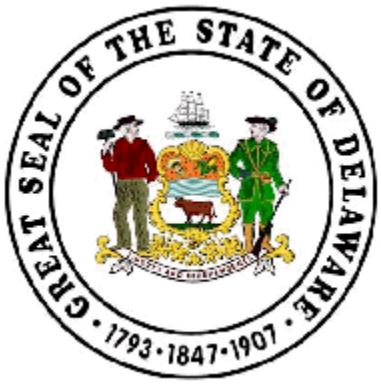


Bright Ideas for Delaware's Energy Future

Delaware Energy Task Force
Final Report to the Governor

September 2003

Table of Contents

List of Figures

List of Tables

Letter to the Governor

Dear Governor Minner:

On behalf of the Delaware Energy Task Force I am pleased to present to you our report *Bright Ideas for Delaware's Energy Future*. More than 100 participants representing a wide range of public and private sector interests worked together for over a year to prepare this report and its recommendations. This considerable effort resulted from Executive Order 31 signed by you in April 2002 establishing the Task Force and its goals and objectives. These objectives recognize the central importance of energy in Delaware's economy, as well as the need to protect the environment that is the foundation of the State's quality of life. We took for our mission the goals embodied in your *Livable Delaware* initiative that addresses significant land use and environmental issues affecting Delaware's future.

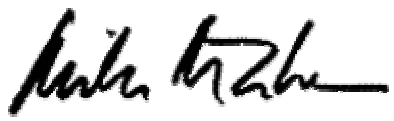
As the recent blackout in parts of the United States and Canada abruptly reminded us, our economic and personal well-being is dependent upon reliable sources of energy. I am pleased to note that reliability was one of the key issues examined by the Task Force and the major recommendations proposed in this area anticipated the ideas currently being discussed nationally in the wake of the blackout.

Our final report addresses the comprehensive set of energy issues your Executive order outlined. Ground transportation issues were not reviewed. The only issue we addressed within the transportation was alternative fuels because other ground transportation issues are being addressed by other State working groups.

The Task Force believes that this report is the beginning, not the end of the process. The options available to address the short and long-term challenges and opportunities facing Delaware require thoughtful consideration. The Energy Task Force has identified a key set of strategic options, each with its own set of recommendations for use in guiding Delaware's energy future. These issues are complex and don't lend themselves to a quick fix, but with the resolve and innovation that is characteristic of the people of Delaware, we are confident that the challenge will be met.

I know I speak for all the Task Force participants when I say it was a privilege to serve you in this important effort. Thank you for the opportunity.

With great respect,



W. Michael McCabe
Chairman

Executive Summary

In April 2002, Governor Ruth Ann Minner established the Delaware Energy Task Force through Executive Order 31. The Task Force's mission is to address the state's long-term and short-term energy challenges.

Delaware Energy Task Force Members

W. Michael McCabe, Chairman
McCabe & Associates

Hon. Harris McDowell
Delaware State Senate

Hon. Joseph DiPinto
Delaware House of Representatives

Andrea Kreiner
Office of the Governor

Arnetta McRae
Chair, Public Service Commission

David Bacher
NRG Energy, Inc.

Joseph M. Rigby
Conectiv

E. Paul Bienvenue
Delaware Electric Cooperative, Inc.

Phil Barefoot
Eastern Shore Natural Gas

Chris Coons
W L Gore & Associates, Inc.

Gary Patterson
Delaware Petroleum Council

Marty Ross
Ross Farms

Brian Grems
Sierra Club

John Hughes
Secretary, Department of Natural Resources & Environmental Control

Michael T. Scuse
Secretary, Department of Agriculture

Lee Ann Walling
Delaware Economic Development Office

Gloria Homer
Secretary, Department of Administrative Services

Task Force Consultant
Ralph Nigro
Applied Energy Group, Inc.

The full Delaware Energy Task Force report is available at www.state.de.us/governor.

Why Delaware Needs an Energy Plan

The energy we use every moment of every day is rarely given any thought by most people. Yet Delawareans are fortunate to have a reliable and affordable energy delivery system. But demand for energy services is growing, and the industry that serves our power needs is changing. As a result, the future holds many challenges, and planning now is critical for providing the public with the reliable and affordable energy we require.

Many states are facing energy crises, but Delaware's existing energy system has been sufficient to meet our needs and no energy crisis looms on the immediate horizon. However, rather than wait for a crisis to strike, we must take advantage of the current situation to chart a prudent course that anticipates and addresses both short and long-term issues that will have an impact on our energy future. Delaware faces a series of challenges that require thoughtful consideration and planning, including:

Increased Energy Demand

Rapid population growth, particularly in the southern portion of the state, will be higher than national averages, resulting in increased demand for energy services, which in turn will increase the pressure on the energy infrastructure and environment.

Increased Energy Cost

Geographic, infrastructure and market issues may cause the cost of delivering energy to Delaware and the Delmarva Peninsula to increase, especially with the removal of residential electricity price caps slated for 2005 and 2006. There is also continuing uncertainty due to on-going utility deregulation and the transformation of the electricity industry on a national level.

Environmental Issues

Energy generation and use is the single largest contributor to pollution, smog and greenhouse gases. Pressures to meet rising energy demands, if not handled properly, will have an adverse affect on our environment and public health. This Report recognizes these challenges and their possible impact on Delaware's economy, the environment and our citizens' prosperity.

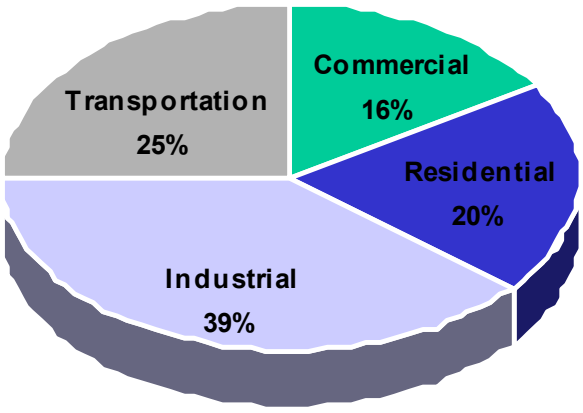
But before we respond to the challenges, let's examine the current status of our energy supply and usage.

Delaware's Energy Profile

Who Uses Our Energy

Energy is consumed by four sectors:

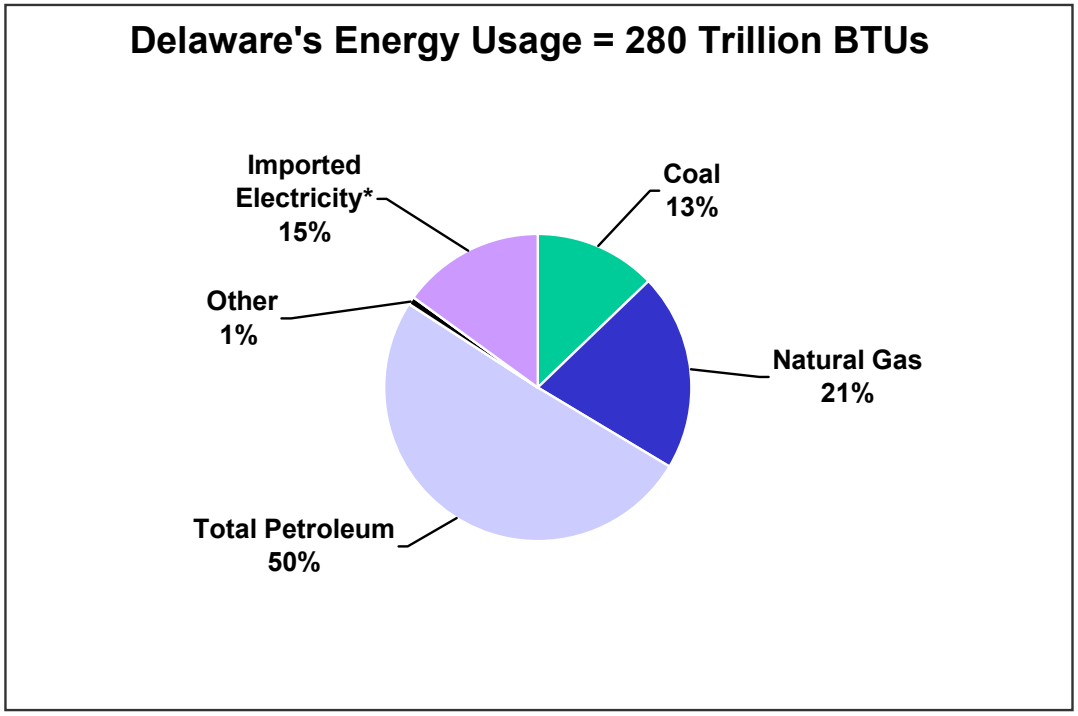
- Residential
- Commercial
- Industrial
- Transportation



The largest consumer of electricity is the industrial sector, in part because Delaware is home to several energy-intensive industries including a major petroleum refinery, chemical plants and large manufacturers. The transportation sector is the second largest and is almost completely dependent on petroleum fuels, mainly gasoline and diesel fuel. The commercial and residential sectors account for the remainder of the state's energy consumption. They include a wide range of end-uses including space heating, air conditioning, water heating and an array of electric appliances and equipment.

Where Our Energy Comes From

Delawareans currently consume approximately 280 trillion BTUs of energy in different forms every year – equivalent to approximately 7.4 gallons of oil per person per day. Eighty-four percent of this energy is delivered directly to Delaware in the form of fossil fuels (coal, petroleum products and natural gas), and is used to fuel homes, businesses, industry and transportation, as well as to generate a portion of the state's electricity. Another 15%, nearly all of the remainder, is delivered in the form of electricity generated mainly by out-of-state fossil and nuclear-fueled power plants.



Note: Imported electricity does not include losses incurred in generating and delivering electricity from out-of-state power plants to Delaware.

Energy Sources

Electricity

Electricity plays a critical role as an "energy carrier," meaning its main function is to deliver energy to users in a more usable form than the primary energy resources used to produce it. Because of its convenience and versatility, electricity use is growing at a faster rate than any other form of energy.

There are, however, issues related to electricity consumption that have important implications on energy planning. Electricity is generated from other fuels, including coal, oil, natural gas and nuclear energy, and is delivered to consumers through an extensive transmission and distribution system. Converting fuels into electricity involves large losses of energy at power plants. On average, about 70% of the energy in the fuels used to generate electricity is lost. Much smaller amounts of energy are lost in transmission and distribution to customers. The sum of these losses is an important factor in developing recommendations to improve the efficiency of electrical appliances and equipment.

Long-term electricity supply concerns include environmental damage from air pollution, price instability and the danger of supply interruptions.

Potential price increases for electricity are another important concern for energy planners. Since the passage of restructuring legislation in 1999, electricity prices have been capped for

residential and small commercial customers of Conectiv Power Delivery and all Delaware Electric Cooperative customers. In addition, Conectiv Power Delivery residential customers received a 7.5% rate reduction. Rate caps will be lifted for the Delaware Electric Cooperative in March 2005, and in May 2006 for Conectiv.

Since 1985, in-state generation of electricity has decreased and now approximately 45% of the electricity sold in Delaware is imported from the PJM Interconnection. PJM is the regional transmission system operator, based in Valley Forge, PA. Utilities, electricity wholesalers and independent suppliers depend on PJM to balance the supply and demand of electricity within most of the Mid-Atlantic region, including Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia. Ninety-seven percent of the PJM electricity sold in DE is generated from non-renewable resources such as coal, oil, natural gas and nuclear.

Natural Gas

The use of natural gas is growing, and the wholesale electricity marketplace at the regional level has favored natural gas for most new generation projects. Natural gas is popular because of the relative cleanliness and low capital costs of gas-fueled power plants, two features that are very important in the unregulated marketplace. Depending on the location of possible new gas-fueled power plants, a large investment in pipeline capacity may be needed. Natural gas is also used for many other purposes in the residential, commercial and industrial sectors. However, in some of the fastest growing parts of Delaware, natural gas is unavailable for these purposes. Recent forecasts also express concern about short-term natural gas supplies and higher prices.

Petroleum

The industrial sector in Delaware uses fuels like natural gas and oil directly for many purposes including process heat and steam. Approximately 46% of all primary energy input in Delaware's industrial sector is petroleum for either feedstock or fuel for the Motiva refinery.

In the transportation sector, nearly 383,000,000 gallons of gasoline were consumed in Delaware in 2000. Nearly 97% of this gasoline was used in on-highway vehicles. Diesel fuel consumption totaled over 182,000,000 gallons, split between on-highway, residential, commercial and industrial heating applications.

Forecasts Predict Energy Consumption to Increase

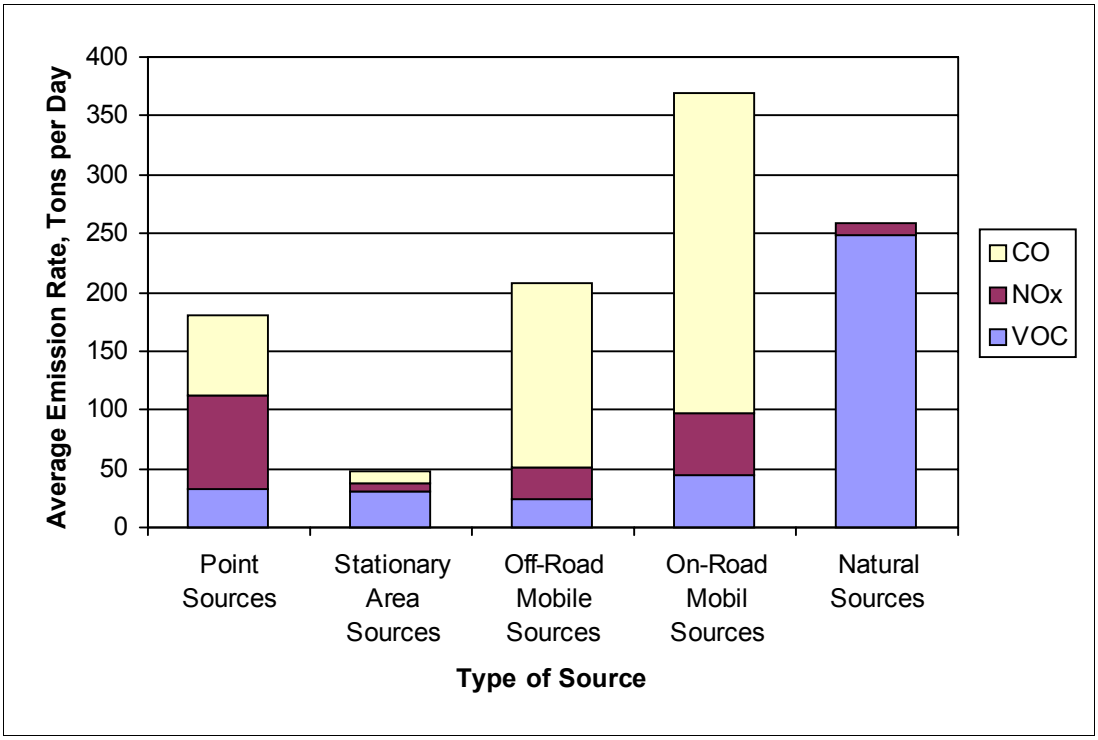
Business-as-usual forecasts indicate that consumption of all fuels and electricity will increase substantially over the next decade. If the business-as-usual forecasts are accepted, Delaware can expect the following increases by about 2010:

- An 18.5% growth in electricity consumption
- An 18% increase in peak electricity demand
- An 8.8% growth in natural gas consumption
- A 6.1% increase in total fuel oil consumption for residential, commercial and industrial use
- A 23% increase in gasoline and other motor fuel consumption

Environmental Impacts of Energy Consumption

The National Ambient Air Quality Standards (NAAQS) establishes limits on the concentrations of certain pollutants based on their effects on our health. In most cases, environmental permits limit emissions of certain pollutants from stationary sources such as power plants, and Federal standards limit pollutants from vehicles. However, the use of energy has inevitable environmental impacts on air, water and land. Burning fossil fuel can result in local, regional and global environmental effects including acid rain, high ground level ozone (smog) and global warming. Our health can be affected as well. Ground level ozone and other emissions have been associated with a variety of respiratory and heart problems, especially in very young and very old people.

In spite of environmental regulations, New Castle and Kent counties are currently classified by the Environmental Protection Agency as "severe non-attainment areas" for ozone under the NAAQS. The state is classified as non-attainment in all three counties under the new 8-hour ozone standard, and is likely to violate a new standard for particulate matter (the "PM2.5 standard") in New Castle County.



How Energy Use Impacts Air Quality

Energy consumed for transportation, electric power generation and industry account for the largest share of on-site air pollutants and toxic emissions. Their total estimated emissions of three specific pollutants, carbon monoxide (CO), nitrogen oxides (NOx), and volatile organic compounds (VOC), is approximately 1,064 tons per day (approximately 388,400 tons per year).

