewable energy technologies that have the greatest potential for use in the State.

To implement this strategy, the Department recommends the following action steps:

1. Continue to collect and analyze renewable resource data through the Wind Resource Assessment Program, and provide public access to the reports and summary information generated from this data.

2. Support research that reduces the cost of ethanol production, including the use of less expensive crops for ethanol-producing feed stocks and new enzymatic processes that convert cellulose directly to ethanol.

3. Continue to pursue federal and State funding sources for research and development that the private sector would be reluctant to conduct.

Strategy 2 - COMMERCIALIZATION INCENTIVES: Provide incentives to reduce regulatory costs and to encourage cost-effective commercialization of alternative energy technologies.

To implement this strategy, the Department recommends the following action steps:

1. Continue to support current federal and State production credits and tax incentives to encourage ethanol products, small- and large-scale wind projects and photovoltaic systems.

2. Continue to support regulatory reforms -- including less expensive and shorter regulatory processes -- to encourage cost-effective investments in renewable energy.

3. Explore new ways of promoting the use of alternative energy in a more competitive electric industry. One possibility is a renewable energy standard that requires every power supplier to purchase a specific percentage of its energy needs from renewable sources.

Strategy 3 - ACCOUNTING FOR SOCIAL COSTS: Ensure that all providers of energy in all energy sectors must account for all social costs of providing their products or services.

To implement this strategy, the Department recommends the following action steps:

1. Evaluate the extent to which current State and federal initiatives already accomplish this strategy.

2. Explore new means of accounting for environmental costs, such as allowance-trading programs, that are compatible with the increasingly competitive natural-gas and electric industries.

3. Intervene in hydroelectric relicensing processes to promote hydroelectric development when it is cost-effective from a social-cost perspective.

Strategy 4 - REPLACE 5 PERCENT OF TRADITIONAL PETROLEUM-FUELED VEHICLES WITH ALTERNATIVE-FUEL VEHICLES BY 2005: Accelerate the percentage of alternative-fuel vehicles used in the State and develop the infrastructure necessary to support these vehicles, such that 5 percent of motor-vehicle gasoline is replaced by 2005. This 5 percent is in addition to the 10 percent of motor-vehicle gasoline replaced by the mandated use of ethanol-blended fuel (E-10).

To implement this strategy, the Department recommends any or all of the following action steps:

1. Exempt AFVs from the State motor-fuels tax for five years.

2. Establish a capital pool to fund AFV development activities by implementing a *one-time* fee of $1 on all vehicles requiring state registration.

3. Implement a vehicle registration credit of 50 percent (up to $100 per year) for AFVs for five years.

CHAPTER 8

MINNESOTA PUBLIC UTILITIES COMMISSION ENERGY RATES POLICIES AND ACTIONS

CHAPTER 8 -- MINNESOTA PUBLIC UTILITIES COMMISSION ENERGY RATE POLICIES AND ACTIONS

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I. INTRODUCTION

Minn. Stat. § 216C.28, subd. 1a requires the Minnesota Public Utilities Commission (Commission) to prepare this section of the State Energy Policy and Conservation Report. At a minimum, the Commission is to analyze its rate design policies with respect to the goals set by the Legislature in Minn. Stat. §§ 216C.05 [increased efficiency in energy consumption, use of renewables, and effective energy forecasting, planning and education], 216B.164 [encouragement of cogeneration and small power production], and 216B.241 [energy conservation improvements] and to recommend legislative and administrative actions to carry out these goals.

The overall mission of the Commission is to create and maintain a regulatory environment that ensures safe, reliable, and efficient utility services at fair and reasonable rates. In carrying out this mission, the Commission must consider and balance a number of statutory mandates and policies. These mandates include setting rates that:

- are reasonable and non-discriminatory for consumers;
- are consistent with utilities' economic and financial needs; and
- encourage energy conservation, renewable use, cogeneration and small power production, to the maximum reasonable extent.

The last mandate is the focus of this Report.

Since the preparation of the 1992 Report, significant changes have taken place in the economic environment in which electric and natural gas utilities operate. Also, a number of new statutes relating to energy policy and rates have been enacted. The Commission, the Legislature, and other stakeholders face the continuing challenge of establishing policies and action steps to help shape this new environment. This section will discuss recent actions and future policy directions of the Commission.

II. RESOURCE PLANNING, SELECTION AND CONSERVATION POLICIES

Policies to promote the overall energy policy goals established by the Legislature tend to fall into two general categories: those which influence the use of energy, such as conservation programs and rate design, and those which influence the mix of resources used to meet energy needs, such as resource planning. These policies interact as changes in the level and pattern of energy use by consumers influence the need for, and type of, resources.

A. RESOURCE PLANNING AND SELECTION

Over the last decade, there has been increasing recognition that utility resource choices have a significant effect on utility rates, economic development, conservation, and the environment. This has lead to increased legislative, regulatory, and public oversight of utility resource decisions. The Commission has authority over certificates of need for large energy facilities, resource planning, and recovery of costs in utility rates. Also, the Legislature has mandated both the development of certain resources and the consideration of environmental costs in resource selection.

1. Electric Resource Planning

In 1990 the Commission adopted rules requiring investor-owned electric utilities to file resource plans every two years. These plans must identify and justify the mix of supply and demand-side resource options that a utility expects to use to meet its projected energy demand over the next 15 years. The rules provide for input into the process from the public, the Commission, and other state agencies, and help ensure that utilities give adequate consideration to all potential resources, including conservation, and to the environmental and socio-economic impact of different resource choices.

In 1993, the Legislature codified the resource planning requirement in Minn. Stat. § 216B.2422 and expanded it to include large generation and transmission cooperatives and municipal power agencies. This statute also establishes a preference for renewable resources by prohibiting the Commission from approving a non-renewable energy facility in a resource plan or certificate of need proceeding unless the utility has demonstrated that a renewable facility is not in the public interest. It also requires utilities to provide least cost plans for meeting 50 and 75 percent of new capacity needs through conservation and renewable energy.

The Commission is currently revising its resource planning rules to reflect the changes in the statute and the experience gained through evaluating more than a dozen plans over the last five years.

2. NSP Renewable Mandate

In 1994, the Legislature mandated that NSP build or acquire 225 MW of wind generation and 50 MW of farm grown closed-loop biomass by the end of 1998. NSP is to build or acquire another 200 MW of wind and 75 MW of biomass by the end of 2002. The Commission is directed to require NSP to obtain an additional 400 MW of wind energy by the end of 2002 if it is found to meet resource planning and least cost requirements. In 1996, the Legislature enacted clarifications to the biomass mandate.

Before the legislative mandate, NSP was developing 25 MW of wind generation pursuant to Commission resource planning directives. The first and second 100 MW of wind additions have been granted certificates of need by the Commission, and are going through the competitive bidding process. The first 50 MW of biomass is also in the bidding process.

3. Environmental Cost Quantification

In 1993, the Legislature required the Commission, to the extent practicable, to quantify and establish a range of environmental costs associated with each method of electricity generation. These costs are to be considered along with other external factors when selecting resource options in all proceedings before the Commission, including resource planning, bidding, and certificate of need.

The Commission established interim environmental values in 1994. The Commission initiated formal evidentiary proceedings to establish permanent values. More than 20 parties are actively participating in this process. This issue is highly controversial, with a wide-range of viewpoints by various parties. The Commission expects to issue a decision on permanent environmental values in the fall of 1996.

4. Spent Nuclear Fuel Storage

In August of 1992, the Commission granted a limited certificate of need to NSP for construction of a dry cask storage facility for spent nuclear fuel at its Prairie Island nuclear generating plant. This was a highly controversial issue, which was ultimately decided by the Legislature. The Legislature confirmed the Commission's decision to allow up to 17 casks, but added certain conditions and mandates, including the NSP renewables mandate discussed above. This controversy brought attention to the role nuclear power plays in Minnesota's energy supply, debate about its future role, and the role of other electricity supply options.

The Commission is participating in the efforts of the National Association of Regulatory Utility Commissioners (NARUC) and the Nuclear Waste Strategy Coalition to require the federal government to assume its responsibilities to dispose of spent nuclear fuel.

5. Natural Gas Planning Issues

In 1994, the Commission considered whether to adopt a formal resource planning process for natural gas utilities; this consideration was required by Section 115 of the federal Energy Policy Act of 1992. The Commission determined that existing Minnesota regulatory processes provide for thorough regulatory review of gas utilities' demand and supply-side planning. Therefore, adoption of a formal

resource planning process is not needed. These existing processes include required investments in conservation, DSM financial incentives, reviews of annual report filings, and reviews of contract demand entitlement changes.

All gas (and electric) utilities are required to file annual automatic adjustment reports with the Commission. These reports describe the utility's procurement policies for selecting the sources of fuel and energy. They also provide a summary of actions taken to minimize cost, including conservation actions. The Department of Public Service performs an in-depth analysis of these filings and the Commission determines whether utilities' current fuel purchasing practices are appropriate. The Commission also reviews demand entitlement levels, which determine the capacity that a utility needs to meet its load requirements, and the amount that may be recovered from customers through a purchased gas adjustment on monthly bills.

B. CONSERVATION INCENTIVE AND RATE POLICIES

Under Minn. Stat. § 216B.241, most investor-owned electric utilities are required to spend 1.5 percent of gross operating revenues on energy conservation improvements. The exception is NSP, which is required to spend 2.0 percent. Natural gas utilities must spend 0.5 percent. These programs are overseen by the Department of Public Service; appeals of Department decisions may be brought to the Commission.

Recognizing the important role of cost-effective conservation program activities, the Commission has developed procedures to allow utilities full rate recovery of approved conservation expenditures and to provide utilities with financial incentives to pursue these demand-side activities. The Commission also considers the effects on conservation when designing specific rates.

1. Conservation Program Cost Recovery

Minnesota law requires that utilities be allowed to recover energy conservation expenditures in rates. The Commission allows the expenditures related to Department-approved conservation programs to be tracked and recovered in a future rate case. The tracker method assures dollar for dollar recovery of prudently-incurred expenses.

In 1993, legislation was passed giving the Commission authority to permit annual adjustments to rates to recover conservation program costs. This allows more immediate recovery of conservation-related expenditures than the tracker method. Annual adjustment mechanisms are particularly attractive to utilities that are increasing conservation expenditures over previous levels. To date, the Commission has approved such adjustments for five utilities.

2. Financial Incentives for Utility Conservation Programs

In 1991, the Commission required all gas and electric utilities to file demand-side management financial incentive proposals. Over the last five years, a variety of incentives were put in place and evaluated. Many of the programs include recovery of the sales margins lost due to customer conservation; some include bonuses for exceeding conservation goals. The Commission recently convened work groups to evaluate these electric and gas financial incentive programs. The Commission determined, based in large part on the work group reports, that financial incentives were valuable for encouraging cost-effective conservation programs and should continue, at least in the near-term.

3. Rate Design

Both the level and design of utility rates influence customer demand for various energy resources. Rates are the vehicle for the utility to collect prudently-incurred costs of providing service to its customers. A number of factors go into designing specific rates; the cost of providing service to each customer class is one of the most important factors, in order to send accurate price signals about the cost of consumption. However, the Commission must also weigh a number of other factors, including the continuity of rates, the avoidance of rate shock, the ability to pay, the competitive environment, and the promotion of conservation. Recent actions with respect to rates for larger customers and low-income rates are discussed later in this chapter.

With respect to using rate design to promote conservation, the Commission has implemented a number of policies. The fixed, customer charge portion of rates has been kept relatively low to place more emphasis on the price of the energy used. The Commission has also approved the development of rates which have a higher price for energy use during peak periods and lower prices during off-peak periods, such as time-of-day, off-peak, controllable, interruptible, and seasonal rates. These types of rates are primarily intended to avoid or delay new power plants by using existing utility capacity more efficiently.

III. CHANGING ENERGY INDUSTRY STRUCTURES AND POLICIES

A. CHANGES IN THE NATURAL GAS INDUSTRY

The interstate gas market has undergone a significant transformation over the last fifteen years. First came the deregulation of prices at the wellhead, followed by the complete unbundling of pipeline services and the creation of a competitive natural gas market through equal and open access to pipeline transportation capacity

by all suppliers and users. The transformation of the interstate gas market was brought about by changes in the demand for and supply of gas and changes in federal pipeline regulation.

Large consumers of natural gas now have the ability to purchase gas directly from suppliers. These customers may use the local distribution company's (LDC) facilities to transport gas to their facilities or may bypass the LDC altogether. In the core gas distribution market, LDCs remain the sole suppliers of bundled gas service (retail service to residential, small business and some large industrial customers) and continue to be subject to significant state regulation. The size of the core distribution market may be reduced as more core customers gain experience and confidence in purchasing gas directly, leading some of them to make an economic decision to bypass the LDC.

1. Rate Design

The Commission has implemented several rate design and regulatory mechanisms to give gas utilities and customers greater flexibility to respond to the significant changes in the structure of the natural gas industry.

Flexible Rates: Under Minn. Stat. § 216B.163, the Commission may approve flexible tariffs for gas utilities whose customers are subject to effective competition. Under flexible rates, utilities are permitted to lower their rates for certain large customers who have unregulated substitutes for natural gas. The Commission has approved flexible gas rates for all major gas utilities in Minnesota.

Unbundling of Rates: A growing number of local distribution companies across the country are responding to changes in the industry by proposing to unbundle rates and services. The Commission is currently evaluating a pilot proposal by Minnegasco to unbundle some of its services and allow gas marketers to aggregate commercial and industrial customers into "pools" and sell gas directly to those customer pools. The utility would continue to recover its regulated non-gas costs from these customers by charging pool members the monthly basic service charge and the per-unit gas delivery charge.

Performance-Based Ratemaking: The Commission is continually evaluating the effectiveness of regulation and developing creative ways to enhance the regulation of utilities and to respond to changes in the natural gas industry. In 1995, the Legislature enacted Minn. Stat. § 216B.167, which allows the Commission to approve performance-based gas purchasing plans. Such plans would provide incentives for utilities to achieve lower natural gas costs by linking financial rewards and penalties with performance and actual lowering of gas costs for the utility's firm customers measured against reasonably attainable benchmarks.

The Commission recently approved a performance-based gas purchasing plan for Minnegasco. The Commission is directed to evaluate the effectiveness of all plans approved under this statute and report to the Legislature by January 1, 1999; the statute sunsets on January 1, 2000.

2. Other Special Rates

The Commission implemented specific rates to further other legislative and regulatory goals.

New Town Rates: To expand the availability of natural gas in the state of Minnesota, the Commission has approved New Town Rates for several gas utilities including NSP, Minnegasco, and Northern Minnesota Utilities. This special rate allows the utility to collect a surcharge from customers to recover the extra cost of extending lines to towns where extensions would not be cost effective under standard rates. In approving New Town Rates for gas utilities, the Commission found that expanded availability of natural gas service could bring benefits to individual customers and enhance the economic viability of smaller communities. As important, the Commission found that the rate protected existing customers and utility stockholders from subsidizing uneconomic service to new areas.

Low Income Discount Rates: In 1994, the Legislature enacted Minn. Stat. § 216B.16, subd. 15, which specifically allows the Commission to consider ability to pay as a factor in setting gas and electric utility rates and to establish programs to assure affordable, reliable, and continuous service to low-income customers. The statute requires the Commission to establish at least one low-income discount pilot program. The Commission has established a low-income pilot program for Minnegasco, which provides a 30 percent discount to the monthly bill of 3,000 low-income customers who also receive assistance from the federal low-income home energy assistance program. The Commission shall evaluate the rate and report to the Legislature by January 1, 1998.

B. CHANGES IN THE ELECTRIC INDUSTRY

A number of changes in the political, legal, economic, and technological characteristics of the electric power industry have combined to stimulate change in its structure and regulation. Developments include an increase in independent power producers, technologies that allow for more effective generation from smaller power plants, and federal policies encouraging competition. The 1992 Energy Policy Act aims to establish a more competitive wholesale electric generation market by, among other things, expanding the FERC's authority to require open-access transmission.

The Commission has recognized these changes by implementing a competitive bidding process for NSP's new power supply, allowing more rate flexibility for large customers, and examining alternative regulatory incentives and structures. The Commission has also implemented specific rate programs directed by the Legislature. In addition to these targeted actions, the Commission has launched a comprehensive investigation into electric industry restructuring issues.

1. Cogeneration and Small Power Production

The Public Utilities Regulatory Policies Act of 1978 (PURPA) requires utilities to purchase power from qualified cogeneration and small power producers; Minn. Stat. § 216B.164 implements PURPA at the state level and provides additional encouragement to these facilities. This Act opened the door to competition in the wholesale electric generation market, albeit to a limited extent. As noted above, the 1992 Energy Policy Act promotes wider wholesale competition through open access to the transmission grid.

The Commission granted a certificate of need to the LS Power cogeneration project in October, 1994. This was the first certificate granted to a large electric facility which was not built by a utility. In 1996, the Legislature passed a bill which reduces property taxes on generating equipment which meets certain efficiency standards and other criteria related to the sale of the output. As competition in the electric industry increases, there are likely to be more non-utility generation projects in Minnesota.

2. Competitive Bidding

The Commission required NSP to develop a competitive bidding process for new generation resources. Entities other than the utility are now able to compete to supply the resources needed by NSP. Competitive bidding may result in lower resource costs and lower rates for consumers, and help promote a more competitive wholesale generation market. Four NSP capacity additions have been, or are in the process of being, competitively bid; two 100 MW wind projects, 50 MW of biomass, and peaking resources. Competitive bidding for new baseload capacity is expected to be implemented by 1997.

3. Rates for Large Customers

Much of the push for increased competition and customer choice at the national level has come from large industrial electric consumers, who want to reduce their costs in response to international and domestic competitive pressures. The Commission must carefully consider its mandates to assure just, reasonable, and non-discriminatory rates for all customers while allowing increased flexibility for customers when it is in the public interest. The Commission has implemented a number of rates that allow increased options and flexibility for utilities and their large customers.