Bright Ideas for Delaware's Energy Future

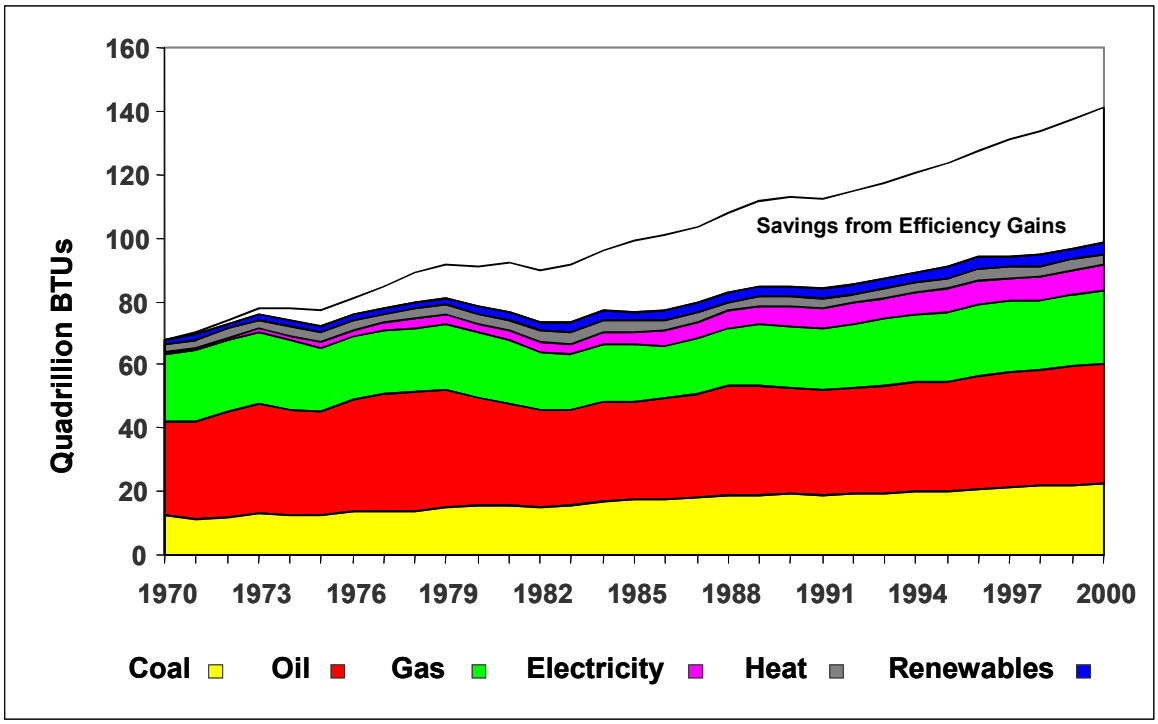
Delaware Energy Task Force Goals

In accordance with Executive Order 31 issued by Governor Minner, the Energy Task Force addressed the following goals:

- The expansion of the diversity of fuels used to meet Delaware's current and future energy needs.
- The development of conservation programs to reduce the need to build more electricity generation facilities.
- Ensuring that energy infrastructure will meet Delaware's future needs for efficiently transporting energy resources.
- Encouraging producers of clean energy technologies and producers of energy efficient products to locate their business operations in Delaware.

Energy Task Force's Strategies and Recommendations

Thirty years ago the nation faced an energy crisis brought about by an embargo of imported oil. For the first time, supplies of cheap and plentiful oil suddenly disappeared and American businesses and workers suffered the disruptive economic impacts for years. One of the most cost-effective and environmentally sound approaches to finding new sources of energy came in the form of conservation and improved efficiency. As the following graph shows, energy consumption rose at a much slower pace due to conservation, resulting in real economic and environmental benefits as compared to historic rates of energy growth.



Savings from Energy Efficiency 1970 through 2000

From "Energy Efficiency, Renewable Energy and Economic Development: Trends and Prospects," presented to the Economic Development Working Group by Dr. John Byrne, Director, University of Delaware CEEP, October 3, 2002.

Without an immediate crisis hanging over us, we are at that point again where innovative technologies and improved efficiency can produce major benefits – a new generation of improvements.

With history as its guide, the Energy Task Force was determined to find alternatives to "business as usual" forecasts and reduce the predicted increases in energy consumption. No single approach solves all the technical, economic, environmental and social issues associated with expanding the electric power infrastructure, as each element of the infrastructure comes with its own set of challenges and opportunities.

The Task Force believes that Delaware must ensure the continued availability, reliability and affordability of energy while recognizing and encouraging the need to make transitions in the ways energy is supplied and used. Guided by a set of nine strategies intended to meet the goals of Executive Order 31, the Task Force created recommendations for each strategy. The recommendations were then classified as a high, medium or low priority. The strategies and high priority recommendations are highlighted on the pages that follow. Medium and low priorities can be found on pages ES-23 through ES-25.

Energy Task Force Strategies:

Strategy 1: Reduce environmental and economic costs of energy consumption through improvements in end-use efficiency and conservation.

End-use efficiency and conservation are critical tools for managing the economic and environmental impacts of energy consumption. Since less than 30% of the energy from fuels used to generate electricity is actually delivered to the end-user because of conversion losses, there is a multiplier effect when electricity is conserved and used more efficiently. Findings indicate that there are many opportunities in the residential, commercial and industrial sectors to increase conservation and efficiency, and a wide range of tools that can be used to do this. There are countless environmental benefits of energy conservation and efficiency. For example, by consuming less fossil fuel, there are fewer emissions and impacts on our air, land and water. In addition, consumers benefit directly from lower energy bills and there is less need for costly infrastructure expansion.

Improvements in energy efficiency and conservation are at the core of Delaware's response to the economic and environmental challenges ahead. The Task Force targeted improvements in end-use energy efficiency and conservation by selecting tools and approaches in several categories:

- Education and Outreach Programs
- Building Codes
- Incentive Programs
- Areas for Further Investigation
- Funding

Recommendations

<u>Education and Outreach</u>

- Implement a comprehensive education program to inform residential consumers about how they can achieve the economic and environmental benefits of more efficient energy use.

- More completely disclose information about fuel sources, emissions, and costs to consumers to better inform their purchasing decisions.

- The state should take full advantage of existing U.S. Department of Energy (DOE) programs targeting industrial efficiency.

- The state should join the U.S. EPA/DOE Energy Star Program in order to take full advantage of the Program's educational, technical and marketing support.

- Develop an aggressive consumer education program to promote Energy Star appliances and equipment to builders and consumers in the Residential and Commercial sectors.

Building Code

- Update residential and commercial building energy codes last set in 1993 in Delaware to the improved 2000 International Energy Conservation Code.

Incentive Program

- The state should recognize outstanding energy-efficient design and construction by sponsoring a "Governor's Award."

- Provide direct incentives to encourage the purchase of selected high efficiency residential appliances and equipment.

Areas for Further Investigation

- To reduce peak loads, a study should investigate the most effective means of implementing demand response/direct load control technologies.

ACTION IN PROGRESS:

Recognize Green Buildings – The first building constructed to the U.S Green Building Council's "Leadership in Energy and Environmental Design" (LEED) Gold standards was dedicated by PFPC, Inc. in the Bellevue Corporate Center north of Wilmington in June 2003.

Funding

Funding sources and mechanisms to pay for energy efficiency and renewable energy programs should be developed to close the gap between the need for funding and available funding, especially if additional incentive programs are established. The following specific recommendations should be considered:

- Consider expanding the number of customers contributing to the Green Energy Fund. Any consideration of expanding the Fund should include all stakeholders.

- Analyze the Green Energy Fund collection rates and incentive levels to determine whether it has adequate revenue to accommodate anticipated demand for programs.

- Pursue other funding sources and mechanisms, such as the Federal Government and non-governmental organizations, to provide resources for energy efficiency, conservation and educational programs.

- Carefully monitor Federal funding opportunities for research and development and, where opportunities match the state's priorities, proposals should be developed and supported.

Low-income households in Delaware spend about 15 to 20% of their total household income on energy. In comparison, other households spend an average of 3.5% on energy. The following specific recommendations should be considered:

- Carefully evaluate the current backlog and anticipated need for low-income weatherization services.

- The state should make maintaining and increasing current Federal weatherization funding levels a high priority.

- The Delaware State Housing Authority should include energy efficiency as a criterion for ranking and selecting multi-family renovation projects.

- The state should investigate participation in the U.S. EPA's Energy Star Bulk Purchasing Program for refrigerators, windows, HVAC and lighting for publicly funded low-income housing renovations.

ACTION IN PROGRESS:

Provide Funding for Low Income Programs – The passage of Senate Bill 93 in June 2003 dedicates $1,000,000 of existing funds for additional low-income energy programs.

Strategy 2: Reduce the environmental impacts of electricity generation by encouraging clean and renewable energy generation.

Delaware's population, and therefore the demand for electricity, is expected to grow faster than the national average. Conservation and efficiency are critical to managing this growth. However, if a large-scale power plant is needed, there is a priority to ensure that it is clean. Once again, this is a complicated issue.

The decision to build a power plant is largely in the hands of unregulated wholesale power producers responding to market conditions. Since the early 1990s, over 90% of the new generating capacity in the U.S. and in the PJM region has been fueled by natural gas. This is the cleanest of the fuels conventionally used to generate electricity, although there have recently been concerns about the short-term rising prices and availability of natural gas and the negative impacts of depending too heavily on it for power generation. Natural gas delivery to a large power plant may also be an issue, depending on its location.

ACTIONS IN PROGRESS:

Promote Renewable Energy – The Delaware Solid Waste Authority (DSWA) signed contracts to develop landfill gas from the Jones Crossing and Sandtown landfills, for a total generation of 10MW of power, which is an important contribution to renewable energy production in the state.

Reduce Climate Change – Governor Minner joined with nine other Northeastern and Mid-Atlantic states in May 2003 to develop a regional program to reduce carbon dioxide emissions from power plants.

Even the cleanest conventional power plants use large amounts of fossil fuels, and have significant environmental impacts. Renewable energy resources that can reduce dependence on fossil fuels for electric power generation, including solar, wind and biomass, are available in Delaware. While the initial costs of renewables are often higher than conventional energy supplies, the benefits of increased renewable use are significant. Renewable energy resource and technology development also have positive implications for economic growth.

Recommendations

- Develop a "Green Pricing" program for electricity that requires offering electricity customers the option to purchase increments of "green energy."
- The state government should join the U.S. EPA Green Power Partnership Program and should procure a portion of its electricity from renewable resources.
- Re-assess photovoltaic system rebates from the state's Green Energy Fund with a goal of having 500 photovoltaic systems in Delaware by 2010.

- Establish a study group to determine the types and quantities of sustainable biomass resources and their best use.

- Establish a renewable energy goal for electricity consumed in the state.

Strategy 3: Reduce the economic impacts of transmission congestion.

Delaware and the Delmarva Peninsula are uniquely affected by location and geography. The current pricing structure within the PJM Interconnection results in relatively higher electricity costs on the Delmarva Peninsula compared to the rest of the PJM region. This is a very complicated issue related to the configuration of the transmission system, the types and locations of generating units on the Delmarva Peninsula, and the design of PJM's wholesale pricing system. Recommendations affecting any of these components are constrained by legal, regulatory, technical and economic boundaries.

ACTIONS IN PROGRESS:

Relieve Transmission Congestion

- The Federal Energy Regulatory Commission (FERC) opened a docket in June 2003 to investigate the causes and impacts of transmission congestion on the Delmarva Peninsula.
- In March 2003, PJM filed a proposal with the FERC that outlines its proposed methods for determining what transmission projects should be built to address congestion. This proposal is still under review by the FERC. Subsequently, the PJM transmission owners, including Conectiv, filed in support of PJM's economic planning proposal designed to address congestion and also provided a rate formula to apply to new transmission investments. The FERC accepted the transmission owners' filing in June 2003 and it will go into effect on November 11, 2003.

Improve Transmission – In May 2003, Conectiv announced that it would begin work on a major 230 kV transmission project between Red Lion, Milford and Indian River to be completed by 2006.

Recommendations

- Simplify the permitting and right-of-way acquisition processes for transmission and distribution projects.
- The Public Service Commission should review the cost recovery process for transmission and distribution investments as new marketplace rules and practices are rapidly changing the way investment decisions are made. The challenge is to ensure that regulated utilities receive fair returns while unregulated utilities are not hindered from competing.
- The state and energy companies should continue to ensure the physical security of the energy infrastructure.

Strategy 4: Promote clean distributed generation.

Distributed generation locates small-scale power generation units close to end-users. They can be deployed at customer sites, utility substations or other locations where the need for power is small, but its value is high. Distributed generation can use a wide variety of equipment and resources including conventional engine-generators, fuel cells and solar photovoltaics.

Distributed generation holds the potential to reduce transmission congestion, reduce losses in electric power delivery, improve reliability and avoid or defer larger investments. Under the right circumstances, it can also greatly improve efficiency through the use of combined heat and power (CHP) applications.

Recommendations

- Encourage distributed generation as an alternative to electric transmission and distribution system expansion.
- Electric and gas utilities should develop rates that encourage distributed generation.
- Identify and encourage combined heat and power opportunities as a means of increasing fuel utilization efficiency.
- The Public Service Commission and the state's utilities should closely follow development in distributed generation interconnection standards.
- The state should establish a distributed generation registry.

Strategy 5: Enhance availability of natural gas.

Natural gas service in Delaware is limited mainly to most of New Castle County, the more populated areas of Kent County and along the U.S. Route 13 corridor in Sussex County. In the fastest growing parts of Sussex County, natural gas is unavailable. The availability of natural gas is important for two reasons. First, new residential and commercial end-users who do not have access to natural gas are likely to use electricity for space heating, water heating and other applications, thereby increasing the overall need for electricity. Second, natural gas is considered critical in the development of relatively clean distributed generation.

ACTION IN PROGRESS:

Investigate Natural Gas Supply – Delaware and Maryland are jointly funding a study to investigate the feasibility of a natural gas pipeline under the Chesapeake Bay.

Recommendations

- The state should evaluate possible incentives for expanding residential and commercial natural gas service.

Strategy 6: Promote alternative transportation fuels.

Delaware's transportation sector, like the rest of the U.S., is almost completely dependent on oil. This has large implications for air quality and dependence on fossil fuels. However, Delaware is a small vehicle market in comparison to other states and has limited capacity to affect the efficiency of vehicles on the road.

Considering these factors, it makes sense for Delaware to promote alternative fuels that can be used in available vehicles, especially bio-diesel and ethanol. These two fuels can be produced locally and distributed to regional markets while providing a boost to Delaware's important agricultural sector. Perhaps more importantly, these fuels have environmental advantages by reducing tailpipe emissions.

ACTIONS IN PROGRESS:

Advance Biodiesel Production & Consumption – There were numerous activities related to advancing bio-diesel production and consumption in Delaware including:

- The Governor appeared in a series of television commercials promoting bio-diesel in September 2002
- Developing a bio-diesel production facility in Delaware has been actively pursued
- Conectiv Power Delivery and the Delaware Electric Cooperative are using bio-diesel in their fleet trucks
- DNREC, DelDOT and Department of Agriculture fleets use bio-diesel in vehicle fleets and the state's dredge
- DSWA converted to bio-diesel for its diesel-powered equipment
- Emissions testing on bio-diesel from high-oleic oil produced by genetically modified soybeans
- Emissions testing on bio-diesel used as heating oil in the Appoquinimick School District
- Uncle Willies began selling bio-diesel at 3 service stations in southern Delaware in February 2003

Provide Ethanol – The state signed a contract for supplying ethanol for refueling state-owned Flex-Fuel vehicles in July 2002.

Recommendations

- Mandate that all diesel fuel sold in Delaware must be at least 2% bio-diesel. (legislation required)

- State government should use B-20 bio-diesel in State-owned vehicles and encourage the use of B-20 bio-diesel in private fleets.

- Officially recognize bio-diesel in the Delaware Code for taxation purposes (legislation required)

- The state should provide training and education on the availability and use of alternative transportation fuels.

Strategy 7: Promote economic development by encouraging advanced energy technology development.

Delaware has historically been a center of technological innovation. The state is also the home of several important companies and research centers involved in solar energy and fuel cell technology development. It is in Delaware's interest to promote itself as a center for these activities. Research, development and manufacturing in renewable energy and advanced energy technologies will help to attract high-paying jobs and solidify the state's position as an important center for clean energy innovation.

ACTIONS IN PROGRESS:

Support Economic Development – The U.S. Department of Energy awarded a contract to a public-private consortium to investigate biotechnologies and energy efficiency for Delaware's agricultural sector.

Expand Fuel Cell Research – With the help of Delaware's Congressional delegation, two Delaware companies, Ion Power and DuPont, will receive combined funding of $9.5 million for fuel cell research.

Recommendations

- As part of its economic development strategy, the state should recruit advanced energy technology companies and end-users with targeted financial incentives.
- The state should facilitate the development of a Clean Energy Research Institute focused on basic and applied clean energy technology research.
- The Delaware Economic Development Office and the electric utilities should address the needs of those business customers who need consistently reliable "high quality" energy.
- The State Energy Office should continue to sponsor appropriate energy-related demonstration projects.

Strategy 8: Implement energy efficiency, conservation and renewable energy in state government.

Through the State Energy Office and other agencies, Delaware's state government has always recognized the value of energy efficiency. However, the challenges are larger than ever before, and the state must actively and symbolically promote energy efficiency and lead this effort by example. The state government can do this by reorganizing its procurement efforts and taking advantage of the opportunities that lie ahead.

ACTIONS IN PROGRESS:

Encourage Use of Hybrid Buses/Vehicles – The Delaware Transit Corporation demonstrated use of Diesel-Electric Hybrid Buses in June 2003. They will add two of these buses to their fleet during the upcoming calendar year.

Relocate State Energy Office – To improve the effectiveness of the State Energy Office and increase its profile within the state, the office was moved to the Department of Natural Resources and Environmental Control following passage of Senate Bill 93 in June 2003.