Competitive Rates: In 1990, the Legislature enacted Minn. Stat. § 216B.162 which directs the Commission to allow competitive electric rates for large customers when effective competition exists, subject to a number of terms and conditions. Effective competition is a market situation in which a customer within the utility's service area has the ability to obtain its energy requirements from an energy supplier that is not regulated by the Commission. The measure originally included a sunset provision. In 1995, the Legislature made this a permanent part of the statutes. The Commission has authorized competitive rate schedules for all regulated electric utilities; approximately nine customers have been or are being served under these rates.

Minnesota Power (MP) Interruptible Rates: The Commission approved a plan by MP to convert 200 MW of firm capacity for Large Power customers to interruptible service, which includes a discount on their demand charge, an obligation to carry a demand commitment for at least the amount of their interruptible load from MP for 15 years, and the right for MP to match any offer for electric service made by any other provider.

MP Incremental Production Rates: The Commission established an *Incremental Production Service Rider* which provides Large Power customers with flexibility to operate their facilities on a short-term basis above and beyond their historical levels without incurring additional demand charges. The Commission also authorized an *Incremental Sales Pilot Rider* for General Service and Large Light & Power customers. The Rider, which is available during March and April, is intended to allow eligible customers to take advantage of short-term incremental production opportunities during the period in which Minnesota Power is experiencing surplus capacity. The Rider is restricted to customers who use electricity in the industrial process, are served from existing facilities, and are able to increase production as a result of the discount.

NSP Competitive Market Rider: The Commission established a Competitive Market Rider for NSP which allows for a discount rate for customers making a substantial new capital investment in production equipment. NSP used the Rider to provide an incentive to North Star Steel to expand its facilities in St. Paul, Minnesota, rather than elsewhere.

Otter Tail Power Company (OTP) Time of Use Rider: The Commission recently approved a new Large General Service Time of Use Rider for OTP which allows the utility and qualifying customers to agree by contract to a firm, on-peak demand level that will be used as the basis to determine the billing demand over the entire term of the contract. The Rider provides increased operating flexibility for the customer as well as stability and predictability for both the utility and the customer.

OTP Real-Time Pricing Rider: In 1996, the Commission approved a real-time pricing experiment for OTP. The goal behind real-time pricing is to closely match the price charged for electricity to the cost of that electricity at the time it is provided, rather than develop an average price as is the case with most tariffed rates. Closely matching cost and price promotes economic efficiencies by allowing customers to choose when to increase, maintain, or decrease production based on their own unique value of electricity.

4. Other Special Rates

The Legislature has directed other specific electric rates to be implemented to carry out various policy goals.

Area Development Rates: In 1990, the Legislature enacted Minn. Stat. § 216B.161 which directs the Commission to allow area development rates to assist industrial revitalization projects. The measure originally included a sunset provision; the Commission submitted a report to the Legislature in 1995 evaluating the effectiveness of the rate. In 1995, the Legislature made this a permanent part of the statutes. The Commission established a permanent area development rate for NSP. The rate is available in a limited number of development zones, allows for a 50 percent discount to a customer's demand charge for a limited period of time, must be offered as a supplement to other development incentives offered by a government authority or municipality, and must recover at least the incremental cost of providing service to the participating customers.

NSP Low-Income Discount Rate: Minn. Stat. § 216B.16, subd. 14 (which was part of the 1994 Prairie Island legislation) requires public utilities with more than 200,000 residential customers to offer a low-income discount rate. The rate must give a 50-percent discount on the first 300 kWh consumed in a billing period for residential customers who receive assistance from the federal Low-Income Home Energy Assistance Program. The Commission has approved such a discount for NSP, the only utility which has more than 200,000 electric customers in Minnesota.

5. Commission Investigation into Electric Industry Structure

In May 1995, the Commission opened an investigation into structural and regulatory issues in the electric utility industry. The Commission noted that restructuring of the electric industry in Minnesota cannot be achieved through Commission action alone; major reforms will need to be addressed by the Legislature. However, the Commission is uniquely positioned to guide the restructuring debate in an even-handed manner, balancing the needs of utilities, shareholders, and various consumers. The Commission's intent is to bring together stakeholders, provide a public forum and, if possible, reach agreements among interested parties as a prelude to legislative action.

The Commission has issued principles and action steps to help guide the discussion of restructuring. The Commission also directed the formation of an Electric Competition Work Group to bring together key stakeholders. Several subgroups have also been formed to examine specific issues. Future activities and directions for this investigation are discussed below.

IV. FUTURE POLICY DIRECTIONS AND RECOMMENDATIONS

Over the next several years, the Commission will continue with administrative actions to carry out its mandates on energy policy, including establishing final environmental cost values, revising its resource planning rules, perfecting the NSP bidding process, and exploring appropriate actions and policies with respect to competition in the natural gas and electric industries.

As part of its investigation into electric industry restructuring, the Commission has formed a working group and a number of subgroups to look into issues such as wholesale competition, rate flexibility, service reliability and quality, unbundling, and public information. Representatives of more than 25 organizations and groups are participating in the process. The Commission expects that its electric industry investigation activities will provide valuable information to the Legislature for its consideration and may result in proposals for legislative action in the 1997 session and in subsequent sessions.

Developing ways of maintaining consumer protection and other benefits that exist under present industry and regulatory structures while providing the benefits of a more competitive market where appropriate will be challenging. It calls for a broad look at such issues as universal service; resource mix, use of renewables, energy efficiency, and environmental protection; and affordable energy and customer protection. The Commission looks forward to working with the Legislature and other stakeholders to implement a deliberate, thoughtful approach to appropriate restructuring of the electric utility industry.

ATTACHMENTS

MINNESOTA AAA

GOVERNOR CARLSON DISCUSSES THE STRENGTH OF THE STATE'S FINANCIAL AND AS BUSINESS CLIMATE

IN MAY, MINNESOTA quietly passed an important fiscal milestone when Moody's Investor Service elevated the state's general obligation bond rating to AAA, the highest rating possible. It was the first time in 22 years that any state had been upgraded to an AAA rating.

Our new AAA status will allow the state to borrow at lower interest rates, resulting in significant savings to taxpayers. Just as significant, however, is what our new rating says about the management of the state's finances and the current strength of Minnesota's economy.

Last September, *Financial World* magazine ranked Minnesota the fourth-best-managed state in the nation—and with good reason. Earlier this year we forecast an $873 million budget surplus for this year, which stands in contrast to the $1.8 billion deficit the state faced in 1991. Careful planning and financial discipline have led to continuous state budget surpluses and the accumulation of reserve accounts totaling $620 million, an amount equal to 6.5 percent of our state's annual expenditures. We have reserved another $700 million in a K-12 education fund, for a total reserve of $1.3 billion.

As we demonstrated to Moody's, we learned a valuable lesson from the financial problems of the 1980s. The primary goal of our Administration is to manage our finances closely and spend every tax dollar wisely to help produce an environment conducive to job growth.

A wealth of new jobs

OUR NEW BOND RATING is the result not only of efficiencies in government, but of the renewed strength of our overall economy. As a business leader, you are undoubtedly aware that the Minnesota economy is stronger than the U.S. economy. Let me point out just how strong.

Minnesota's unemployment rate dropped to 3.1 percent early this year, by far the lowest rate since the state began to keep detailed records in 1969, and almost certainly the lowest rate since World War II. In the Twin Cities area, the unemployment rate dipped to 2.6 percent during the four months in 1995.

Since January 1991, some 288,000 new jobs have been created in Minnesota. That compares with 8.7 million throughout the United States. Look at those numbers: Minnesota has 2 percent of the nation's population, but 3.3 percent of the new jobs. That means that Minnesota's businesses are creating jobs at a rate 60 percent faster than the rest of the nation.

But are we creating good jobs? Yes. While the United States has experienced a 2 percent decline in manufacturing jobs since 1991, Minnesota has enjoyed an increase of 7.7 percent—and we gained manufacturing jobs 20 percent faster in greater Minnesota than in the Twin Cities metropolitan area. A new report from the Department of Finance shows that personal income in Minnesota will have grown by 5.5 percent from 1991 to 1997, compared to a 2.8 percent inflation rate—indicating that new jobs are paying above-average wages.

We always want to do better, and not all communities have shared equally in our expanded economic vitality. All of Minnesota has benefitted from it, however.

For the first time in recollection, no region within our state is distressed, and no industry can be called troubled. In fact, it would be difficult to identify a single Minnesota community that is worse off than it was in 1991.

Access to capital, labor and markets

WHAT ACCOUNTS FOR our current strength? In part, people like you. Minnesota has no shortage of business managers and entrepreneurs who create new products, provide excellent service, respect their employees, reward their shareholders, pay their taxes and enhance their communities.

Our diverse mix of industries helps protect us from wide swings in employment. Our farm operations, food companies and manufacturers of both consumer and industrial products combine to engender stable economic growth. So does the presence of headquarter operations.

One of Minnesota's strengths that's not often discussed is the access of businesses here to expansion capital. Minnesota companies, through Minnesota financial institutions, have access to credit and equity capital as great as anyone else in the world.

We are home to 528 banks and 22 savings and loans, all of which are eager to make loans to businesses and agriculture. At the end of last year, the loan-to-deposits ratio of Minnesota banks was 94 percent, which was high relative to other states and high by historic standards. In every Minnesota community, businesses that want to expand can get a hearing not just from an institution with the ability to make business loans, but from competing institutions eager to do so.

Access to equity capital is also strong here. For at least 10 years, Minnesota has ranked among the top 10 states in both venture-capital pools and venture-capital disbursements. Our investment banks, including Piper Jaffray and Dain Bosworth, have been aggressive underwriters of stock offerings. Of the 306 Minnesota companies that were publicly traded as of the end of last year, 106 had been taken public in the previous four years.

Access to markets is another strength: Minnesota offers businesses a favorable location in the geographic center of North America, excellent north-south and east-west highway systems, good telecommunications and railway systems, and the ability to ship goods via the Great Lakes and the Mississippi River.

The Minneapolis-St. Paul International Airport provides increasing access to international markets. In May 1995, Northwest Airlines offered 69 incoming non-stop international flights per week. A year later, it offers 152.

As you have recognized, Minnesotans exemplify the Midwestern work ethic, adhering to values of honest effort and honest dealing with customers, employers, and peers. Minnesota's workers rank low in absenteeism; they show up for work on time, arrive with strong skills and work habits, and put in a full day's effort.

They—and therefore you—benefit from access to high-quality education. In the 1970s, the Legislature set a goal of making available at least two years of public post-secondary education within 35 miles of 90 percent of the state's population. That goal was achieved in time for a wave of baby boomers seeking advanced education and training. It was expensive, but it helped create a workforce that is literate, thinking, and ready to learn.

We have in Minnesota seven campuses of the University of Minnesota, eight state universities, 20 private liberal arts colleges, 16 community colleges, 30 technical colleges and five consolidated technical-community colleges.

Our technical and consolidated colleges provided 42,000 students a year training in 200 skilled occupations, many of them with a distinct focus on the technological needs of the future. Our technical colleges are willing to provide custom coursework specific to the needs of businesses in their communities and often will hold classes on the premises of those businesses.

Energy is less expensive in Minnesota than in other states. Northern States Power, for example, receives an average of 4.6 cents per kilowatt hour from industrial users—10 percent less than the U.S. average. Electric rates in the Twin Cities are far below those in the largest metropolitan areas of the United States.

It's also worth pointing out that Minnesota is home to thousands of business that support other businesses: advertising agencies, public-relations firms, marketing companies and law firms and accounting companies with practices aimed at helping growing businesses grow faster.

Public-private partnerships are important here, and state support for business activity is unwavering. Our Department of Trade and Economic Development is prepared to offer businesses assistance in selecting expansion sites, advice in dealing with licensing requirements, help in getting products into foreign markets and access to selective incentive programs.

Six years of progress

FRANKLY, I'M PROUD of the progress Minnesota has made during the 1990s to make this state a better place to do business.

We have eliminated our number-one competitive disadvantage by reforming workers compensation. Not more than a year ago, our workers compensation costs were nearly the highest in the nation. Since then, they have been brought down by 24 percent, and premiums continue to fall. It no longer makes sense for companies to leave this state to avoid paying those premiums.

We have helped manufacturers by passing a phase-down of the sales tax on replacement capital equipment—a tax that punishes investment in improved productivity and holds back capital-intensive manufacturing companies.

We have helped reduce the cost of government with welfare reform measures that have eliminated benefits for employable adults without children and placed an emphasis on work and helping families stay together. Healthcare reform, known as MinnesotaCare, has enabled 4,100 families to stay off AFDC, saving the state and federal governments an estimated $2 million each month.

We have held down the price of government. Not only have we turned a huge state deficit into a significant surplus, but specific tax-cutting legislation enacted since 1991 has resulted in a $356 million decrease in the amount of state taxes collected.

We plan to do more. But I am confident that the reforms instituted during the past six years have fostered a business climate that will help all of Minnesota prosper.

I hope as your business prospers, you will seek ways to expand in Minnesota. If there are ways in which my administration can be of help, please do not hesitate to call.

Warmest regards,

Arne H. Carlson

Governor Arne H. Carlson

MOST CURRENT MINNESOTA ENERGY PRICE FORECASTS

Forecasts of Minnesota energy prices are crucial for statewide energy policy planning. The most current energy price forecasts are presented here (a description of the forecast methodology presented in Appendix 2). Table 1 shows the nominal energy price forecasts, and Table 2 shows the energy price forecasts in real or constant 1994 dollars. Nominal prices include the expected impact of future inflation. Real or constant prices exclude the impact of forecasted inflation. Also shown in Table 2 is the GNP deflator used to convert the nominal energy prices into constant 1994 dollars.

The nominal energy price forecasts are obtained by taking the most recent Minnesota nominal energy price data[1] and multiplying them by the average annual energy inflation forecasts[2] of Data Resource Incorporated (DRI). The results are then divided by DRI's forecasts of the GNP deflator[3] for that year to derive the forecast of the real energy price. DRI's forecasts are used because of DRI's reputation as one of the country's leading economic forecasting firms. Moreover, econometric estimations used by DRI account for the simultaneous feedback effects between macroeconomic factors and policies at the regional, national, and international level.

The forecasts of energy prices presented here do not account for seasonal fluctuations and interstate and intrastate variations in prices. But these omissions do not seriously limit their usefulness in policy simulations, since the substantial focus of our analysis is on long-run trends and the Minnesota energy market is small relative to the national market. Therefore, it is reasonable to use forecasts of annual average changes in national prices to estimate Minnesota energy prices.

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[1] The most current energy prices available for the State of Minnesota are 1994 prices.
[2] Forecasts of energy price inflation are obtained from Table 17 of the *DRI review of the U. S. Economy: Long Range Focus (Spring 1995).*
[3] The forecast of the GNP deflator is obtained from Table 15 of the *DRI Review of the U. S. Economy: Long Range Focus (Spring 1995).*

TABLE 1

lominal Prices

				COMMERCIAL			INDUSTRIAL			RESIDENTIAL		
	Coal	Resid Fuel Oil	Gasoline	Natural Gas	Dist Fuel Oil	Electric	Natural Gas	Dist Fuel Oil	Electric	Dist Fuel Oil	Electric Retail	Natural Gas
	$/Ton	$/Gal	$/Gal	$/Mcf	$/Gal	c/kwh	$/Mcf	$/Gal	c/kwh	$/Gal	c/kwh	$/Mcf
994	30.84	0.30	1.16	4.38	0.58	6.31	2.94	0.67	4.36	0.81	7.36	5.21
995	30.65	0.35	1.21	4.15	0.55	6.42	2.79	0.64	4.43	0.80	7.46	5.01
996	30.84	0.33	1.25	4.46	0.59	6.40	2.99	0.68	4.43	0.82	7.49	5.12
997	31.05	0.32	1.26	4.59	0.61	6.44	3.08	0.70	4.45	0.82	7.56	5.27
998	31.46	0.34	1.30	4.78	0.63	6.48	3.21	0.73	4.47	0.85	7.62	5.41
999	31.74	0.35	1.31	4.93	0.65	6.53	3.31	0.75	4.51	0.89	7.74	5.60
000	32.03	0.36	1.36	5.15	0.68	6.64	3.45	0.79	4.59	0.92	7.86	5.79
001	32.41	0.39	1.42	5.46	0.72	6.76	3.66	0.83	4.67	0.96	7.99	6.03
002	32.93	0.42	1.49	5.87	0.78	6.89	3.94	0.90	4.76	1.01	8.13	6.33
003	33.69	0.45	1.56	6.40	0.85	7.04	4.29	0.98	4.86	1.08	8.29	6.66
004	34.60	0.49	1.63	6.96	0.92	7.21	4.67	1.06	4.98	1.16	8.49	7.00
005	35.50	0.53	1.71	7.48	0.99	7.39	5.02	1.14	5.10	1.24	8.71	7.36
006	36.31	0.56	1.83	8.05	1.07	7.59	5.40	1.23	5.25	1.33	8.95	7.75
007	37.18	0.59	1.95	8.61	1.14	7.82	5.78	1.32	5.40	1.42	9.22	8.15
008	38.19	0.63	2.03	9.23	1.22	8.06	6.19	1.41	5.57	1.50	9.51	8.56
009	39.30	0.67	2.11	9.84	1.30	8.32	6.60	1.50	5.75	1.50	9.80	8.96
010	40.44	0.70	2.19	10.46	1.38	8.60	7.02	1.60	5.94	1.66	10.13	9.35
011	41.57	0.74	2.33	11.05	1.46	8.91	7.42	1.69	6.15	1.73	10.50	9.73
012	42.77	0.78	2.40	11.68	1.55	9.23	7.84	1.79	6.38	1.80	10.89	10.12
013	43.97	0.82	2.49	12.33	1.63	9.60	8.27	1.89	6.63	1.87	11.33	10.50
014	45.20	0.86	2.59	12.98	1.72	9.97	8.71	1.99	6.89	1.94	11.77	10.89
015	46.51	0.90	2.68	13.63	1.80	10.33	9.15	2.08	7.14	2.01	12.20	11.27
016	47.86	0.94	2.83	14.27	1.80	10.70	9.58	2.18	7.39	2.08	12.66	11.66
017	49.15	0.99	2.92	14.94	1.98	11.06	10.03	2.29	7.64	2.17	13.11	12.04
018	50.43	1.03	3.02	15.64	2.07	11.45	10.50	2.39	7.91	2.26	13.58	12.41
019	51.69	1.08	3.13	16.36	2.17	11.84	10.98	2.50	8.18	2.37	14.06	12.77
020	52.99	1.13	3.24	17.08	2.26	12.23	11.46	2.61	8.45	2.47	14.54	13.14