Recommendations

- State buildings that have the potential to save significant energy should be benchmarked for energy efficiency.
- Allow the use of performance contracting for energy efficiency upgrades in state facilities. (legislation required)
- Update energy efficiency standards for state-owned buildings. (legislation required)
- Require energy life-cycle cost analysis for new construction and renovations. (legislation required)
- Establish a revolving loan fund to internally finance energy efficiency projects in state-owned facilities. (legislation required)
- Require consideration of energy-efficient products in state procurement. (legislation required)
- Mandate the procurement of Energy Star rated equipment where possible. (legislation required)
- Expand training efforts encouraging employees to identify energy saving opportunities and promoting energy-efficient operation in state facilities.

- Form an Energy Cabinet Committee to coordinate state government energy activities.

- Require state agencies to evaluate the merits and cost effectiveness of stationary fuel cells and photovoltaics as primary or back-up power sources for buildings and remote power applications.

- Require individual state agencies to enter energy consumption data into the state's tracking system.

- Additional resources should be provided to the State Energy Office to effectively carry out its expanded mission.

Strategy 9: Continue the planning effort to ensure that long-term goals are met.

This energy plan is a giant step toward achieving the goals established by Governor Minner in Executive Order 31. The success of this plan will depend on four factors: commitment, monitoring, flexibility and accountability. Rapidly changing events, technologies and circumstances will affect future implementation and plans will require adjustment. For these reasons, planning, tracking progress and reporting should be on-going efforts. Without these functions, feedback will be unavailable, opportunities will be missed and potential problems will not be identified.

Recommendations

- Develop legislation to require on-going energy planning for the state.
- The State Energy Office should establish and maintain an energy end-use data collection and analysis program.
- Delaware should establish an Energy Stakeholder Coordination Council to monitor Delaware's energy transport systems, draft and implement actions necessary to enhance energy systems, and provide counsel to the Governor to promote an economic, reliable and competitive energy market for all Delaware consumers.
- Delaware should support and enhance on-going utility and PJM regional planning processes to insure reliability and cost-effectiveness.

Medium-Low Priority Recommendations

Previous pages show high priority recommendations for each strategy. The Task Force would like to see those implemented as soon as possible. In addition, they set these medium and low priority recommendations for the future.

Strategy 1: Reduce environmental and economic costs of energy consumption through improvements in end-use efficiency and conservation.

Education & Outreach	Priority
• Once the state is a member, it should promote the Energy Star Program to potential private sector partners who would receive similar benefits.	Medium
• Educate homebuyers about the advantages of "Energy-Efficient" Mortgages.	Medium
• Provide commercial building owners with information and services to help them save energy.	Medium
• Offer small and medium-sized industrial consumers audits to help improve energy efficiency.	Low
Building Codes	
• Train building energy code officials to enforce updated energy codes.	Medium
Incentive Program	
• Develop commercial tax incentives and/or credits for energy-efficient equipment purchases in the commercial sector.	Medium
• Develop commercial tax incentives and credits to encourage Leadership in Energy and Environment (LEED)-certified buildings in the commercial sector.	Low
• Develop a rebate program specifically for energy-efficient motors and variable speed drives to encourage replacement of older, low efficiency motors and the adoption of variable speed drives.	Low
• Develop a custom incentive program for industrial energy users.	Low
Areas for Futher Investigation	
• Investigate utility rates that encourage higher efficiency, such as real time energy pricing.	Medium
• Develop a pilot project that encourages construction of at least some publicly funded housing to Energy Star standards.	Low

Strategy 2: Reduce the environmental impacts of electricity generation by encouraging clean and renewable energy generation.

- Review Delaware laws for their impact on the use of sustainable biomass and energy crops in an environmentally acceptable manner. Medium
- Catalog potential power plant sites from the standpoints of environmental impacts, access to and the ability to license electric transmission, road and rail transportation infrastructure and natural gas delivery infrastructure. Medium

Strategy 3: Reduce the economic impacts of trans mission congestion.

- Encourage advanced transmission and distribution technologies. Medium
- Encourage and support proactive communications among Transmission Owners, Load Serving Entities and PJM. Medium
- To help maintain diversity of fuel sources, Innovative funding should be explored for energy-related environmental improvement projects Medium

Strategy 5: Enhance availability of natural gas.

- The state should examine possible incentives to expand the natural gas infrastructure on a project-specific basis to develop clean power generation when and where it is needed. Medium

Strategy 6: Promote alternative transportation fuels.

- Future contracts for state motor fuel purchases should require bidders to include access to E-85 ethanol refueling stations in return for a minimum purchase amount. Medium
- The state should provide funding to aid purchases of Neighborhood Electric Vehicles (NEVs) for public and private urban fleets. Medium
- Amend state motor vehicle laws to remove barriers to the use of NEVs. Medium
- The state should ban the use of MTBE by 2006. The state should encourage the use of ethanol as the primary substitute for MTBE at a level regionally acceptable. Medium

Strategy 7: Promote economic development by encouraging advanced energy technology development.

- The state should fund a visible fuel cell technology demonstration project to support the fuel cell industry in Delaware. Medium

Strategy 8: Implement energy efficiency, conservation and renewable energy in state government.

• Encourage environmental permitting flexibility for fuel cells.	Medium
• Evaluate the use of hybrid vehicles for the state fleet and develop procurement guidelines for purchasing these vehicles.	Medium
• Require state agencies to seek assistance from the Energy Office and/or Contracting Unit before purchasing high value and/or unique energy-related equipment and services. (legislation required)	Medium
• Use life-cycle cost analysis to assess products with potential to save significant amounts of energy, that are not Energy Star labeled, before they are purchased. (legislation required)	Low
• Evaluate the use of recycled products to reduce "embedded energy."	Low

Strategy 9: Continue the planning effort to ensure that long-term goals are met.

• Delaware should help facilitate the establishment of a Multi-State Energy Commission to address regional energy issues.	Medium
• Future energy planning efforts should include a more comprehensive treatment of the transportation sector.	Medium
• Include water consumption in future energy planning efforts.	Low

Chapter 1: Introduction

The Delaware Energy Task Force is pleased to submit its Final Report to the Governor. The contents of this report represent the combined efforts of nearly 100 individuals and organizations throughout the State, over a period of twelve months, in response to the Governor's Executive Order 31 (Appendix A). In her Executive Order, Governor Minner recognized the central importance of energy in Delaware's economy, as well as the need to protect the environment that is the foundation of the State's well being.

The Task Force was charged with addressing the Goals of Executive Order 31:

- To expand the diversity of fuels used to meet Delaware's current and future energy needs;
- To develop conservation programs to reduce the need to build more electricity generation facilities;
- To ensure that the energy infrastructure will meet Delaware's future needs for efficiently transporting energy resources;
- To encourage producers of clean energy technologies and producers of energy efficient products to locate their business operations in Delaware.

For Delaware, the need to achieve these goals is motivated by a series of near-term and long-term challenges:

Geographic Issues: Delaware's location on the Delmarva Peninsula results in unique electricity transmission issues. For example, at times it is necessary to run higher cost local generating units to maintain system reliability rather than import power from generating plants located in other parts of PJM. In 2003, the Federal Energy Regulatory Commission opened a docket to study the causes and possible remedies of congestion. This follows earlier studies of the matter by the Delaware Public Service Commission and PJM.

Population Growth: Delaware's population has been growing at a faster rate than the country at large. This is especially true in parts of Kent and Sussex Counties. Based on U.S. Census Bureau figures, the total U.S population grew by 13.1% between 1990 and 2000. In comparison, Delaware's overall population grew by 17.6%. Much of this growth occurred in Kent and Sussex Counties. While New Castle County's growth was nearly the same as the national average, the populations of Kent and Sussex Counties grew by more than 14% and 38%, respectively. The demand for energy services has increased along with population, placing increasing stress on the energy infrastructure and the environment.

Environment: As energy consumption increases, so do the environmental impacts on air quality, water and land. Parts of Delaware are already out of compliance with National Ambient Air Quality Standards for certain pollutants. Increased use of conventional fuels for electric power generation, home heating, transportation and other uses will leave a mark on Delaware's environment.

Utility Deregulation: The electric utility industry has gone through a wave of deregulation and restructuring since the passage of the Energy Policy Act. Many states, including Delaware, passed legislation to open wholesale and retail electricity markets. Success has been mixed, and the shift to open electricity markets is by no means complete. Electric utilities and merchant generators are faced with rapid changes in markets, business practices and regulations well into the future. As a result, uncertainty will be a feature of the transition toward open markets. One example of this uncertainty is the effect that FERC's Standard Market Design (SMD) proposal could have on wholesale market pricing practices.

Electricity Prices and Removal of Electricity Rate Caps: Delaware enacted electric utility restructuring legislation in 1999. Temporary electric rate reductions and rate caps were put in place for Conectiv Power Delivery and Delaware Electric Cooperative customers as part of Delaware's restructuring legislation. Rate caps expire for the Delaware Electric Cooperative in March 2005 and for Conectiv Power Delivery in May 2006. As these caps expire it is difficult to predict the effects. It is possible that rates will increase, exposing many Delawareans to higher electricity prices. However, higher prices may also encourage competitive suppliers to enter Delaware's market.

The Goals and Objectives set forth by the Governor cover a comprehensive set of energy issues with the exception of ground transportation. Only alternative fuels were considered in the transportation sector because other ground transportation issues were being addressed by different State working groups. The challenges and opportunities facing Delaware require thoughtful consideration of the options available to address them. The Task Force believes that this report is the beginning of the process.

Goals and Objectives of Executive Order 31

The following excerpt is from Executive Order 31, signed by Governor Minner on April 26, 2002:

The Delaware Energy Plan shall address the following goals and objectives:

a) *The expansion of the diversity of fuels used to meet Delaware's current and future energy needs, through:*

   i) *Encouraging the development of clean, base load electric supply on the Delmarva Peninsula;*

   ii) *Encouraging a diverse fuel mix among electricity supply generation to avoid reliability impacts due to shortages;*

   iii) *Promoting production and use of bioenergy and clean alternative energy;*

   iv) *Broadening the existing diversity and decreasing the environmental impact of fuels that meet Delaware's transportation needs; and*

   v) *Expanding electric generation infrastructure utilizing clean distributed energy resources (e.g., natural gas, photovoltaics, fuel cells, micro turbines, combined heat and power and wind energy).*

b) *The development of conservation programs to reduce the need to build more electricity generation facilities through:*

   i) *Identification and promotion of business and residential energy use reduction opportunities;*

   ii) *Increasing the usage of energy-efficient products and clean energy sources through the State procurement process; and*

   iii) *Incorporating energy efficiency and conservation into the design and operation of State buildings.*

c) *Ensuring that the energy infrastructure will meet Delaware's future needs for efficiently transporting energy resources through:*

   i) *Increasing transmission capacity in existing rights-of-way;*

   ii) *Developing new transmission lines to provide natural gas to western and eastern Sussex County; and*

   iii) *Upgrading transmission lines below the Chesapeake & Delaware Canal to increase the capacity to transport additional electricity supply from other parts of the PJM transmission grid and eliminate congestion on the Delmarva Peninsula.*

d) *Encouraging producers of clean energy technologies and producers of energy efficient products to locate their business operations in Delaware through:*

   i) *Expansion of the market for renewable energy technologies in Delaware; and*

   ii) *Increasing the number of producers/developers of clean energy technologies located in Delaware.*

I. Guiding Principles

Delawareans currently consume about 280 trillion BTUs of energy annually in many different forms to heat their homes, operate their businesses, fuel industries and to power the transportation system. This is equivalent to about 7.4 gallons of oil per person per day.

Delaware, like most other states, is dependent on fossil fuels – coal, oil and natural gas – to provide this energy. The consequences of consuming large amounts fossil fuels are well known: environmental damage from air pollution, price instability and the danger of supply disruptions. With these issues in mind, the Task Force developed recommendations guided by a set of key principles:

- Increasing end-use efficiency and conservation
- Expanding resource diversity
- Enhancing economic competitiveness
- Promoting environmental stewardship
- Maintaining and improving reliability and security

Increasing end-use efficiency and conservation and reducing environmental impacts from energy consumption (emissions to the air, and discharges to water and land) are perhaps the most important in both the short and long run. In fact, Governor Minner set the target of making Delaware the most energy-efficient state in the country when she addressed the first meeting in June 2002.

From the Task Force point-of-view, increasing end-use efficiency and conservation means two things:

- Reducing the energy consumed by individual end-uses
- Conserving or avoiding the use of energy when it is not necessary

All of the principles are individually important, but end-use efficiency and conservation ties them together in fundamental ways. Their individual importance and their relationships to increasing end-use efficiency and conservation are described below:

Resource Diversity: Diversity is used to describe the range of supply-side resources that provide energy services for residential, commercial and industrial end-users. A diverse resource portfolio reduces the State's exposure to economic, environmental, fuel transportation and other problems that could cause disruptions. Whether the resource is renewable or non-renewable, end-use efficiency minimizes the costs and environmental impacts that are always present when converting energy from a raw input to a useful form.

Economic Competitiveness: Delaware's economic competitiveness is dependent on many factors, including the cost and reliability of its energy supply. Maintaining reasonable energy

prices while enhancing environmental quality are important goals. Economic competitiveness applies to retaining current industries and to the development of new industries focused on the efficient use of available energy resources, new resources and new technologies. Delaware is at the forefront of these areas in many respects. To the extent that end-use efficiency is cost-effectively maximized, capital and other resources are available for other investments and environmental quality is improved. Furthermore, money that would otherwise be spent to purchase energy supplies, mainly from out of the state, are more likely to stay in-state, contributing to overall economic growth.

Environmental Stewardship: Environmental stewardship means balancing the need to preserve and protect the environment with human needs. Many of our most intractable environmental problems can be traced directly to the use of fossil fuels. All but a fraction of oxides of nitrogen and carbon monoxide emissions come from fossil fuel combustion. All of the sulfur emissions in Delaware are a result of burning or processing fossil fuels. A large percentage of volatile organic compound emissions and hazardous air pollutants also come from fossil fuel use. Any energy policy must deal squarely with these issues by seeking solutions to current problems and promoting new methods and resources. The link between end-use efficiency and the environmental impacts of energy use are very clear. For every unit of energy not consumed through efficiency improvements, there is a direct, measurable reduction in air, water and other emissions. This is especially true where electricity is concerned because approximately three units of energy input are required for each unit of electricity output.

Reliability and Security: There is no doubt that a reliable, secure energy system is necessary for the safety and prosperity of all Delawareans. High reliability results from a combination of a robust energy delivery infrastructure and functioning markets, regardless of whether the commodity is electricity, natural gas, or other fuels. Security, in this sense, is the vulnerability of the market to shortages, price spikes and other disruptions. Enhancing reliability and security will require an understanding of the available choices and their potential impacts, whether they are conventional infrastructure investments or alternatives. Regardless of what is chosen, end-use efficiency plays a key role because it provides a demand-side response to supply-side problems, and lessens the reliability and security impacts of disruptions.

II. Strategies for Addressing Delaware's Needs

All of the recommendations in this report are guided by a set of strategies intended to meet the goals of Executive Order 31. At the core of these strategies is the belief that Delaware must ensure the continued availability, reliability and affordability of energy while recognizing and encouraging the need to make transitions in the ways energy is supplied and used. The primary goal of making these transitions is to move towards a more sustainable energy system.

Strategy 1: Reduce environmental and economic costs of energy consumption through improvements in end-use efficiency and conservation.

End-use efficiency and conservation are critical tools for managing the economic and environmental impacts of energy consumption. They are also potentially Delaware's largest homegrown energy "resource." This is especially important for electricity, since less than 30% of the energy from fuels used to generate electricity is actually delivered to the end-user because of conversion losses. The findings indicate that there are numerous opportunities in the residential, commercial and industrial sectors to increase conservation and efficiency, and a wide range of tools that can be used. The environmental benefits of energy conservation and efficiency are obvious: by consuming less fossil fuel, there are fewer emissions and impacts on our air, land and water. In addition, consumers benefit directly from lower energy bills and there is less need for costly infrastructure expansion.

Improvements in energy efficiency and conservation are at the core of Delaware's response to the economic and environmental challenges ahead. The Task Force targeted improvements in end-use energy efficiency and conservation by selecting tools and approaches in several categories:

- Education and Outreach Programs
- Building Codes
- Incentive Programs
- Areas for Further Investigation
- Funding

Strategy 2: Reduce the environmental impacts of electricity generation by encouraging clean and renewable energy generation.

Delaware's population, and therefore the demand for electricity, is expected to grow faster than the national average. Conservation and efficiency are critical to managing this growth. However, if a large-scale power plant is needed, there is a priority to insure that it is clean. Once again, this is a complicated issue. The decision to build a power plant is largely in the hands of unregulated wholesale power producers responding to market conditions. Since the early 1990s, over 90% of the new generating capacity in the U.S. and in the PJM region has been fueled by natural gas. This is the cleanest of the fuels conventionally used to generate electricity, although there have recently been major concerns about the rising price of natural gas, potential supply constraints and the negative impacts of depending too heavily on it for power generation. In addition, natural gas is not available in large parts of the State where growth is highest.

Even the cleanest conventional power plants use large amounts of fossil fuels, and have significant environmental impacts. Renewable energy resources that can reduce dependence on fossil fuels for electric power generation, including solar, wind and biomass, are available in Delaware. While the initial costs of renewables are often higher than conventional energy

supplies, the benefits of increased renewable use are significant. Renewable energy resource and technology development also have positive implications for economic growth.

Strategy 3: Reduce the economic impacts of transmission congestion.

Delaware and the Delmarva Peninsula are uniquely affected by location and geography. The PJM Interconnection is the regional transmission system operator, based in Valley Forge, Pennsylvania. Utilities, electricity wholesalers, and independent suppliers depend on PJM to balance the supply and demand of electricity within most of the Mid-Atlantic region, including Pennsylvania, New Jersey, Maryland, Delaware, and the District of Columbia. The current pricing structure within the PJM Interconnection results in relatively higher electricity costs on the Delmarva Peninsula compared to the rest of the PJM region. This is a very complicated issue related to the configuration of the transmission system, the types and locations of generating units on the Delmarva Peninsula, and the design of PJM's wholesale pricing system. Recommendations affecting any of these components are constrained by legal, regulatory, technical and economic boundaries.

Strategy 4: Promote clean distributed generation.

Distributed generation is the use of small-scale power generation close to end-users. It can be deployed at customer sites, utility substations or other locations where the need for power is small, but its value is high. Distributed generation can use a wide variety of equipment and resources including, conventional engine-generators, fuel cells, and solar photovoltaics. The value of distributed generation is that it can help to reduce transmission congestion, reduce losses in electric power delivery, improve reliability and avoid or defer larger investments. Under the right circumstances, it can also greatly improve efficiency through the use of combined heat and power (CHP) applications.

Strategy 5: Enhance availability of natural gas.

Natural gas service in Delaware is limited mainly to northern New Castle County and parts of Kent and Sussex Counties along the U.S. Route 13 corridor. In the fastest growing parts of Kent and Sussex Counties, natural gas is unavailable. The availability of natural gas is important for two reasons. First, new residential and commercial end-users who do not have access to natural gas are likely to use electricity for space heating, water heating and other applications where gas would be a logical and efficient choice, thereby decreasing the overall need for electricity. Second, natural gas is expected to be important in the development of distributed generation.

Strategy 6: Promote alternative transportation fuels.

Delaware's transportation sector, like the rest of the U.S. is almost completely dependent on oil. This has very large implications for air quality and dependence on fossil fuels. However,

Delaware is a very small vehicle market in comparison to other states and has limited capacity to affect the efficiency of vehicles on the road. Considering these factors, it makes sense for Delaware to promote alternative fuels that can be used in available vehicles, especially bio-diesel and ethanol. These two fuels can be produced locally and can be distributed to regional markets while providing a boost to Delaware's important agricultural sector. Perhaps more importantly, these fuels have environmental advantages by reducing tailpipe emissions.

Strategy 7: Promote economic development by encouraging advanced energy technology development.

Delaware has historically been a center of technological innovation. The State is also the home of several important companies and research centers involved in solar energy and fuel cell technology development. It is in Delaware's interest to promote itself as a center for these activities. Research, development and manufacturing in renewable energy and advanced energy technologies will help to attract high-paying jobs and solidify the State's position as an important center for innovation.

Strategy 8: Implement energy efficiency, conservation and renewable energy in State government.

Through the State Energy Office and other agencies, Delaware's state government has always recognized the value of energy efficiency. However, the challenges are larger than ever before, and the State must actively and symbolically promote energy efficiency and lead by example. The State government can do this by updating its procurement and construction efforts and taking advantages of the opportunities that lie ahead.

Strategy 9: Continue the planning effort to insure that the long-term goals are met.

This energy plan represents the beginning, rather than the end, of achieving the goals established by the Governor in Executive Order 31. The success of this plan will depend on four factors: commitment, monitoring, flexibility and accountability. Rapidly changing events and circumstances will affect future implementation and plans will require adjustment. For these reasons, planning, tracking progress and reporting should be on-going efforts. In the absence of these functions, feedback will be unavailable, opportunities will be missed and potential problems will not be identified.

III. The Delaware Energy Task Force

The Task Force included 17 members, appointed by the Governor, representing a wide spectrum of public and private sector interests. Six Working Groups were formed to support the Task Force. The Working Groups held the discussions and performed the detailed analyses necessary to respond to the Governor's Executive Order. Each group was charged with a specific area of responsibility and was chaired by a member of the Task Force or their designee. Support was provided by staff from various State government agencies and a support contractor. Working Group members were initially invited to participate by the Governor's Office. The Working Groups extended invitations to additional members once work began during the summer of 2002. The members of the Task Force and Working Group Chairs were:

Task Force Member	Affiliation
W. Michael McCabe Task Force Chair	McCabe & Associates
David Bacher	NRG Energy
Philip Barefoot	Eastern Shore Natural Gas
E. Paul Bienvenue	President, Delaware Electric Cooperative
Chris Coons	W. L. Gore & Associates
Representative Joe DiPinto	Delaware House of Representatives
Brian Grems	Sierra Club
Gloria Homer	Secretary, Department of Administrative Services
John Hughes	Secretary, DNREC
Andrea Kreiner	Governor's Policy Advisor
Arnetta McCrae	Chair, Delaware Public Service Commission
Senator Harris McDowell	Delaware State Senate
Gary Patterson	Director, Delaware Petroleum Council
Joe Rigby	President, Conectiv Power Delivery
Marty Ross	Ross Farms
Michael Scuse	Secretary, Department of Agriculture
Lee Ann Walling	Delaware Economic Development Office

Lists of each Working Group's members and their affiliations are provided in Appendix B.

The six Working Groups met at least monthly from July 2002 through March 2003. Their efforts were guided by the goals and objectives outlined in Executive Order 31. In several cases, formal work plans were developed to guide the groups' inquiries. After an initial period to collect input and discuss key issues, the Working Groups developed formal recommendations. Four of the six groups also wrote detailed reports supporting their findings and recommendations. These reports are provided in Appendices C through F.

Each Working Group focused on key issues within their respective areas:

Conservation and Efficiency	• Understanding energy use in the State • Comparing Delaware with other states • Identifying and analyzing conservation and efficiency measures
Diversity of Fuels	• Encourage and maintain fuel diversity in electric power generation • The potential need for additional clean base load power generation • Expansion of renewable energy • Develop strategic use of distributed generation as an alternative to conventional power plant and electric transmission projects • The use of alternative fuels for meeting non-electric energy requirements including space heating and hot water needs
Transmission and Distribution	• Capacity • Regional and State planning • Alternatives to transmission capacity • Infrastructure security • New technologies for maximizing transmission capacity • Land use • Financial issues related to electric and natural gas infrastructure expansion • Electric system operational issues
Transportation Fuels	• Uses of transportation and related fuels • Opportunities for alternative transportation fuels • Development of bio-diesel and ethanol production and distribution infrastructure
Economic Development	• Research and development • Retaining and developing jobs in energy-related manufacturing
State Procurement	• Identifying opportunities for improving efficiency in State-owned buildings • Developing procurement policies to support energy-efficient purchases and operations

In the sections that follow, a vast amount of information, analysis and discussion is summarized. This report represents the input of many individuals and organizations working collectively, and provides a foundation for planning for the challenges and opportunities ahead.

Chapter 2: Delaware Energy Profiles and Comparisons

Delawareans, like most Americans, enjoy a modern lifestyle that is very dependent upon the availability and affordability of energy. Energy use in the State can be viewed in several different ways, but the most common ways are to consider the mix of resources used to supply energy *(primary energy)* and the ways in which consumers use energy *(end-use consumption)*. Electricity is of special importance because it involves the conversion of very large amounts of primary energy, mostly in the form of fossil fuels, into another form – electric power for end-use. This conversion involves large losses of energy, which are described in more detail later in this report.

This section provides a current view of Delaware's primary energy and end-use energy consumption. All of the figures and tables in this section are derived from data provided by the Energy Information Administration (EIA)[1].

I. What Resources Supply Our Energy?

Several different "primary energy" resources supply the needs of end users. Primary energy is a basic input to the economy and is measured by the consumption of resources like coal, oil, and natural gas. Primary energy resources can be used directly (like natural gas for heat), refined into more usable products (like refining crude oil for gasoline and other fuels) or converted into different forms of energy (like coal, hydro and nuclear energy for power generation). The current mix of primary energy resources used in all sectors is shown in Figure 1.[2] This figure summarizes the total energy inputs in 1999 for:

- The entire United States (95.5 Quadrillion BTUs)
- The region consisting of Delaware, Maryland, Pennsylvania and New Jersey (8.0 Quadrillion BTUs)
- Delaware alone (0.28 Quadrillion BTUs)[3]

On the basis of fossil fuel consumption, Delaware and the nearby region are practically identical to the nation overall. Fossil fuels provide the largest share of primary energy, accounting for 84% of total primary energy consumption in the U.S. and Delaware. For the region, fossils fuels account for a slightly smaller share, approximately 82%. However, there are two important differences between national, regional and state primary energy consumption profiles:

[1] The last complete EIA data for Delaware was for 1999.

[2] For purposes of tracking energy consumption, the U.S. economy is often divided into the following sectors: residential, commercial, industrial, transportation and utilities. Although the transportation sector, with the exception of alternative fuels, was excluded from the Task Force scope Figure 1 includes all sectors in order to provide an overall view of energy consumption.

[3] A BTU (British Thermal Unit) is the U.S customary unit used to measure energy. One BTU is actually a very small amount of energy. It is defined as the amount of energy needed to raise the temperature of one pound of water by 1 degree Fahrenheit. One Quadrillion BTUs is abbreviated as a "Quad."

- Compared to the nation, the region including Delaware, Maryland, Pennsylvania and New Jersey is nearly twice as dependent on nuclear energy, which is used only for electric power generation.

- Delaware imports about 15% of its total energy supply as electricity. Much of this is generated by fossil-fueled and nuclear power plants in neighboring states. Although imported electricity is not a form of primary energy, it represents an important part of Delaware's total energy supply. Figure 3 includes losses in the electric transmission system to deliver imported electricity, but not the losses that arise from converting primary fuels to electricity at the power plants.

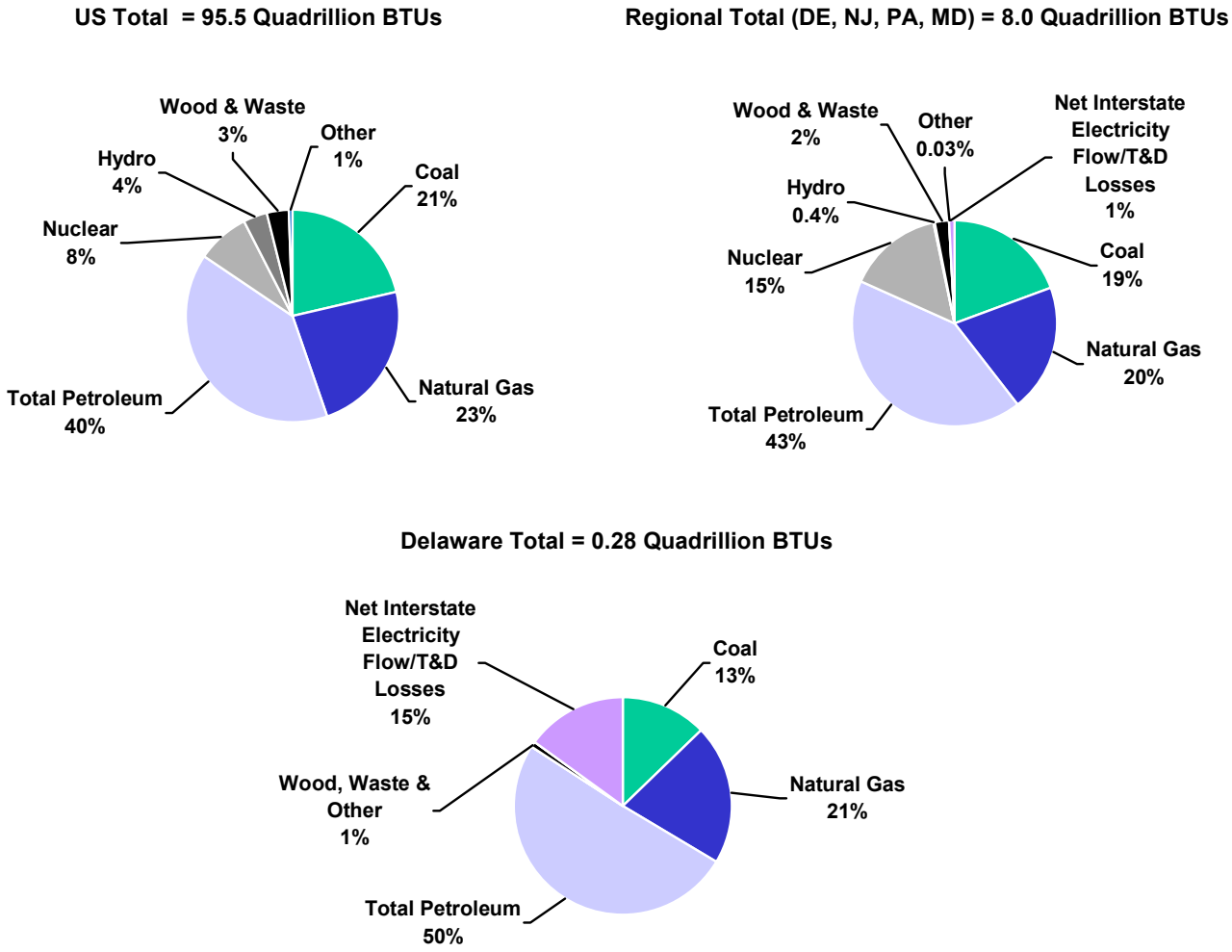


Figure 1: Total U.S, Regional and Delaware Energy Consumption in 1999 (Quadrillion BTUs)

II. The Importance of Electricity

Electricity plays a special role as an "energy carrier." This means that its main function is to deliver energy to end-users in a more usable form than the primary energy resources used to produce it. Because of its convenience and versatility, electricity use is growing at a faster rate than any other form of energy. This reflects the continuing "electrification" of society.

Beginning in the early 1900s, electricity was substituted for other less convenient forms of energy to provide light and motive power. Later, electricity made it possible to power a wide range of equipment in homes and businesses for refrigeration, air conditioning and heating. Rapid advances in communication and information technologies also created new demands for electricity. The importance of electricity to Delaware's economy is indisputable. However, there are three issues related to electricity consumption that have important implications for energy planning:

- Energy losses in electric power generation and delivery, and their associated energy and environmental impacts
- Diversity of resources used to generate electricity
- Price caps

A. Energy Losses in Electric Power Generation and Delivery

Electric power generation and delivery include inherent and significant energy losses. There are two major causes of these losses:

- First, power plants cannot convert all of the energy contained in their primary fuels to electricity. On average, only about 30% of the total energy input at power plants is converted to electricity for delivery to consumers. The most efficient fossil-fueled power plants in service today can achieve efficiencies of only about 50%. The losses inherent in power generation are largely unavoidable and are not addressed by the Task Force.[4]

- Second, there are additional losses when electricity is delivered to consumers through the transmission and distribution systems. Of the electricity generated at the power plant, approximately 5 to 7% is typically lost in transmission and distribution.

These losses are collectively called "electricity system losses." Because of these losses, less than 30% of the energy delivered to a power plant in the form of coal, oil or natural gas can be

[4] Fossil-fueled power plant efficiencies are governed by individual power plant designs. The vast majority of conventional fossil-fueled steam power plants in service today, which account for about 75% of the nation's generating capacity, are limited by both theoretical and practical constraints to efficiencies ranging from about 25 to 40%. Newer gas-fueled combined cycle power plants are more efficient, ranging from 40 to 50%. Efficiencies are constrained by the theoretical limits set by the laws of thermodynamics, and the practical limitations of materials, fuels and major components.

delivered to end users in the form of electricity. Figure 2 schematically illustrates the electric power system. The magnitude of these losses has large implications when considering how to reduce the environmental impacts of power generation. It means that increasing *end-use efficiency and conservation* provide a "three-for-one" leveraging effect – for every unit of electricity saved by end users, about three units of primary energy are saved, and the associated environmental impacts from its conversion are avoided.