TABLE 2

Real Prices (1993 dollars)

				COMMERCIAL			INDUSTRIAL			RESIDENTIAL			
	Coal	Resid Fuel Oil	Gasoline	Natural Gas	Dist Fuel Oil	Electric	Natural Gas	Dist Fuel Oil	Electric	Dist Fuel Oil	Electric Retail	Natural Gas	Implicit GDP Deflator
	$/Ton	$/Gal	$/Gal	$/Mcf	$/Gal	c/kwh	$/Mcf	$/Gal	c/kwh	$/Gal	c/kwh	$/Mcf	$94
1994	30.84	0.30	1.16	4.38	0.58	6.31	2.94	0.67	4.36	0.81	7.36	5.21	1.000
1995	30.08	0.34	1.19	4.07	0.54	6.30	2.74	0.62	4.35	0.9	7.32	4.91	1.019
1996	29.55	0.31	1.20	4.27	0.57	6.14	2.87	0.65	4.24	0.78	7.18	4.91	1.043
1997	29.06	0.30	1.18	4.30	0.57	6.03	2.89	0.66	4.17	0.77	7.08	4.93	1.068
1998	28.78	0.31	1.19	4.37	0.58	5.92	2.93	0.67	4.09	0.78	6.97	4.95	1.093
1999	28.19	0.31	1.17	4.38	0.58	5.80	2.94	0.67	4.01	0.79	6.87	4.97	1.126
2000	27.27	0.31	1.16	4.38	0.58	5.66	3.00	0.68	3.91	0.78	6.69	4.93	1.174
2001	26.57	0.32	1.17	4.47	0.59	5.54	3.00	0.68	3.83	0.79	6.55	4.94	1.220
2002	26.31	0.33	1.19	4.69	0.62	5.50	3.15	0.72	3.80	0.81	6.49	5.05	1.252
2003	26.13	0.35	1.21	4.96	0.66	5.46	3.33	0.76	3.77	0.84	6.43	5.17	1.289
2004	25.75	0.37	1.21	5.18	0.69	5.36	3.47	0.79	3.71	0.86	6.32	5.21	1.344
2005	25.19	0.37	1.21	5.31	0.70	5.24	3.56	0.81	3.62	0.88	6.18	5.22	1.409
2006	24.49	0.38	1.23	5.43	0.72	5.12	3.64	0.83	3.54	0.90	6.04	5.23	1.483
2007	24.00	0.38	1.26	5.56	0.74	5.05	3.73	0.85	3.49	0.92	5.95	5.26	1.549
2008	23.81	0.39	1.26	5.75	0.76	5.03	3.86	0.88	3.47	0.94	5.93	5.34	1.604
2009	23.68	0.40	1.27	5.93	0.78	5.01	3.98	0.91	3.46	0.96	5.91	5.40	1.660
2010	23.36	0.41	1.27	6.04	0.80	4.97	4.05	0.92	3.43	0.96	5.85	5.40	1.731
2011	22.89	0.41	1.28	6.09	0.81	4.90	4.09	0.93	3.39	0.96	5.78	5.36	1.816
2012	22.43	0.41	1.26	6.13	0.81	4.84	4.11	0.94	3.35	0.95	5.71	5.31	1.907
2013	22.13	0.41	1.25	6.20	0.82	4.83	4.16	0.95	3.34	0.94	5.70	5.29	1.987
2014	22.15	0.42	1.27	6.36	0.84	4.89	4.27	0.97	3.38	0.95	5.77	5.34	2.040
2015	21.98	0.43	1.27	6.44	0.85	4.88	4.32	0.99	3.37	0.95	5.77	5.33	2.116
2016	21.50	0.42	1.27	6.41	0.85	4.81	4.30	0.98	3.32	0.94	5.69	5.24	2.226
2017	20.93	0.42	1.24	6.36	0.84	4.71	4.27	0.97	3.26	0.92	5.58	5.13	2.348
2018	20.51	0.42	1.23	6.36	0.84	4.66	4.27	0.97	3.22	0.92	5.52	5.05	2.459
2019	20.47	0.43	1.24	6.48	0.86	4.69	4.35	0.99	3.24	0.94	5.57	5.06	2.525
2020	20.31	0.43	1.24	6.55	0.87	4.69	4.40	1.00	3.24	0.95	5.57	5.04	2.608

MINNESOTA'S ENERGY MODEL: WHAT IT IS AND HOW IT WORKS

DESCRIPTION OF THE MODEL

The Department used the ENERGY 2020[1] model of Minnesota's energy use and the REMI[2] model of Minnesota's economy for most of the forecasts and analyses presented in this Quadrennial Report. These two models interact dynamically to produce a unified picture of the impacts of statewide energy use on the state economy, as well as the impact of changes in the State economy on statewide energy use. Both models can be calibrated to any service territory or region. The versions used for this report have been calibrated to the State of Minnesota.

REMI is commonly used for state and regional forecasting. Other Minnesota state agencies using REMI include the Department of Revenue, the Department of Trade and Economic Development, and Pollution Control Agency. The REMI model[3] uses a traditional Keynesian Income/Expenditure model to forecast national Gross National Product (GNP), economic activity by Standard Industrial Classification (SIC), and the various National Income accounts (Personal Consumption Expenditures, Investment, etc.). The model forecasts Minnesota's share of economic activity. Relevant factors include Minnesota's historic share of these accounts, Minnesota's percentage of the total national population, and differences between Minnesota and national prices. REMI also accounts for the effects of various special projects or circumstances on Minnesota's share of the national output for that industry.

The REMI model belongs to a class of models called "Computable General Equilibrium (CGE)" models.[4] The underlying assumption of such models is that firms choose production (output) levels and set the mix of factor inputs to maximize profit, based on prevailing market conditions. Unlike a traditional input/output (I/O) model which assumes that inputs are fixed as a percentage of output, REMI assumes that all inputs are substitutes for each other. Similarly, peoples choose their levels of savings and consumption to maximize their happiness. REMI also predicts (and adjusts for) changes in regional demographics due to births, deaths, and population migration.

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[1] Energy 2000 is produced by the Policy Assessment Corporation in Boulder, Co., in association with Systematic Solutions, Inc., in Yellow Springs, OH.
[2] REMI is produced by Regional Economic Models, Inc., in Amherst MA.
[3] From this point on we will use the phrases "REMI" or "the REMI model" to indicate the specific version of the REMI model that has been calibrated to the State of Minnesota.
[4] For documentation on the REMI model, see *Regional Economic Modeling*, by George Treyz, Kluwer Academic Publishing, 1993.

ENERGY 2020 uses a systems dynamics approach to model energy use by type of fuel and end-use; it also models the economic effects and change in pollution resulting from energy use. In other words, Energy 2020 considers all the factors directly affecting demand for energy, including:

- physical factors such as electric motors and natural gas space heating in homes;
- behavioral factors such as gasoline prices (which affect how much people drive and the gas mileage of the cars they choose to buy); and
- factors directly affecting production, such as the types of power plants installed historically and how these plants might be built in the future, given anticipated costs and customer demand.

The starting point for ENERGY 2020 is an estimate of the amount of energy use associated with industrial production (the "energy intensity" of production) or with income. For example, paper mills use a given average amount of energy per unit of output. ENERGY 2020 would take the REMI estimate of activity in the paper milling industry and multiply it by the average energy use per dollar of output in that industry. Energy 2020 modifies its estimates of energy intensity based on prices of the various fuels, adjustments in the capital stock, and various other behavioral variables. ENERGY 2020 passes the appropriate data to REMI to permit REMI to modify the economic forecast as necessary. The price forecasts in the model are provided exogenously, using inflation rates developed by DRI (see Appendix 1).

PERFORMING SIMULATIONS AND ANALYSIS

To use ENERGY 2020 to model the effect of a given change in policy or behavior, the appropriate variable is changed. For instance, to forecast the effects of a carbon tax, the price of a fuel would be increased by the tax per ton of carbon times the amount of carbon released when the fuel is used. To examine the effect of a fuel-efficiency standard, the section of the model that estimates what types of cars people would choose is "turned off," and exogenous estimates of new car efficiencies are substituted. A new forecast would then be generated that takes into account the relevant changes in the capital stock, consumer behavior, etc. Because the model has both energy and economic sectors, it can estimate the effect of an energy policy on the Minnesota economy. The effect of a specific economic policy on the State's energy use could also be estimated using ENERGY 2020.

ENERGY 2020 is used by state energy offices in Minnesota, Maine, Connecticut, Rhode Island, Massachusetts and Vermont. It is used by many utilities in the U.S., including Minnesota Power. Other users include Natural Resources Canada, the Saskatchewan Department of Energy and Mines, the European Union countries, Latvia, Estonia, Lithuania and Poland. An earlier version of the model has been used as the basis for all U.S. national energy plans/policies since 1978.

STUDY OF MINNESOTA TAXES PAID BY ELECTRIC UTILITIES AND THE IMPLICATIONS OF UTILITY TAX ASSESSMENTS

I. MINNESOTA TAXES PAID BY UTILITIES

Minnesota utilities pay the following state and municipal taxes:

- income taxes,
- payroll taxes,
- property taxes,
- sales taxes, and
- franchise fees/gross receipts taxes.

Each tax is assessed on a unique basis. For example, income taxes reflect the tax effects of revenue and expense transactions included in the determination of pretax accounting income. (Cooperative utilities such as Anoka Electric and Dakota Electric pay no state income taxes because they are non-profit entities.) State payroll taxes consist of unemployment, workers compensation, and employee withholdings. Utilities pay property taxes on both real and personal property. Most utility property is taxable. However, certain property such as municipal utility property is exempt from property taxes.

Although municipal utility property is exempt from property taxes, two categories of municipal payments should be noted. First, Municipal Power Agencies[1] (MPAs) pay property taxes. When an MPA purchases a portion of a non-municipal generating station (i.e., a station that is owned by a cooperative or investor-owned utility) and sells the power back to its member cities, the MPA pays property taxes on its portion of the generating station. Second, municipal distribution utilities make payments in lieu of taxes in certain Minnesota taxing districts. The Minnesota Municipal Utilities Association plans to complete an analysis of utility taxation, including municipal utility payments in lieu of taxes, by January 15, 1997.

Minnesota utilities collect sales and franchise fees/gross receipts (or gross earnings) taxes from their customers and remit these taxes to the State (sales tax) and respective municipality (franchise fee/gross receipts tax). In Minnesota utilities pay a sales tax of 7 percent on energy sales revenue. Utilities also pay franchise fees or gross receipts taxes to municipalities. These funds can be used to compensate municipalities

[1] A Municipal Power Agency is a consortium of various municipally owned utilities which are members of the MPA and purchase electricity from the Agency for resale to their customers.

for the use of public property for private gain. Although franchise fees are generally based on a percentage of gross revenues, several municipalities assess a flat fee.

Table 1 provides examples of the 1995 taxes paid by the four investor-owned electric utilities and four large cooperative electric utilities in Minnesota.[2]

TABLE 1
TOTAL ELECTRIC UTILITY TAX PAID IN MINNESOTA IN 1995

	PROPERTY TAX REAL AND PERSONAL	SALES TAX (COLLECTED IN MINNESOTA)	INCOME TAX (MINNESOTA ONLY)	PAYROLL TAX (MINNESOTA UNEMPLOYMENT)	FRANCHISE FEE (OR GROSS RECEIPTS)	TOTAL
NSP	152,078,365	65,076,000	31,709,000	15,172,000	25,505,000	289,540,365
MN Power	34,706,493	5,963,664	3,843,817	149,982	700,000	45,363,956
Otter Tail	7,152,715	4,197,450	1,370,067	33,458	233,643	12,987,333
Interstate	3,670,381	1,935,124	573,770	12,230	569,969	6,761,474
Anoka Elec. Coop	3,179,055	4,658,862	0	22,380	534,379	8,394,676
Dakota Elec. Assn.	4,742,500	4,487,719	0	18,181	144,025	9,392,425
Cooperative Power*	7,095,000	0	0	482,317	0	7,577,317
United Power*	10,827,954	0	5,000	25,567	0	10,858,521
TOTAL	**223,452,463**	**86,318,819**	**37,501,654**	**15,916,115**	**27,687,016**	**390,876,067**

* Cooperative Power and United Power sell energy to wholesale customers and therefore pay no Minnesota sale tax on their energy sales.

II. WHERE DO UTILITY TAXES GO AND WHAT DO THEY FUND?

The revenues from utility-paid income taxes and payroll taxes are collected into the general fund for the state of Minnesota, the same as for all other businesses operating in the State. This is also true for the sales tax collected from utility customers. The general fund is then used to fund the various programs and departments of the state. In these instances, utility generated revenue is treated the same as revenue from other businesses and is not earmarked for any particular programs.

In contrast, property-tax revenues accrue to the local taxing district making the assessment. Therefore, the benefits from property-tax revenues are not distributed evenly across the state, but rather are concentrated in geographical areas where the utilities own property. Property-tax revenues go into the general fund of the district in which they are assessed, in this case to the county, school district or other local unit(s).

[2] For purposes of this analysis Northwestern Wisconsin is excluded, since this utility serves less than 100 customers in Minnesota.

Table 2 illustrates how utility property-tax revenues are apportioned among Minnesota counties.

TABLE 2
BREAKDOWN OF COUNTY PROPERTY-TAX REVENUES BY UTILITY
1995

COUNTY	UTILITY PERCENTAGE	TOTAL UTILITY PAID TAXES*	TOTAL TAXES (ALL TAXPAYERS)
Aitkin	2.15%	$244,890.00	$11,392,681.00
Anoka	1.73%	3,292,984.99	190,320,656.00
Becker	1.71%	345,162.00	20,155,581.00
Beltrami	4.27%	800,329.00	18,742,711.00
Benton	7.91%	1,707,374.00	21,581,203.00
Big Stone	4.98%	205,164.00	4,121,865.00
Blue Earth	6.62%	2,626,851.60	39,702,342.00
Brown	0.84%	129,657.00	15,369,718.00
Carlton	14.27%	3,141,388.88	22,006,353.00
Carver	2.89%	1,896,660.00	65,580,077.00
Cass	4.20%	1,015,872.00	24,211,095.00
Chippewa	9.28%	975,137.05	10,507,247.00
Chisago	8.98%	2,131,581.44	23,749,036.00
Clay	1.18%	303,684.32	25,822,249.00
Clearwater	2.18%	155,332.00	7,131,373.00
Cook	2.57%	146,345.00	5,685,304.00
Cottonwood	0.91%	94,440.00	10,411,869.00
Crow Wing	2.87%	1,233,382.23	42,958,577.00
Dakota	4.50%	14,526,624.82	322,788,335.00
Dodge	2.88%	270,312.00	9,381,937.00
Douglas	1.31%	299,150.60	22,760,649.00
Faribault	3.11%	396,728.74	12,756,002.00
Fillmore	1.59%	174,453.00	10,964,890.00
Freeborn	4.13%	828,040.00	20,069,890.00
Goodhue	48.13%	25,368,305.36	52,709,961.00
Grant	4.16%	220,153.35	5,291,935.00
Hennepin	2.52%	37,141,195,93.00	1,472,811,142.00
Houston	1.63%	145,136.00	8,907,807.00
Hubbard	4.71%	612,930.00	13,001,866.00
Isanti	2.12%	339,882.00	16,028,614.00
Itasca	32.80%	12,920,736.01	39,396,319.00
Jackson	3.68%	424,515.00	11,539,968.00
Kanabec	0.57%	36,590.00	6,473,864.0
Kandiyohi	1.62%	458,427.00	28,277,640.00
Kittson	3.26%	236,768.00	7,261,543.00
Koochiching	11.83%	1,220,377.00	10,315,197.00
Lac Qui Parle	2.84%	165,006.30	5,814,723.00
Lake	7.32%	551,558.90	7,538,723.00
Lake of the Woods	14.62%	426,504.00	2,917,833.00
LeSueur	4.31%	649,864.00	15,089,127.00
Lincoln	3.35%	161,606.00	4,822,497.00
Lyon	1.66%	290,561.52	17,454,927.00
Mahnomen	3.45%	142,906.00	4,142,277.00
Marshall	1.35%	116,091.00	8,580,808.00
Martin	4.52%	792,368.00	17,542,692.00
McLeod	1.10%	224,310.00	20,349,253.00