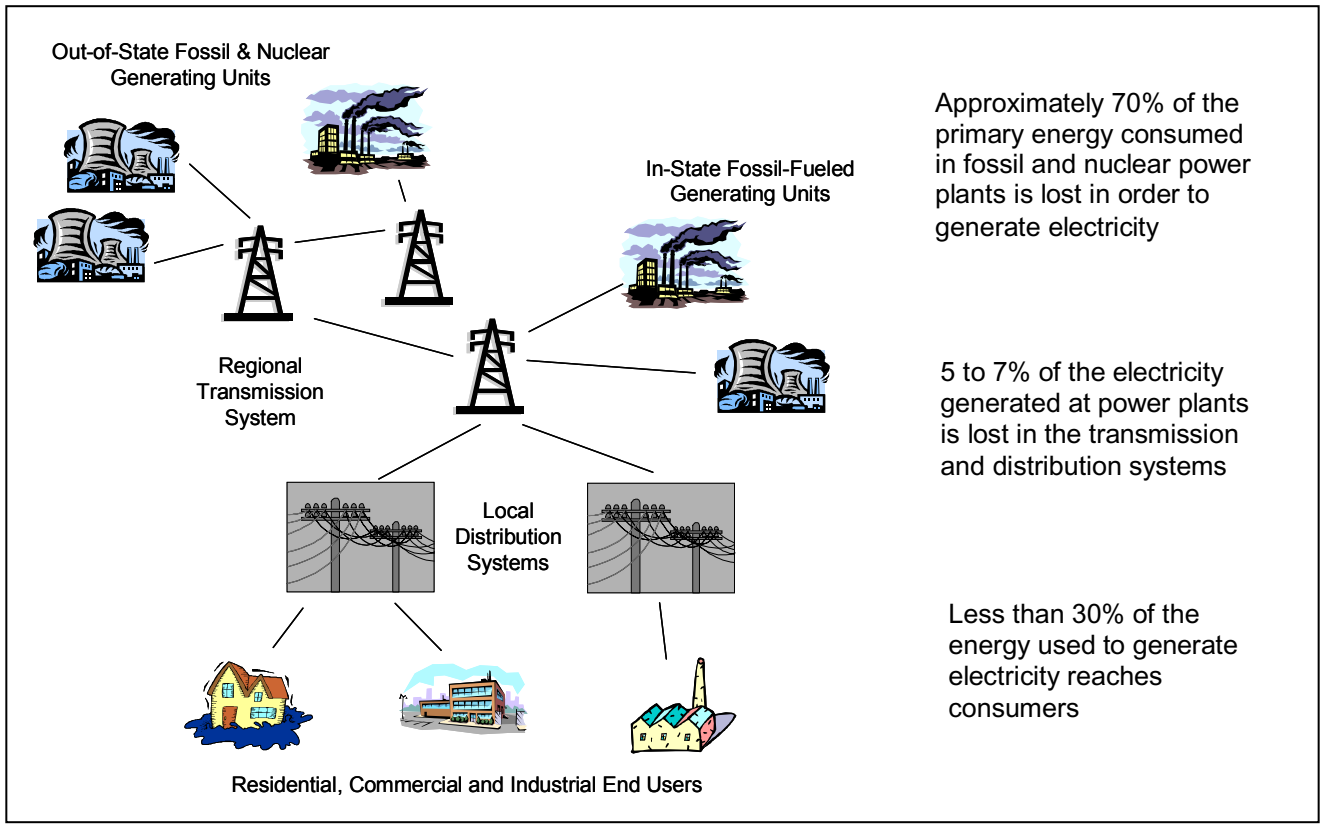


Figure 2: Schematic Illustration of the Electric Power System

The magnitude of the combined generation, transmission and distribution losses is significant. Electricity system losses total more than 25% of all energy consumed in Delaware in all sectors.

B. Sources and Diversity of Electric Power Generation

Fuel diversity refers to the mix of energy sources used to generate electricity. The diversity of fuels used for generating electricity may be viewed in two ways given available data:

1. On the basis of total electricity sales (i.e., the mix of fuels used to generate all of the Megawatt-hours sold in Delaware), and;

2. On the basis of installed generating capacity (i.e., the amount of Megawatt capacity categorized by fuel type in the PJM region and on the Delmarva Peninsula).

Since Delaware purchases much of its electric power from beyond it borders, it is necessary to consider both in-State and out-of-State sources. Generating capacity on the Delmarva Peninsula is heavily concentrated in Delaware and is approximately equal to peak electricity demand. However, for economic reasons, these plants do not supply all of Delaware's needs. This is explained further in the following figures.

As electricity consumption increases, so does the demand for fuels to generate electricity. In Delaware's case, fossil fuels have been the sole primary energy sources for in-State electric power generation. Figure 3 shows primary energy consumption for in-State electric power generation from 1960 to 1999. Until 1985, primary energy consumption for electric power generation in the state was increasing steadily. Since then, it has declined steadily.

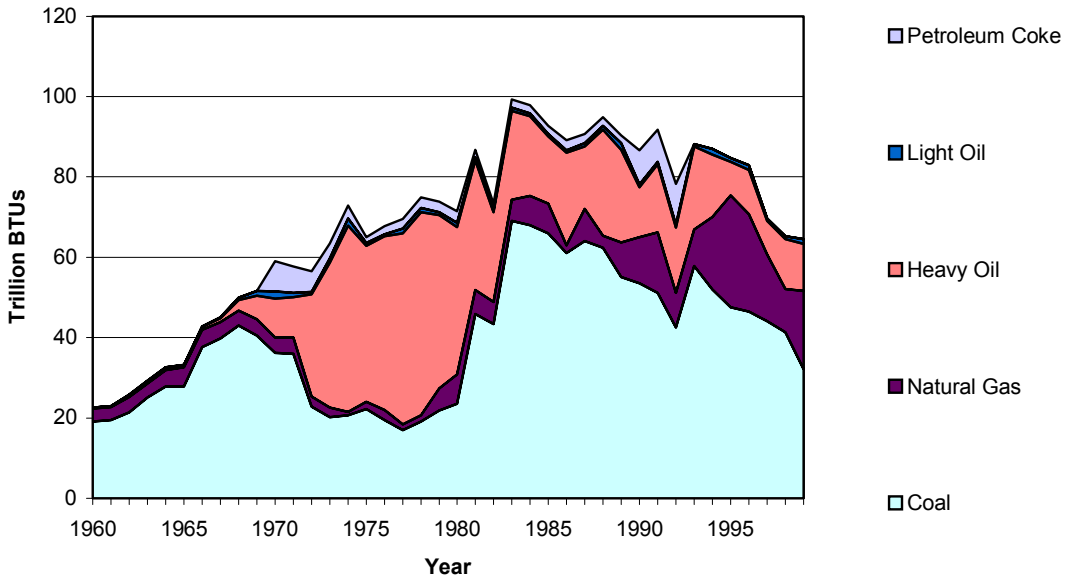


Figure 3: Fuel Consumption for In-State Electric Power Generation

This is shown in more detail in Figure 4 for the period from 1990 to 2000. As this figure shows, total electricity sales have continued to increase even though the amount of electricity generated in the State has decreased. The gap between in-State generation and electricity sales is made up by imports of energy from the PJM Interconnection. As of 2000, approximately 45% of the electricity sold in Delaware was imported from PJM. The most significant factor contributing to this trend is the expansion of the unregulated wholesale electricity market and fixed retail electric rates. These encourage purchases of relatively low cost nuclear- and coal-generated electricity from outside of Delaware.

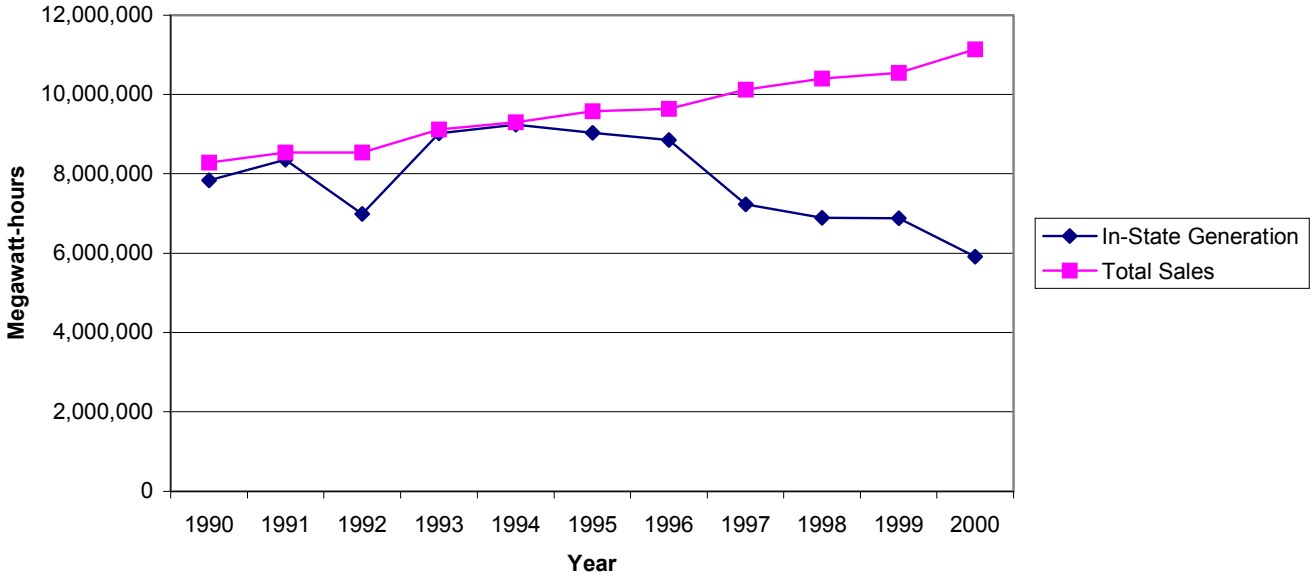


Figure 4: In-State Electric Power Generation and Total Sales Comparison

The fuels used in the installed generating capacity on the Delmarva Peninsula and in PJM are shown in Figure 5. Once again, the amount of generating capacity on the Delmarva Peninsula is approximately equal to demand. However, generating capacity is more heavily weighted towards oil and gas than in PJM as a whole. Since oil and natural gas tend to be more expensive fuels than coal and nuclear energy, this means that generating capacity on the Peninsula is used more for peaking and load following than for base load.

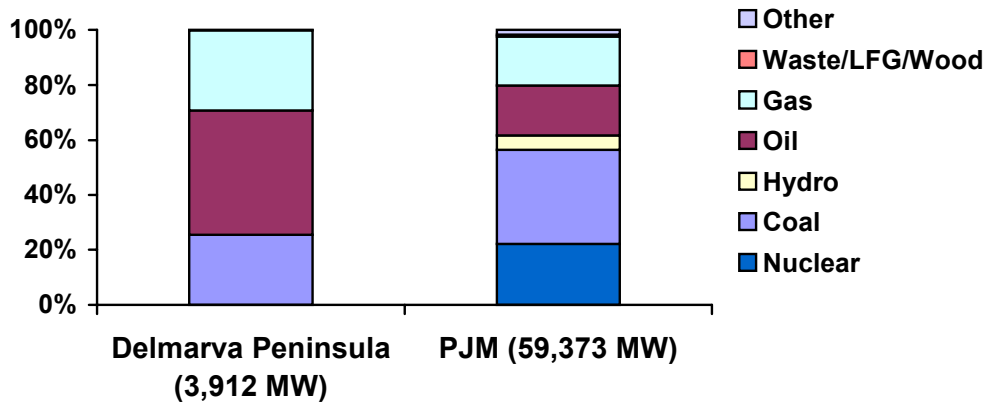


Figure 5: Delmarva Peninsula and PJM Generating Capacity by Fuel Type

Figure 6 shows the fuels used to generate electricity consumed in Delaware, including electricity from out-of-State sources. This indicates that the electricity consumed in Delaware is produced from a mix of fuels that is essentially representative of PJM's resource mix as a whole. This means that electricity consumed in the State is generated primarily from coal and nuclear sources. The balance is generated from a number of different resources including oil, gas, hydro and biomass (wood, waste and landfill gas).

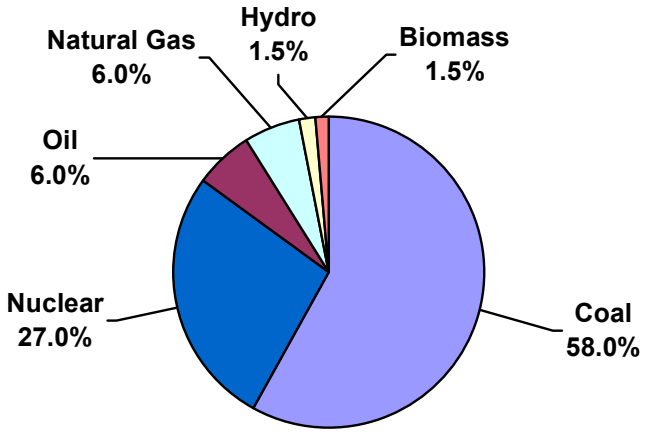


Figure 6: Fuels Used to Generate Electricity Consumed in Delaware

Figure 7 shows the size, distribution and fuels used in the power plants located on the Delmarva Peninsula.

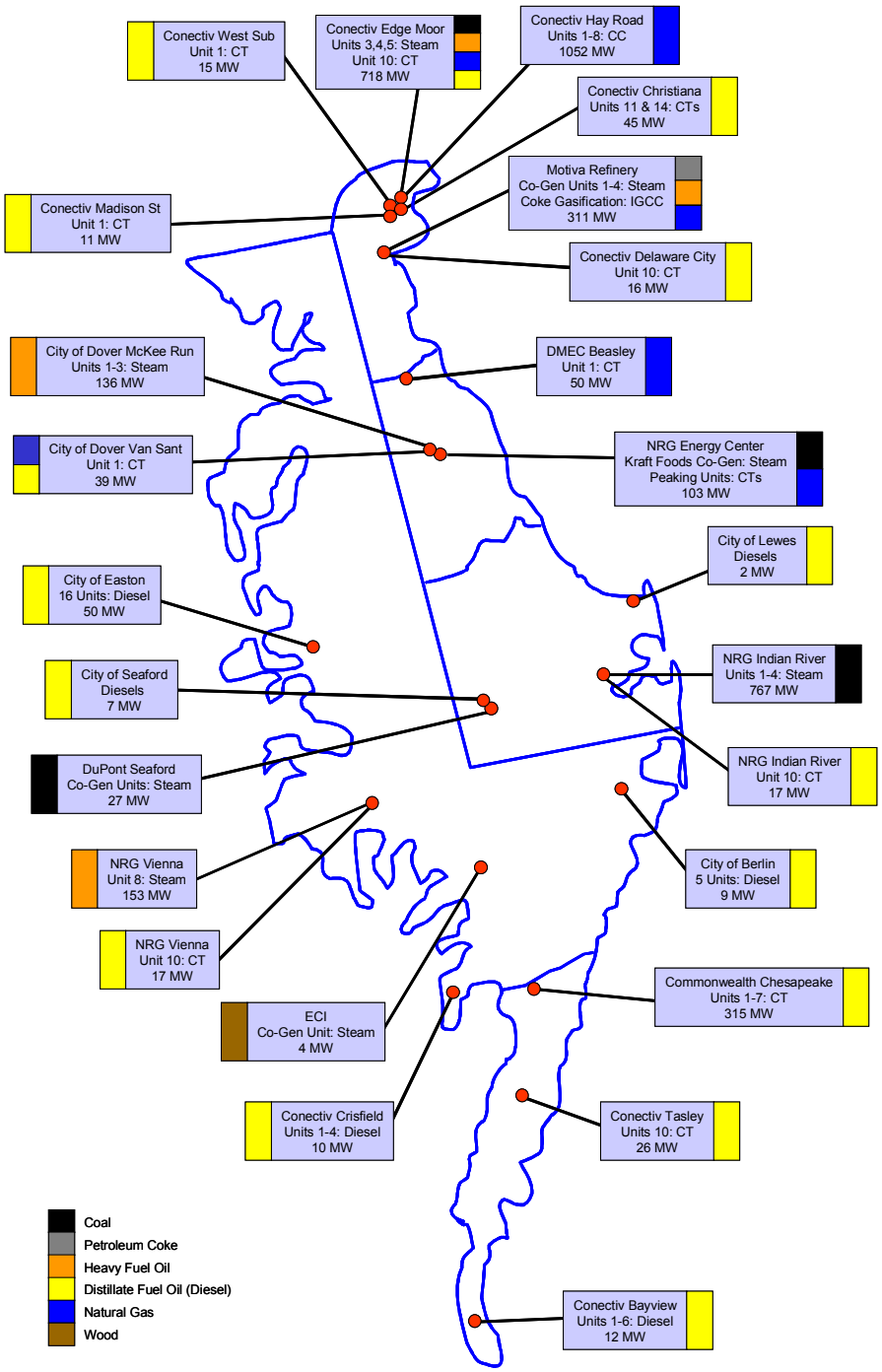


Figure 7: Delmarva Peninsula Power Plants

While there is significant diversity in terms of the fuels used for existing generating capacity, it is clear that most of the electricity generated and consumed in the region comes from two resources – coal and nuclear energy. These account for over three-fourths of the electricity sold in PJM and Delaware. Except for small amounts of hydro and biomass-generated electricity, all of the electricity sold in Delaware, and the larger region, is generated from non-renewable

resources. Improving fuel diversity therefore means insuring continued diversity in existing fuel resources and adding more energy resources that are cleaner.

Under current operating and market conditions, regional dependence on fossil and nuclear fuels for power generation is not likely to change in the near future. Since the early 1990s, virtually all of the new generating capacity constructed within the United States and the region has been fueled by natural gas. Based on current forecasts by the Mid-Atlantic Area Council (MAAC), this trend will continue as more new gas-fueled generating capacity enters commercial operation in the next three years.[5] This has occurred because of the relative cleanliness and low capital costs of gas-fueled power plants, two features that are very important in the unregulated marketplace, and it is likely to continue.

However, increased reliance on natural gas for power generation may create other problems. The same MAAC forecast also expresses concerns about the ability of pipeline capacity within the region to support growing gas-fueled generating capacity and the implications of this for overall reliability. Natural gas prices have also been higher and have recently shown volatility. Increased demand for power generation, along with weather and other factors, forced gas prices upwards by a factor of three or more in parts of the country during the winter of 2002-2003. As recently as June 2003, the Chairman of the Federal Reserve expressed his concern that high natural gas prices could impede economic growth.[6] Recent studies by the U.S. Department of Energy also suggest that increased natural gas imports, in the form of liquefied natural gas (LNG) may be needed to bridge potential supply shortfalls.

In short, enhancing fuel diversity in electric power generation for Delaware apart from the region faces two significant challenges:

- First, Delaware imports about 45% of its electricity, hence its fuel diversity is very dependent on the mix of resources outside of the State and the Peninsula. The amount of imported electricity will continue to be determined by wholesale prices and the costs of transmission.