Meeker	2.43%	306,157.48	12,618,305.00
Mille Lacs	2.25%	287,193.31	12,745,199.00
Morrison	8.92%	1,457,234.00	16,336,014.00
Mower	2.52%	574,409.45	22,816,802.00
Murray	2.32%	180,354.63	7,773,892.00
Nicolett	1.71%	317,555.00	18,534,852.00
Nobles	0.96%	131,625.00	13,701,106.00
Norman	0.85%	58,578.00	6,930,349.00
Olmsted	0.28%	266,163.00	95,766,316.00
Ottertail	9.41%	3,155,344.00	33,521,769.00
Pennington	0.10%	7,044.00	7,368,672.00
Pine	9.35%	1,339,807.36	14,326,038.00
Pipestone	4.07%	268,681.00	6,597,897.00
Polk	2.99%	702,274.00	23,463,355.00
Pope	5.69%	439,458.89	7,716,656.00
Ramsey	4.03%	20,291,829.29	504,037,106.00
Red Lake	5.51%	142,820.00	2,592,284.00
Redwood	1.59%	210,984.00	13,243,539.00
Renville	3.02%	411,583.59	13,631,978.00
Rice	4.42%	1,363,244.10	30,875,827.00
Rock	1.85%	121,638.00	6,583,439.00
Roseau	9.99%	886,385.78	8,875,034.00
Scott	3.52%	2,427,572.94	69,048,961.00
Sherburne	36.83%	17,852,669.12	48,478,239.00
Sibley	2.24%	227,150.73	10,132,771.00
St. Louis	13.21%	16,456,173.00	124,549,385.00
Stearns	3.89%	3,166,148.40	81,460,032.00
Steele	0.53%	106,979.00	20,258,714.00
Stevens	4.90%	314,637.56	6,419,587.00
Swift	4.96%	373,345.00	7,521,587.00
Todd	5.75%	633,722.00	11,027,148.00
Traverse	3.17%	149,832.04	4,724,354.00
Wabasha	3.49%	449,770.00	12,873,966.00
Wadena	8.23%	598,505.94	7,270,717.00
Waseca	1.58%	195,191.00	12,335,460.00
Washington	7.43%	11,905,053.08	160,152,776.00
Watonwan	3.16%	254,975.00	8,067,970.00
Wilkin	1.23%	75,152.94	6,112,752.00
Winona	4.89%	1,224,529.00	25,034,649.00
Wright	27.40%	16,599,382.71	60,581,137.00
Yellow Medicine	1.11%	101,034.00	9,125,564.00
TOTAL	**5.25%**	**$225,619,523.40**	**$4,299,672,554.00**

* As reported by the utilities.

Franchise fees are assessed by municipalities, and in most cases the revenues go into the general operating fund of that municipality. Some municipalities have indicated that franchise fees are used to offset specific expenses, such as street improvements or rights-of-way, but such specific uses are difficult to track. Table 3 gives an overview of the municipalities collecting franchise fees and gross receipts taxes and the revenues generated in 1994.

TABLE 3
TOTAL REVENUES COLLECTED FROM
ELECTRIC UTILITY FRANCHISE FEES AND GROSS RECEIPTS TAX

MUNICIPALITY*	PERCENT OF GROSS REVENUE**	TOTAL FEE COLLECTED 1994
Albert Lea	5%	$957,355.00
Apple Valley	2%	NA
Baker	flat fee	$3.05
Coon Rapids	4%	$842,143.00
Crookston	3%	NA
Duluth	1.38%	$700,000.00
Minneapolis	3.0 - 5.75%	$11,252,099.00
Moorhead	5%	$245,195.00
Mora	3%	$108,000.00
Mounds View	3%	$224,134.00
Newport	NA	$400.00
Rochester	$0.0056/kW	$109,775.00
Sauk Centre	1%	$40,000.00
South St. Paul	3%	$416,807.00
St. Charles	5%	$60,261.00
St. Cloud	3%	$871,458.00
St. Paul	3.4 - 8.0%	$10,047,265.00
West St. Paul	5.26%	NA
White Bear Lake	1.50%	$136,640.00
Winona	4%	$573,426.00

* Data from survey respondents, not available for all municipalities.
** Franchise fees are assessed as a percentage of the utility gross revenue.

III. HOW ARE UTILITIES TAXED DIFFERENTLY FROM OTHER BUSINESSES?

The public utility industry provides a substantial portion of Minnesota's tax revenues. Some taxes are applied similarly to utilities and non-utilities, while other taxes are applied differently. For example, both utilities and non-utilities pay Minnesota income, sales, and payroll taxes. However, unlike non-utility businesses, utilities pay taxes on both real and personal property. Non-utility businesses pay taxes only on real property. Real property includes land and buildings. In general, personal

property consists of movable property. Most public utility machinery is personal property.

Table 4 compares the 1995 property taxes for the four investor-owned electric utilities and four large cooperative electric utilities in Minnesota with the property taxes they would have paid if they were non-utility businesses.

TABLE 4
1995 PROPERTY TAX COMPARISON

UTILITY	1995 TAX AS A UTILITY	1995 TAX IF OPERATED AS A NON-UTILITY BUSINESS	DIFFERENCE
NSP	$152,078,365	$19,770,187	$132,308,178
MN Power	$34,706,715	$10,759,082	$23,947,633
Otter Tail Power	$7,152,715	$829,225	$6,323,490
Interstate	$3,670,381	$954,299	$2,716,082
Anoka Elec. Coop	$3,179,055	$161,451	$3,017,604
Dakota Elec. Assn.	$4,742,500	$515,096	$4,227,404
Cooperative Power	$7,095,000	$780,000	$6,314,550
United Power	$9,371,903	$5,547,185	$3,824,718
TOTAL	**$221,996,634**	**$39,316,525**	**$182,679,659**

Table 5 illustrates the impact that utility personal property taxes have on rates for the two largest electric utilities in Minnesota. These additional taxes account for about 0.26¢ to 0.44¢ of the cost of each kWh.

TABLE 5
RATE IMPACT OF UTILITY PERSONAL PROPERTY TAXES

UTILITY	TOTAL RETAIL SALES (KWH)	TOTAL RETAIL SALES ($)	PROPERTY TAX UNIQUE TO UTILITIES	RATE IMPACT	PERCENTAGE OF TOTAL AVERAGE CUSTOMER BILL
MN Power	8,382,001,627	$395,603,882	$23,947,633	0.256¢/kWh	6.05%
NSP	25,256,513,000	$1,411,987,561	$132,308,178	0.438¢/kWh	9.37%

Minnesota utilities also pay franchise fees, while non-utility businesses do not. Table 6 provides the 1995 franchise fees paid by the same group of eight utilities included in Tables 1 and 4.

TABLE 6
1995 FRANCHISE FEE/GROSS RECEIPTS TAX

UTILITY	FRANCHISE FEE/ GROSS RECEIPTS TAX
MN Power	$700,000
Otter Tail Power	$233,643
Interstate	$569,969
Northern States Power	$25,505,000
Anoka Electric Coop	$534,379
Dakota Electric Assn.	$144,025
Cooperative Power	$0
United Power	$0
TOTAL	**$27,687,016**

IV. WHAT ARE THE IMPLICATIONS OF MINNESOTA UTILITIES' STATE AND LOCAL TAXES?

Clearly, Minnesota utilities are treated differently from other businesses through the assessment of personal property taxes and franchise fees. These costs are then

passed on to consumers. The franchise fees are directly passed through as a separate line item on utility bills, similar to sales tax. Higher property taxes are also passed on to consumers indirectly through higher rates.

Many communities view utilities as a stable and necessary source of revenues.[3] As shown earlier, utility taxes comprise a large portion of the total revenues of certain counties in Minnesota, thus creating a reliance upon utility tax revenues for many local programs. But while the benefits are concentrated in specific geographic areas, the costs are passed on to all of the utility's ratepayers, regardless of their location. Thus, personal property taxes are, in fact, a hidden tax on all ratepayers.

Increasing competition and the movement toward restructuring the electric industry are focusing attention on Minnesota's electric utility taxes and the need for change. For example, a law passed by the 1996 legislature partially exempts certain cogeneration plants from state property taxes. This legislation raises concerns about the equity of the current utility property-tax structure and its effects on regulated utilities and their ability to compete. Personal property taxes are costs that non-utility businesses do not have to consider in setting their prices. Although franchise fees are not factored into rates, a business that is not required to pass this cost on to consumers will have a competitive advantage.

Another important consideration in evaluating the competitive position of Minnesota utilities is the tax policy of surrounding states. While some state property-tax systems are similar to Minnesota's, others differ significantly. For example, Minnesota, Indiana and North Dakota assess utility property taxes at a state level. In Illinois utility property taxes are assessed at a local level. States also differ in the types of property subject to taxes. Unlike Minnesota, in Illinois public utilities pay no taxes on personal property. However, electric and gas public utilities in Indiana, Iowa, Michigan, Missouri, Nebraska, and North Dakota pay taxes on both real and personal property. Property-tax valuations also differ. For example, in Minnesota, Iowa, Michigan, Missouri and Nebraska public utility property is valued using a combined cost and income approach. In contrast, in Illinois and Indiana public utility property is valued using a cost-based approach. The cost approach to property valuations includes the cost of ongoing additions. As a result, a combined cost and income approach generally results in lower property valuations than a cost-based approach, because plant additions grow at a faster rate than utility income.

In Wisconsin electric and gas public utilities pay a license fee on gross revenues in lieu of paying property taxes, excluding special assessments for local improvements. Wisconsin has assessed license fees on a central basis since 1985. Although it has not

[3] This perception is due, in large part, to the higher rate of property taxes levied on utilities.

yet conducted a comprehensive study, the Wisconsin Department of Revenue believes that license fees generate less revenues than property taxes.

Table 7 illustrates how Minnesota's property-tax system compares to other states' systems. Note that the real property tax under a cost-based approach results in a lower tax than a real and personal property tax under a combined cost and income approach, while a real and personal property tax under a cost-based approach results in a higher tax.