- Second, for Delaware to alter the mix of fuels used to generate electricity within the State, projects must have economic characteristics that allow them to compete in the wholesale market, regardless of the resource. The dynamics of the wholesale marketplace at the regional level have favored natural gas for most new generation projects. In Delaware, the most recent new generating units have been natural gas peaking and load following units.

C. Electricity Prices and Rate Caps

Since the passage of restructuring legislation in 1999, electricity prices have been capped for residential and small commercial customers of Conectiv Power Delivery and all Delaware

[5] Mid-Atlantic Area Council, 2002 Reliability Assessment for 2003 and 2006, July 2002.
[6] Testimony of Chairman Alan Greenspan on natural gas supply and demand issues before the Committee on Energy and Commerce, U.S. House of Representatives, June 10, 2003.

Electric Cooperative customers. In addition, Conectiv Power Delivery residential electric customers received a 7.5% rate reduction. Rate caps will be lifted for the Delaware Electric Cooperative in March 2005, and in May 2006 for Conectiv Power Delivery. Together, these utilities account for nearly 90% of total electricity sales and customers. Rate reductions and price caps have also been implemented in two neighboring states, New Jersey and Pennsylvania. Caps will be lifted in New Jersey in 2003 and in Pennsylvania in 2006.

The effects of these rate reductions and price caps have been significant. In 1999, according to Energy Information Administration statistics, Delaware had the 16th highest average price of electricity in the nation at 7.12 cents per kilowatt-hour (kWh). By 2000, Delaware's average electricity price had dropped to 28th highest, 6.10 cents per kWh, a net reduction of 14.3%. During the same period, New Jersey's rank dropped from 5th to 11th, but the average rate dropped by only 5.2%. Pennsylvania remained unchanged because rate caps had been implemented earlier.[7]

Rate caps have generally been good for consumers because higher costs due to congestion or other factors have not been passed on. Removing rate caps in Delaware and neighboring states may cause electric rates to increase. Because much has changed in the electricity marketplace since the late 1990s, it is uncertain how large the price increases might be. If price increases emerge, one of the effects is likely to be increased demand for energy conservation, and it is important that information and other options be made available for Delaware consumers.

[7] Energy Information Administration. State Energy Data 1999 and State Energy Data 2000. www.eia.gov.

III. What Are The Environmental Impacts of Energy Consumption?

The use of energy in a modern economy includes inevitable environmental impacts on air, water and land. This summary describes some, although not all, of the impacts of energy consumption on the environment. Particular emphasis is placed on air quality, although the impacts on land and water are also important.

Fossil fuel combustion releases sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), particulates (including $PM_{2.5}$ and PM_{10}), volatile organic compounds (VOC), various air toxics and large amounts of carbon dioxide (CO_2).

The effects of each type of pollutant vary. There are local, regional and global environmental effects, for example: acid precipitation is caused mainly by SO_2 and NO_x; high ground level ozone (smog) is linked mainly to NO_x and VOC; global warming has been associated with CO_2. Emissions also have human health effects. Ground level ozone caused by NOx and VOC has been associated with a variety of respiratory and heart problems, especially in very young and very old people. Likewise, $PM_{2.5}$ and PM_{10} have been implicated in aggravating asthma and other respiratory problems.

In most cases, environmental permits limit emissions of criteria pollutants from stationary sources such as power plants, and Federal standards limit pollutants from vehicles. Limits on emissions from stationary and mobile sources are intended to help meet National Ambient Air Quality Standards (NAAQS). The NAAQS establish limits on the concentrations of certain pollutants based on their effects on human health.

In spite of environmental regulations that restrict emissions from stationary and mobile sources, New Castle and Kent counties are currently classified by the Environmental Protection Agency as "severe non-attainment areas" for ozone under the NAAQS. The State is classified as non-attainment in all three counties under the new 8-hour ozone standard, and is likely to violate a new standard for particulate matter (the "$PM_{2.5}$ standard") in New Castle County. The state is in attainment for levels of other criteria pollutants including sulfur dioxide, nitrogen dioxide and carbon monoxide.

A. Impacts of Energy Use on Air Quality

Energy consumed for transportation, electric power generation and industry account for the largest share of criteria air pollutants and toxic emissions. These emissions are summarized in the following figures and table.

Figure 8 summarizes estimated emissions of three specific pollutants by source: carbon monoxide (CO), nitrogen oxides (NOx), and volatile organic compounds (VOC). Total emissions of all three pollutants are approximately 1,064 tons per day (approximately 388,400

tons per year). The transportation sector, which includes on-road and off-road mobile sources, accounts for approximately 84% of CO, 45% of NO_x and 18% of VOC.

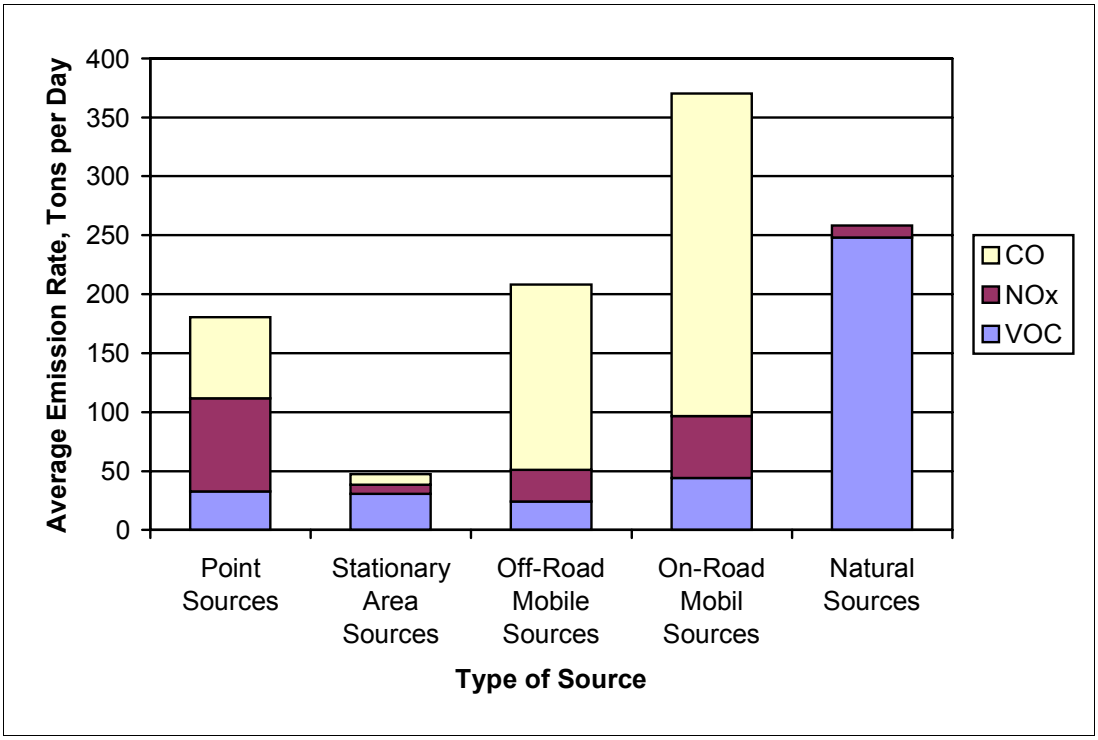


Figure 8: CO, NOx and VOC Emissions from All Sources[8]

More detail is provided in Table 1 for Delaware's stationary point sources, including power plants. Table 1 shows NO_x, SO_2 and mercury emissions from all stationary point sources in the State and the percentage of those emissions from power plants.[9] Over half of the NO_x emitted by stationary point sources is from power plants, while nearly half of SO_2 emissions are from coal and oil fired power plants. Another major source of SO_2 is the Motiva refinery, which produces approximately 35% of total stationary point source SO_2 emissions.

[8] Department of Natural Resources and Environmental Control, "1999 Periodic Ozone State Implementation Plan for VOC, NOX and CO." Note that VOC emissions from natural sources include crops, trees and other vegetation. VOC emissions from natural sources are high in relation to man-made sources, however, vegetation also reduces the concentrations of other pollutants, provide cooling, and generate oxygen.

[9] Data from DNREC presentation: "New Emission Control Requirements for EGUs: 5 Decision Points to Consider." Data for NOx and SO2 emissions from 1999 Emissions Inventory. Data for mercury emissions from 2000 Toxics Release Inventory.

Table 1: NO_x, SO_2 and Mercury Emissions from Point Sources

	NO_x (Tons per Year)	SO_2 (Tons per Year)	Mercury (Lbs per Year)
Total Emissions from Coal & Oil Fired Electric Generating Units	12,012	34,685	425
Total Delaware Point Source Emission Inventory	20,876	77,834	1,553
Coal & Oil Fired Electric Generating Unit Percent of Total	58%	45%	27%

Similarly, Figure 9 shows that power generation also accounts for more than half of the total toxic releases to the environment, including air, water and land. Toxics include acid gases, heavy metals and heavy metal compounds, a wide range of organic chemicals, nitrates and others.

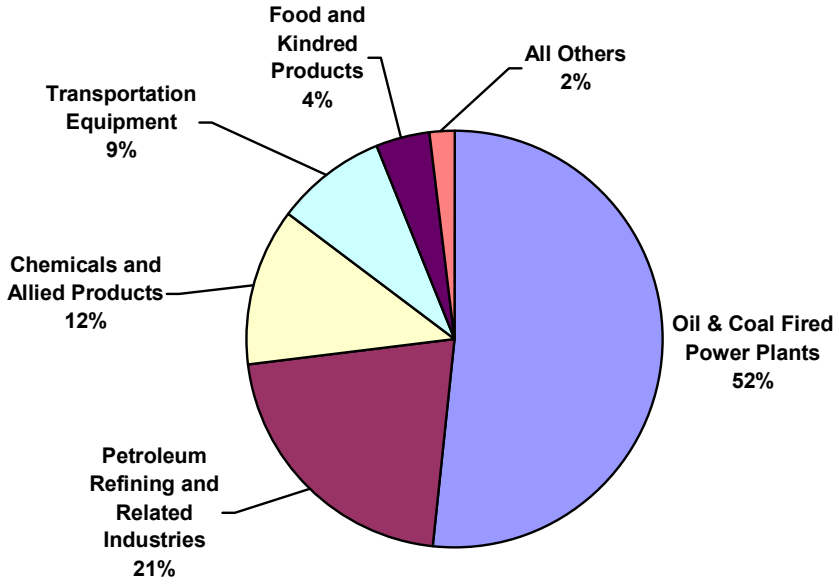


Figure 9: Total On-Site Toxic Releases

Less information is available regarding total particulate emissions (PM_{10} and $PM_{2.5}$). Data provided by DNREC indicates that, while Delaware generally meets NAAQS for PM_{10}, there is relatively little margin for growth in emissions. Transportation sector emissions play an important role in overall levels of these two pollutants. This is especially true for off-road mobile sources, like diesel-powered construction equipment.

It its important to note that emissions from out-of-state sources are excluded. A large portion of Delaware's electricity is imported from neighboring states. Emissions from mobile and stationary sources, including power plants, south and west of Delaware are transported toward the northeast with a direct impact on Delaware's air quality.

B. Climate Change

Fossil fuel use also generates large amounts of carbon dioxide, which is a greenhouse gas and contributes to climate change. The use of fossil fuels of all types in Delaware emits approximately 16 million metric tons of carbon dioxide annually. Approximately 33% of carbon dioxide emissions are a result of burning fossil fuels for power generation. The transportation sector accounts for about 25%, industrial energy consumption accounts for about 21%, and the residential and commercial sectors combined account for the remaining 21% of carbon dioxide emissions.[10]

The potential impacts of climate change on Delaware are summarized in the Delaware Climate Change Action Plan.[11] Climatologic effects cited include increased average temperatures, increases in overall rain and snowfall, increase the number and severity of storms and hurricanes, and increases the frequency of very hot days during the summer. Other likely effects include changes in vegetation and higher incidence of certain diseases and pest problems as changes in local and regional climate alter their historical ranges. Finally, sea level rise would alter coastal areas, change salinity levels in inland bays, affect fisheries, and impact ground water resources.

IV. How Do We Use Energy?

The amount of primary energy used in an economy is a measure of the *energy supply,* but *energy demand* must also be considered in order to have a more complete view. This section of the report provides information about energy demand in the residential, commercial, industrial, and transportation sectors in Delaware. Energy demand is described in two ways:

- By the types of fuels consumed within each sector; and,
- By the types of end-uses within each sector.

It is straightforward to show demand for fuels like natural gas and oil. However, electricity needs to be considered differently because of losses. As discussed earlier, electricity system losses are incurred in the utility sector before the electricity is delivered to end-users. Electricity consumption can be measured directly, but in order to completely account for energy demand, electricity system losses must be allocated to each sector or end use. In the following sections, electricity consumption and allocated electricity system losses are shown separately. The total of electricity consumption and losses indicates the total amount of primary energy used to supply electricity for each sector and end use.

The sectors that are considered are described below:

- *Residential:* Includes all household use of energy.

[10] Byrne, J. B., et. al., Delaware Climate Change Action Plan. University of Delaware Center for Energy and Environmental Policy, Newark, DE, January 2000. pg. 7
[11] Ibid. pp. 20-22.

- *Commercial:* Includes energy use by commercial establishments, public sector buildings, churches, schools, and a wide range of others. This sector may also include certain agricultural end uses, such as energy consumed by farmers, but not the energy used to process food products.
- *Industrial:* Includes a very wide range of manufacturing and process energy consumption
- *Transportation:* Energy consumed by all modes of transportation

The utility sector is not considered separately because electricity consumption and losses have been allocated to the other sectors.

A. Overview of Energy Consumption

A summary of energy consumption within each sector is described in this section. As an overview, Figure 10 shows the share of total energy consumed by each of the four major end-use sectors in Delaware. Electricity losses were allocated to each sector based on its electricity consumption.

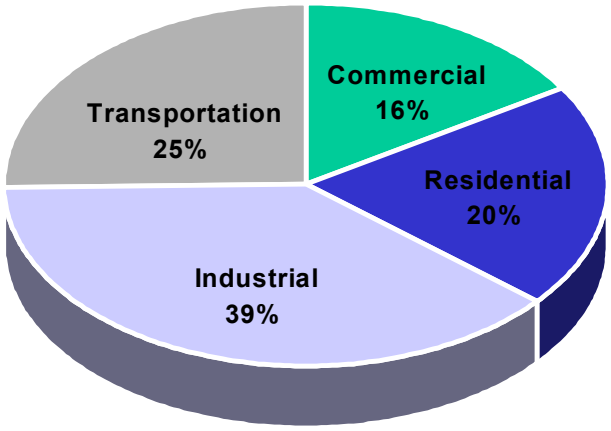


Figure 10: Overview of Delaware Energy Consumption by End-Use Sector

A more detailed breakdown, including specific fuels, is provided in Table 2.

Table 2: 1999 Delaware Energy Consumption (trillions of BTUs)

Sector	*Coal*	*Natural Gas*	*Petroleum*	*Other*	*Electricity*	*Electrical System Losses*	*Total*
Commercial	-	7	4	0	12	23	***46***
Residential	-	10	9	1	12	24	***56***
Industrial	4	23	44	0	12	24	***107***
Transportation	-	-	71	-	-	-	***71***
Total	***4***	***40***	***128***	***1***	***36***	***71***	***280***

To place Delaware's energy consumption in historical perspective, Figure 11 shows trends in the same sectors since 1960.

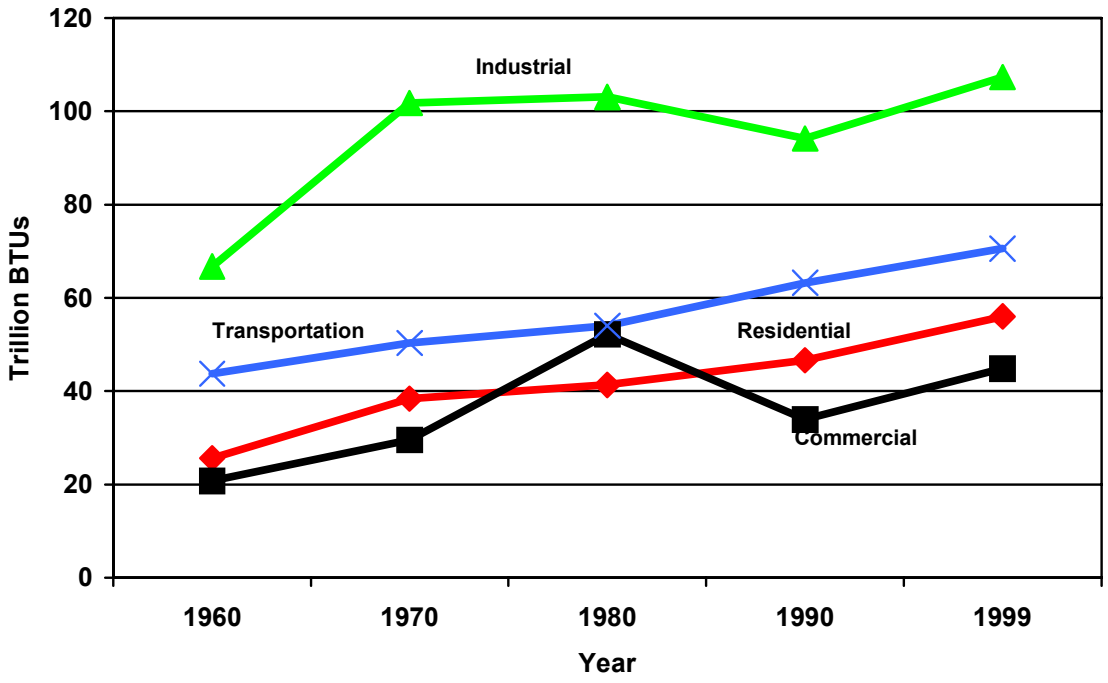


Figure 11: Delaware Energy Consumption Trends

B. Detailed Energy Consumption Within Sectors

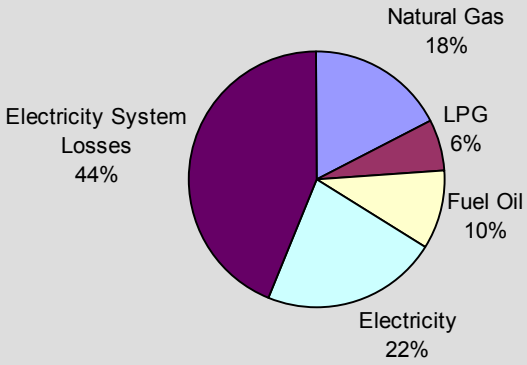
The following sections describe how energy is supplied and typically used within each sector. End-uses include the energy services provided by the various forms of energy delivered to the consumers, such as heating, air conditioning, lighting, motor drives, etc.

i. Residential Sector

In 1999, the residential sector in Delaware consumed a total of approximately 56 trillion BTUs of energy in all forms. The following figures aid understanding how energy was consumed in this sector.

Residential Energy Consumption: Energy Inputs

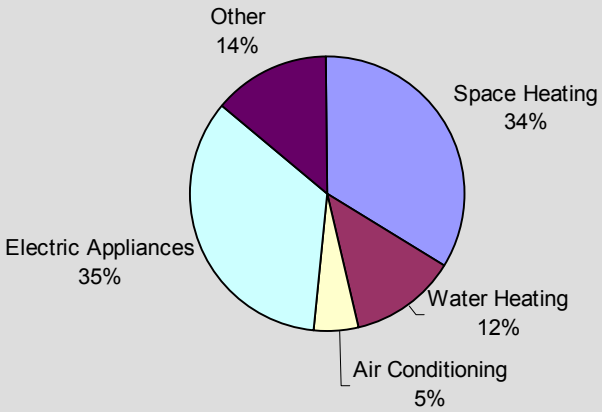
- Two-thirds of the primary energy that is consumed to supply Delaware's residential sector is used to furnish electricity. This includes the electricity directly consumed by end-users and electricity system losses. Natural gas, fuel oil and propane (LPG) that are used directly in homes account for the remainder of energy resources consumed in the residential sector.



Residential Energy Consumption: Major End-Uses

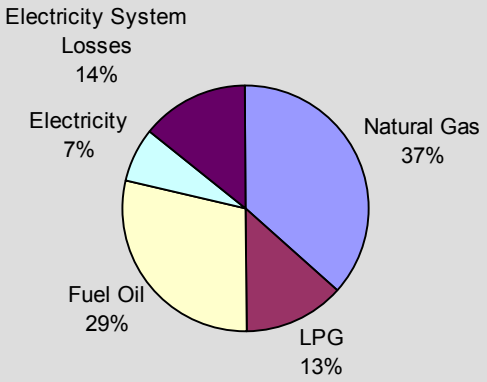
- Among major energy end-uses, space heating accounts for 34% of all primary energy input in the residential sector and is the largest single end-use. In this figure, space heating includes all sources: electricity, natural gas, fuel oil and propane.

- Water heating (including electric) and air conditioning are also large individual end-uses. However, 35% of energy consumption in the residential sector is in a wide array of electric appliances.



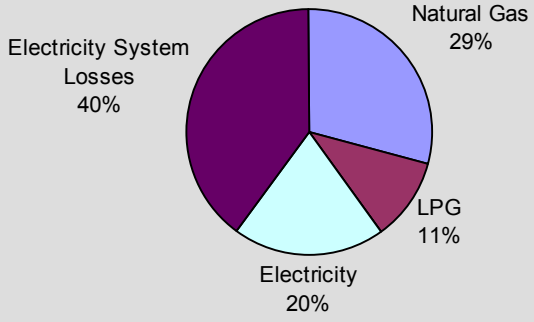
Residential Energy Consumption: A Closer Look at Space Heating

- Natural gas, fuel oil and propane account for 79% of space heating energy consumption. Electricity accounts for 7% of space heating energy provided to end-users (on the basis of primary energy consumption), but for 21% of total primary energy consumption because of electricity system losses.
- Delaware is more dependent than other states on LPG and fuel oil



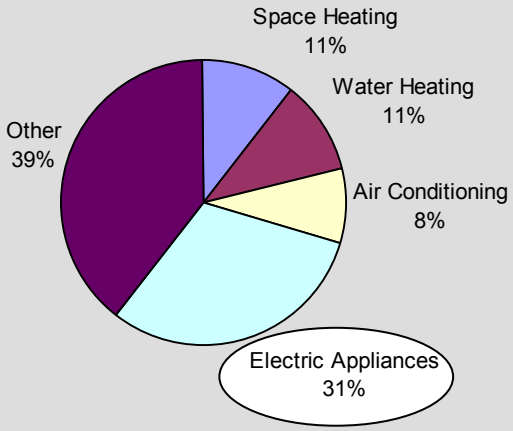
Residential Energy Consumption: A Closer Look at Hot Water Heating

- Electricity accounts for 20% of hot water heating (on a primary energy basis) but for 60% of total primary energy consumed.

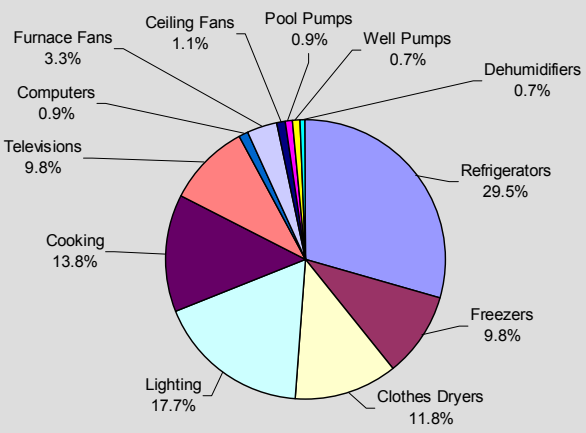


Residential Energy Consumption: A Closer Look at Electricity Use

- About one-third of residential electricity consumption can be traced to space heating, water heating and air conditioning.
- About two-thirds of residential electricity consumption is due to a wide array of appliances and miscellaneous end-uses.



- The electricity consumed by residential appliances can be further broken down. The largest electricity-consuming end-uses are refrigerators, freezers, clothes dryers and lighting.
- Other small end-uses for electricity abound, but are either very difficult to quantify or may be impractical to address through efficiency improvements.



The preceding figures also lead to several conclusions about how to address improvements in residential sector energy efficiency:

- Space heating, water heating, air conditioning and major electric appliances account for the majority of energy consumption in the residential sector. Therefore it makes sense to prioritize these areas for efficiency improvements.

- Delaware depends more heavily on fuel oil and LPG (propane) for residential heating than other states, partly because natural gas is not available in many areas of the State. Efforts to increase the efficiency of residential heating systems should specifically include fuel oil and LPG heating equipment, as well as electric and natural gas systems.

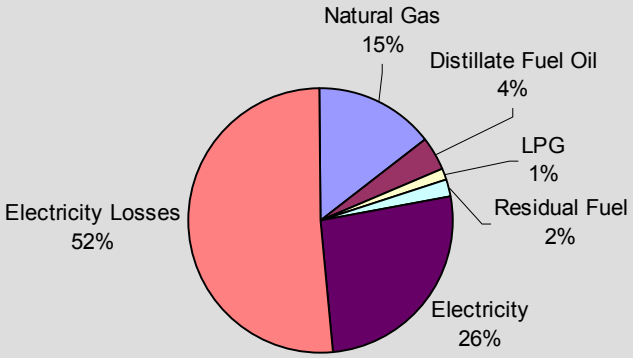
- Building envelope measures aimed at reducing thermal losses are important complements to space heating and air conditioning equipment programs.

ii. Commercial Sector

The commercial sector is also Delaware's fastest growing sector. In 1999, the commercial sector in Delaware consumed a total of approximately 46 trillion BTUs of energy. In comparison to the residential sector, the energy end uses were less varied in the commercial sector, but are heavily concentrated on the use of electricity. The following figures help to understand how energy was used in the commercial sector.

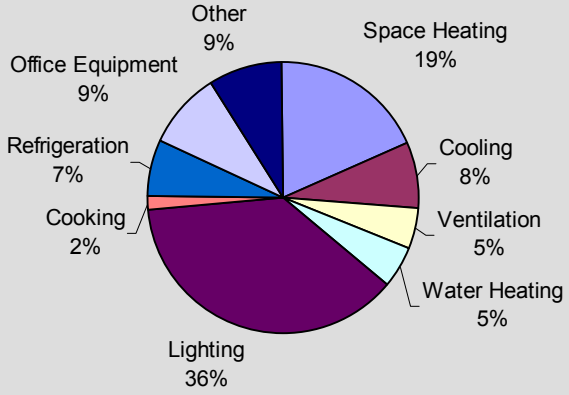
Commercial Energy Consumption: Energy Inputs

- Electricity is the dominant form of energy used in the commercial sector. Nearly 80% of commercial sector energy input is electricity and electricity system losses. Natural gas accounts for nearly all the remaining energy consumption, mainly for space heating.



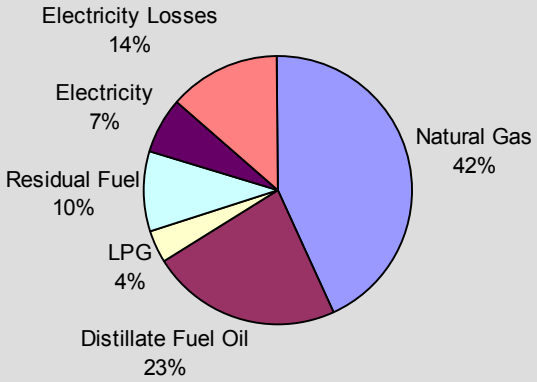
Commercial Energy Consumption: Major End Uses

- End-uses that consume electricity are dominant in the commercial sector, especially lighting, which accounts for over one-third of commercial sector energy consumption. The next largest end-use is space heating, which accounts for approximately 19% of total energy end-use.



Commercial Energy Consumption: A Closer Look at Space Heating

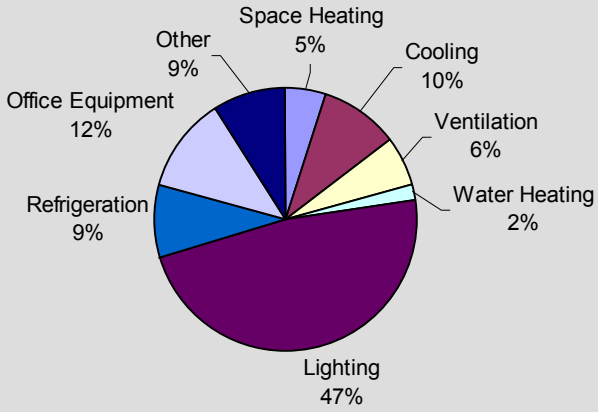
- Natural gas and oil (including distillate oil and residual oil) account for approximately 79% of commercial space heating. Like the residential sector, electricity provides about 7% of space heating energy (on a primary energy basis), but accounts for 21% of total primary energy consumed for heating.



Commercial Energy Consumption: A Closer Look at Electricity Use

- When electricity end-uses are examined, lighting is the largest single end-use, accounting for about 47% of total electricity consumption in the commercial sector. In comparison, electric heating, air conditioning, ventilation and electric hot water heating combined account for 23% of total electricity consumption.

- Other major electricity end-uses are office equipment, and commercial refrigeration systems.



From the preceding figures, several conclusions can also be made about commercial sector energy efficiency:

- Because the sector is very electricity intensive, highest priority should be placed on measures that improve electricity end-use efficiency.

- Lighting, electric space heating, air conditioning, commercial refrigeration and office equipment efficiency are logical targets for efficiency improvements.

- Like the residential sector, building envelope measures aimed at reducing thermal losses should complement space heating and air conditioning efficiency improvements.

iii. Industrial Sector

Delaware's industrial sector is the largest end-use sector in the State. In 1999, industrial end-users consumed a total of approximately 107 trillion BTUs of energy from all sources. Unlike residential and commercial energy end uses, the industrial sector is difficult to characterize accurately because of a lack of Delaware-specific data. As a result, the following figures are partly based on national averages.

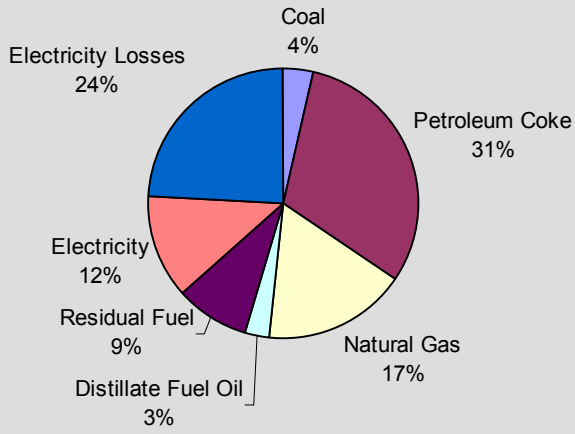
The industrial sector in Delaware is energy-intensive compared to surrounding states and states of similar size. The reason for this is that two major end-users account for about half of industrial sector energy consumption. The Motiva refinery processes very large amounts of oil and oil products in its refinery in Delaware City. Crude oil feedstock and fuels used in the refinery are recorded by the EIA as energy consumed in Delaware. This is somewhat misleading since refined products are sold in a regional market. Likewise, OxyChem's chlor-alkalai production facility in Delaware City uses an electricity-intensive electrolytic process. This plant uses approximately 13% of the electricity consumed in Delaware's industrial sector.

Industrial energy end-users are also a very diverse group. Energy intensive industries, especially those owned by large parent companies, tend to be very sophisticated about energy use and have access to technical and capital resources. In very large and/or energy-intensive industrial plants, many of the opportunities for efficiency improvements are in areas that require highly specialized expertise.

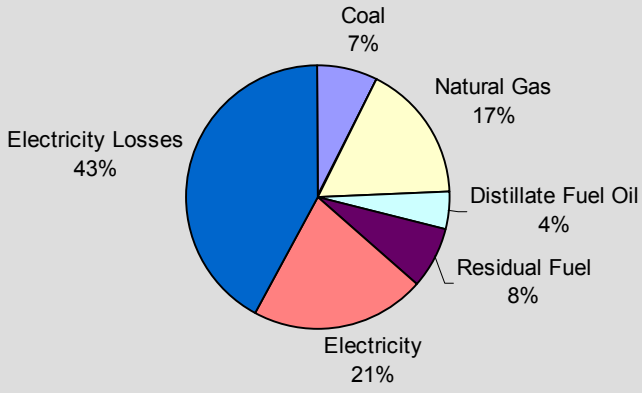
Industrial Energy Consumption: Energy Inputs

- The industrial sector in Delaware is generally less electricity intensive than the residential and commercial sectors because fuels like natural gas and oil are used directly to provide process heat instead of electricity.

- A significant feature of industrial energy use is the large amount of petroleum coke consumed. Petroleum coke is a byproduct of oil refining and accounts for about 31% of total energy consumption in the industrial sector. In Delaware, petroleum coke is used at the Motiva refinery mainly to generate electricity and steam that are used in the refinery.

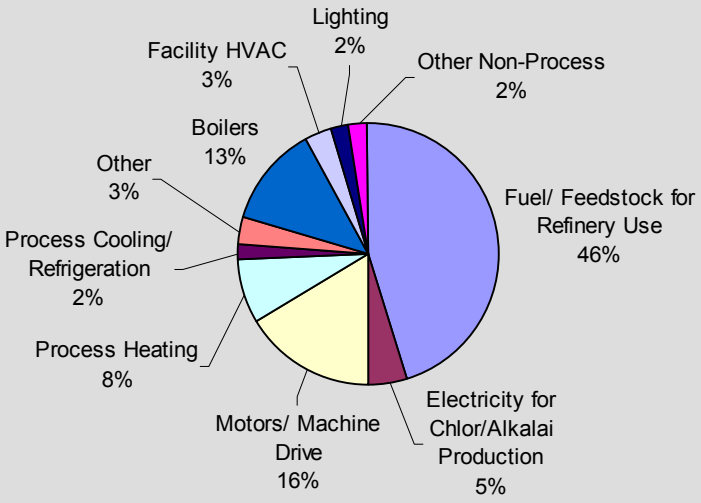


- The distribution of energy consumption changes if the two major end-users are taken out of the data. When this is done, electricity and electricity system losses account for approximately 64% of total industrial consumption. Petroleum coke disappears altogether because it is not used outside of the refinery.