TABLE 7
COMPARISON OF STATE PROPERTY TAXES
FOR ELECTRIC AND GAS UTILITIES*

TAX REAL PROPERTY, COST APPROACH	TAX REAL & PERSONAL PROPERTY, COMBINED COST & INCOME APPROACH	TAX REAL & PERSONAL PROPERTY, COST APPROACH
IL	MN, IO, MI, MO, NE, ND	IN

* Note that Wisconsin is excluded from this property-tax comparison because the state imposes a license fee on electric and gas public utilities based on gross revenues in lieu of property taxes.

V. CONCLUSIONS AND RECOMMENDATIONS

In Minnesota utilities are assessed taxes that do not apply to non-utility businesses. These costs place utilities at a competitive disadvantage as they are passed on to ratepayers. Franchise fees are theoretically collected to offset the specific costs imposed by utilities, yet are usually treated no differently from other sources of revenue and put in the general fund. The personal property tax, a tax assessed only on utilities in the State of Minnesota, is essentially an additional, hidden tax on consumers. Increasing competition in the electric industry will exacerbate the problems of an "uneven playing field for utilities."

To address these concerns and place utilities on a more even playing field with non-utility businesses, the Department recommends the following:

- Identify clearly to consumers all taxes included in utility rates .

- Treat utilities and non-utility businesses similarly for tax purposes.
- Subject providers of equivalent services to the same franchise fees and terms. Track franchise fees to ensure that these taxes are used only for franchise-related purposes.
- Investigate whether the ability of Minnesota utilities to compete with out-of-state businesses is impeded due to varying tax policies among states.

DEPARTMENT'S APPROACH TO ESTIMATING SOURCES OF STATEWIDE ELECTRICITY CONSUMPTION

Gathering data on electric consumption in Minnesota is relatively straightforward. But determining the sources of the electricity used to serve Minnesota consumers poses unique challenges not encountered in other energy sectors. The thorniest complication is that state boundaries have little relevance for electrical generation and transmission. The most relevant entities in the electric network--utilities, control areas, power pools and interconnections--do not coincide with state boundaries. Many utilities operate in more than one state and purchase and sell energy to utilities in still other states. Electricity flows freely over a network encompassing many states. In fact, the entire Eastern United States constitutes one "interconnection."

As a result, the energy used to serve Minnesota consumers comes from resources located throughout the Upper Midwest, Canada and beyond. Any estimate of sources of electricity used to serve Minnesotans must account for this remote generation, and also recognize that much of the energy from generating units in Minnesota is used to serve consumers in other states.

These complications do not prevent us from gathering meaningful data on the sources of Minnesota's electrical energy; it just means that we need to be careful to explain what the data does and does not capture. There are at least three possible ways to present "state" data on electrical generation.

- Use 100 percent of the production of all generating units located within Minnesota's borders.
- Use an allocated portion of the production of all generating units located within Minnesota's borders.
- Use an allocated portion of the production of all generating units used to serve Minnesota consumers, regardless of whether the unit is located in Minnesota.

In this Report the Department adopts the third approach. In most cases our intent is to identify the sources of the electrical energy used to meet the needs of Minnesota consumers. We can then estimate how much of our electricity comes from various types of electrical generation--such as nuclear, coal, natural gas, wind, etc. Limiting ourselves to generation from Minnesota units would misrepresent the mix of resources used to serve Minnesotans.

To implement this approach the Department first attempts to identify and break down all generating units used to serve Minnesota's energy needs by owner/operator. We then allocate a portion of the output of each unit to Minnesota. The allocation factor is the percentage of the owner's load that is in Minnesota. To the extent possible we also isolate the sources of firm purchases used to serve Minnesotans, and apply the same percentages to these purchases.

For example, since Minnesota consumers use approximately 76 percent of the total energy produced by Northern States Power Company (NSP), the Department attributes 76 percent of the energy from NSP's plants and firm purchases to Minnesota consumers. This allocation applies to all of NSP's units, regardless of whether they are located in Minnesota, Wisconsin or elsewhere.

In contrast, only 13.1 percent of Interstate Power Company's (Interstate) generation is used to serve consumer needs in Minnesota. Consequently, the Department allocates 13.1 percent of the energy from Interstate's generating units to Minnesota. Again, this approach holds regardless of where the unit is located.

Finally, all of the output of small wind generators in the State is assigned to Minnesota, as is the output of any generator owned and operated by a Minnesota customer for the customer's own needs. But the production of a large wind project selling all of its energy to NSP, such as the 25-MW wind project in Lake Benton, is allocated as if it were one of NSP's generating units (as explained above).

One ramification of this approach is that only a small percentage of the output of some plants in Minnesota (such as Interstate's Fox Lake steam plant) are treated as "Minnesota" generation, while a large percentage of the output of some remote plants (such as the Coal Creek plant in North Dakota) are included. Again, these examples illustrate that the generating mix in the State of Minnesota is a poor indicator of the mix of units used to serve Minnesota consumers.

Unless otherwise noted, data on electric generation in this Report is derived from the approach explained above. In a couple instances we depart from this approach and estimate production from all generating units within the State, regardless of whether all of their output is used to serve Minnesota consumers. These estimates are particularly relevant for renewable resources, as one of our goals is to foster a renewable energy industry within the State. The cases where we use this approach are clearly identified in the text.

Another complication is that electrical energy, as opposed to other forms of energy, is commonly expressed in watt-hours. Whenever possible we express electrical generation in terms of watt-hours to avoid the need for converting electrical energy to

BTUs. This method is acceptable when we are dealing only with the electricity sector and not comparing consumption or generation across energy sectors. But any comparison of energy data across sectors requires a conversion of electrical usage or generation to BTUs. Due to huge energy losses in the generation and transmission of electricity, such comparisons depend critically on whether we are focusing on "end-use" energy or "primary" energy. (These two measures of energy use are explained and illustrated in Chapter 2.) Many of the figures in Chapters 2 and 7 compare data across industries. In these cases the Department uses reasonable conversion factors to express electrical watt-hours in terms of BTUs.

These conversion factors are difficult to pinpoint, because individual fuels have different Btu contents. Even the same fuel (e.g., coal) has considerable variability in Btu content, depending on its composition. In most cases the Department uses established Btu conversion factors. But the energy content from some sources (particularly wind, solar, and hydro) is difficult to define, because the energy from these resources is not derived by combusting a material that has an estimable Btu content. In such cases, the Department uses conversion factors that have a reasonable and simple theoretical basis and which best illustrate the relative contributions of these resources. Specifically, the alternative energy resources listed above are considered to contain 10,500 Btus per kWh of electricity produced, which is the average Btu content of coal used to produce 1 kWh. Thus, 1 kWh from wind, solar or hydro resources is treated in the same manner as 1 kWh from coal. The Department believes this conversion is reasonable: Alternative energy resources are substitutes for other, more traditional electric resources. The largest of these traditional resources is coal.

Minnesota Department of Public Service
Wind Resource Assessment Program (WRAP)

Subject	1983 through 1993	1994 to Present
Wind Sites	Controlled and selected by utilities; some sites not representative of surrounding area.	Controlled and selected by staff engineers, all sites are representative of surrounding area. None have significant nearby obstructions.
Number of Sites	DPS 21; Northern States Power 10.	DPS 21 (site selection process overhauled and 18 of the original sites relocated); Otter Tail Power 5. NSP has approximately 25 sites but no longer contributes data to WRAP.
Data Loggers	Second Wind using EPROM chips -- manual replacement every two months.	NRG with cellular phones and programmable capabilities of data collection and transmission -- weekly downloads.
Completeness of Data	Raw data collected 50 to 60 percent of time.	Raw data collected 95 to 97 percent of time.
Data Collected	Single elevation at most sites; wind direction on some sites.	Three elevations and wind direction at all sites; to ensure accuracy, most sites have 2 anemometers at each elevation.

Subject	1983 through 1993	1994 to Present
Mapping Capability	Manually drawn map of wind speeds.	Computer generated maps using GIS technologies that consider elevations and ground cover in addition to wind speeds. Maps show wind power potential for all areas of the state.
Federal Funding	None.	Staff actively sought funds to support program: $45,000 Wind/Solar study; $50,000 Wind Shear study; $50,000 Mapping Technology Improvement; $_____ proposed study of distributed wind generation.
Cooperative Projects	Data received from the 10 NSP sites (proprietary).	Otter Tail Power, 5 sites (proprietary until 1/1/97); NSP wind/solar, 4 sites public information; White Earth Indians, 2 sites public information (when installed).
Studies by DPS Staff	None.	Utility load profiles vs. measured wind and solar capacity; effect of elevation on wind power potential; mapping analysis of Minnesota's wind resource.

Subject	1983 through 1993	1994 to Present
Technical papers presented by DPS Staff	One presentation.	Three papers at national conferences and one paper at an international conference.
Grants by DPS	None.	School Wind Turbine Program -- three wind monitoring sites established, two curriculum grants awarded, and one wind turbine installation pending.
Data Validated	No.	Yes.
Data Quality Assurance	Manual review of spreadsheet files every one to two months.	Automated graphic review of database information weekly; automated validation and error checking to be installed and operating by the end of the year.
Computer Software used for data management/mapping	Lotus, Superpaint.	Database and GIS Applications include MicroSite, FoxPro, Excel, EPPL7, Arc/Info, WindAtlas, WASP.