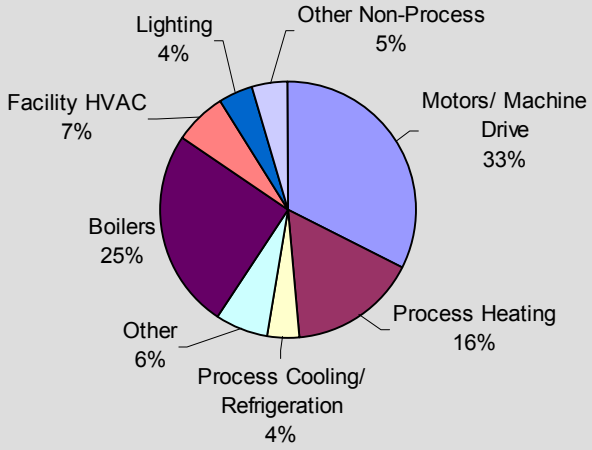


Industrial Energy Consumption: Major End Uses

- 46% of all primary energy input in Delaware's industrial sector is either feedstock or fuel for the Motiva refinery. The largest end-use after this is for motors and machine drives.

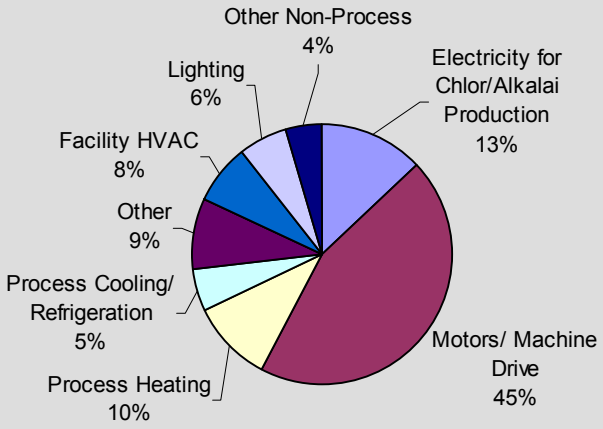


- In the absence of the influence of the two largest end-users, the share of energy consumed by specific end uses shifts significantly. Motors and machine drives clearly become the largest energy end use in the industrial sector, followed by boilers and process heating. This is not surprising, since nationally the main use of fuels in the industrial sector is to produce steam or other forms of heat for countless processes.



Industrial Energy Consumption: A Closer Look at Electricity Uses

- The largest end-use for electricity in the industrial sector is electric motors. Motors are used extensively in nearly all industrial facilities.
- Chlor-alkalai production is very electricity-intensive, using approximately 13% of all of the electricity consumed in the industrial sector.



Some conclusions about the industrial sector are summarized in the following points:

- Industrial sector energy consumption is dominated by a few end-uses. Fuels are used primarily in boilers and for direct process heating. Electricity is used predominantly to operate electric motors.

- The priorities for efficiency improvement in the industrial sector are:

    - Motor efficiency to reduce electricity consumption in this sector
    - Boiler efficiency, maintenance practices and proper sizing to reduce fuel consumption for steam and hot water production.
    - Process heating system efficiency to reduce fuel consumption for drying, curing, and other industrial heating process.
    - Combined heat and power generation (CHP) to improve overall fuel utilization efficiency

- The end-users with potentially the greatest needs are small to medium sized firms with limited access to expertise and capital.

iv. Transportation Sector

The transportation sector differs significantly from the residential, commercial and industrial sectors because of its almost total dependence on petroleum. More than 383,000,000 gallons of gasoline were consumed in Delaware in 2000. Nearly 97% of this gasoline was used in on-highway vehicles.[12] With the exception of public sector use, virtually all gasoline consumption is taxable. In the same year, diesel fuel (Number 2 Fuel Oil) consumption totaled over 182,000,000 gallons. Unlike gasoline, diesel fuel is used in a broader range of applications. This is shown in Figure 12. In fact, only about one-third of total diesel fuel consumption is for taxable, on-highway transport applications. Approximately the same amount is used for residential, commercial and industrial space and process heating applications. The remainder is used in several off-highway, farm and marine applications.

The primary reason the Task Force considered fuel consumption in the transportation sector was to assess the potential applications of alternative fuels as substitutes for petroleum-based fuels to improve diversity in this sector.

[12] Sources: Energy Information Administration, Fuel Oil and Kerosene Sales 2000 and Federal Highway Administration, Motor Fuel Use 2000

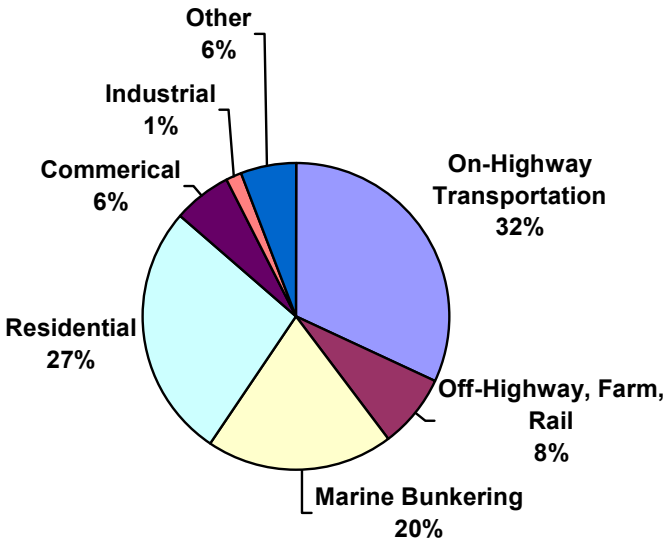


Figure 12: End Uses for Diesel Fuel (No. 2 Fuel Oil)

Chapter 3: Energy Forecasts

A reasonable question, given all of the preceding information is: "Where are we going?" This section presents two possible answers. The first answer centers on "business-as-usual" forecasts, which assume smooth growth in energy consumption tied to population and economic growth. In many respects, these forecasts are extrapolations of historical trends.

I. "Business-As-Usual" Forecasts

In the absence of any policy changes or major disruptions, Delaware can be expected to follow a "business-as-usual" trajectory. Forecasts are provided for four important energy resources: electricity, natural gas, distillate heating oil and propane. These forecasts provide one vision of future energy consumption as well as a benchmark for comparison against alternatives.

The second answer depends on the effects of policy changes, incentives and other measures to change the trajectory of the "business-as-usual" forecasts. In January 2000, the University of Delaware Center for Energy and Environmental Policy (CEEP) published the Delaware Climate Change Action Plan (DCCAP).[13] The DCCAP provides an array of recommendations intended to alter business-as-usual. The DCCAP was a two-year collaborative effort led by CEEP researchers and sponsored by the State Energy Office and the U.S. EPA State and Local Climate Change Program. Numerous stakeholders from the private and public sectors provided input. The purpose of the plan was to analyze greenhouse gas emissions and possible policy measures to reduce future emissions.[14] Since greenhouse gas emissions, especially carbon dioxide, are tied very closely to energy consumption, the DCCAP provides a foundation on which to build alternatives.

An overview of business-as-usual energy and greenhouse gas emissions forecasts for each of Delaware's major end-use sectors is provided by the DCCAP using 1990 as the baseline year. These forecasts are summarized in Table 3 below:

Table 3: DCCAP Energy End-Use Consumption Forecasts[15]

Sector	*1990 Energy Consumption (Trillion BTUs)*	*2010 Energy Consumption (Trillion BTUs)*	*Annualized Growth Rate (%)*
Residential	26.7	33.4	1.1
Commercial	16.3	28.9	2.9
Industrial	75.5	105.0	1.7
Transportation	55.6	68.6	1.1
TOTAL	174.1	235.9	1.5

More detailed forecasts for specific resources are provided in the following section.

[13] The complete report is available at www.udel.edu/ceep/reports/deccap/deccap.htm.
[14] This level of reduction to 7% below 1990 levels was tied to the Kyoto Protocol. Although the Kyoto Protocol was not ratified by the United States, it provides a useful benchmark for comparison.
[15] Byrne, J. B., et. al., op. cit., pp. 35, 51, 61, 69. The energy consumption figures in Table 3 are for end-use only and do not include electricity system losses.

A. Electric Power

Base-case load growth forecasts indicate that Delaware's consumption of electricity will increase at a rate of slightly over 2% annually for the next decade. Figures 13 and 14 show business-as-usual forecasts for growth in Gigawatt-hour (GWh) consumption for Delaware and corresponding peak load growth for the entire Peninsula in MW. Growth in base load at this time is being met by increased purchases of energy from PJM, and this is likely to remain the most cost-effective means of meeting base load requirements. Growth rates in southern Delaware are expected to be substantially higher as new residential and commercial development spreads. Parts of Sussex County may experience growth rates exceeding 10% annually for at least part of the forecast period. Given the rates of load growth, additional generating capacity will be required to meet future needs on the Peninsula. However, much of the load growth is taking place in areas that are also constrained by the transmission infrastructure. As load grows, constrained transmission operations and associated higher costs could become more frequent in the absence of either transmission or generation investments.

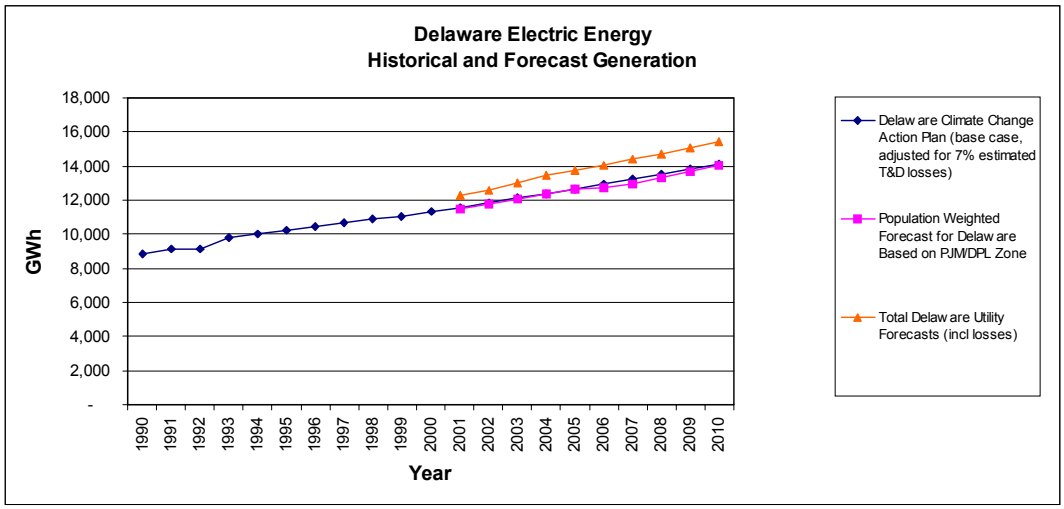


Figure 13: Delaware Historic and Forecast Electric Energy Requirements

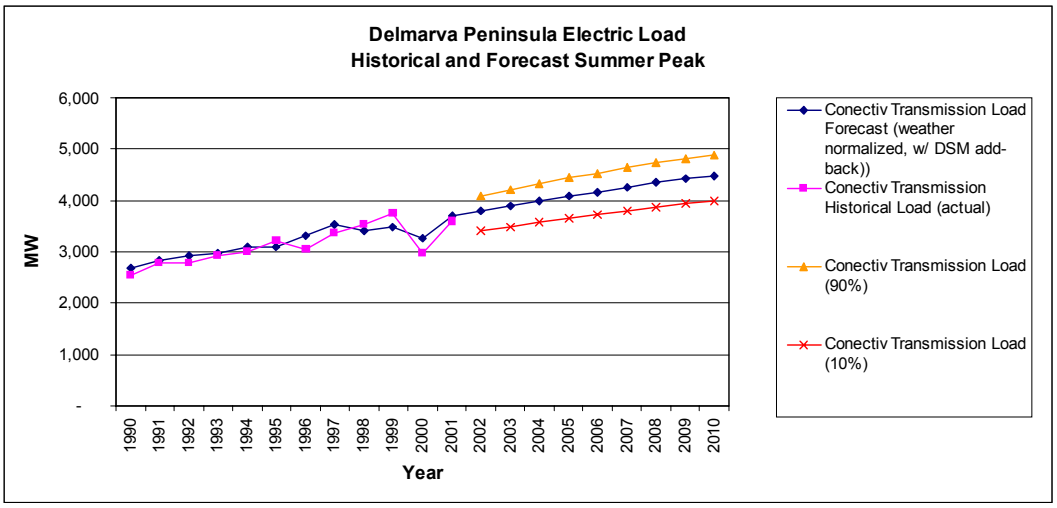


Figure 14: Delmarva Peninsula Historic and Forecast Summer Peak Loads

B. Transportation and Other Fuels

Figure 15 shows projected consumption of motor gasoline, diesel fuel and compressed natural gas through 2012, based on EIA data. This data was estimated using forecasts for the larger Census Region, adjusted for Delaware's population. Annual growth projected by the EIA is approximately 2.3%, which is higher than the DCCAP forecast.

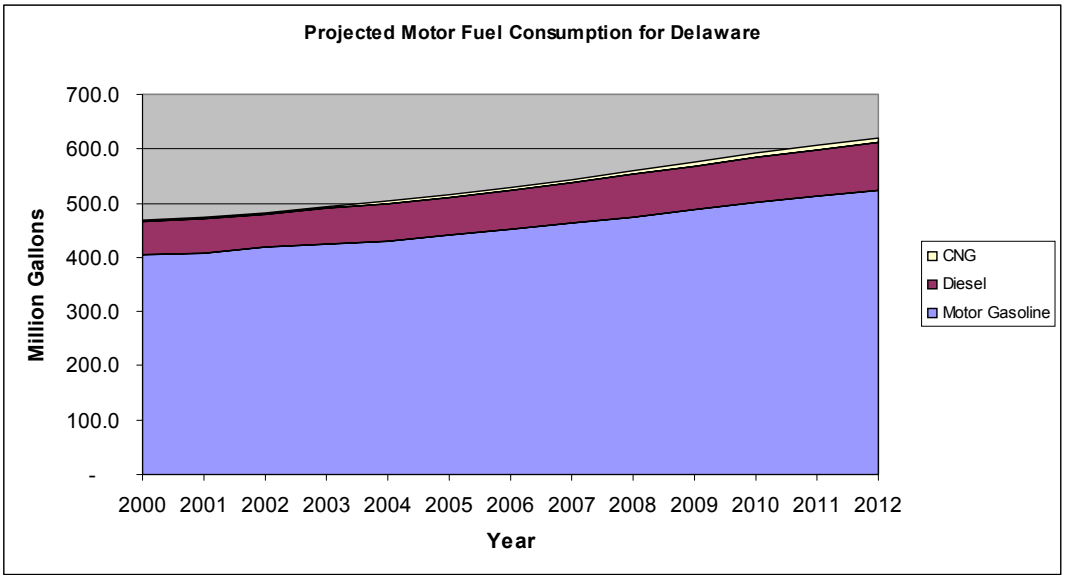


Figure 15: Delaware Forecast Motor Fuel Consumption

EIA data and utility forecasts were used to compile a forecast for natural gas. Figure 16 is divided into three major end-use categories: residential, commercial and industrial, which is

consistent with EIA data. The utility forecasts for industrial gas consumption include pipeline transportation customers.[16] Gas consumed for electric power generation is not shown in Figure 16.

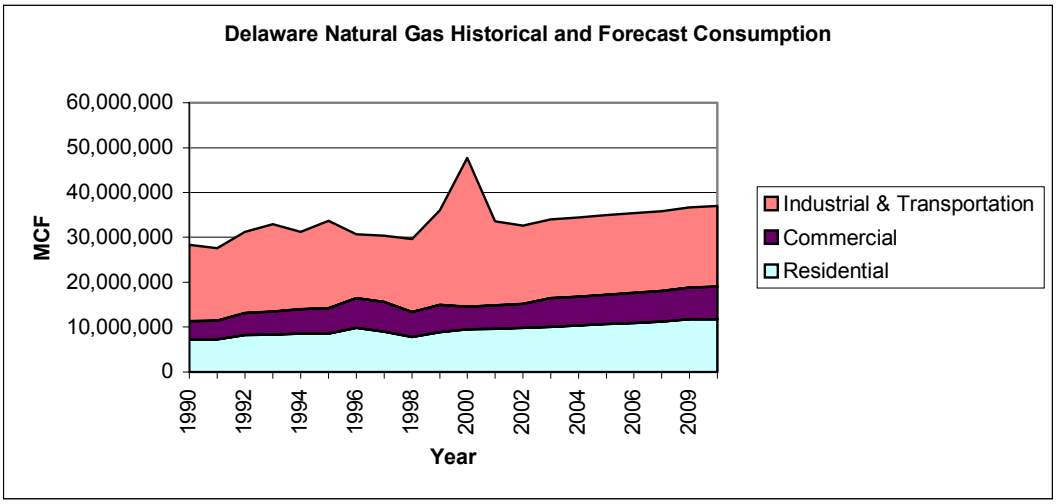


Figure 16: Delaware Natural Gas Forecast by End-Use Sector

The forecast data for residential and commercial consumption show a smooth continuation of the upward trend in actual consumption from 1990 through 2000. Historical industrial consumption, as recorded by the EIA data shows a very large increase in recorded consumption between 1999 and 2000. This occurred due to a very large short-term increase in gas consumption on the part of one industrial customer. Following this spike in consumption, overall gas consumption in the industrial sector resumes a smooth upward trend consistent with trends in the residential and commercial sectors.

Using this data, natural gas consumption is expected to increase by approximately 1.2% annually from 33,900,000 MCF to 36,900,000 MCF by 2010.

A major uncertainty in forecasting natural gas demand is the potential expansion of natural gas service. If service were expanded significantly, especially in the fast growing areas of southern Delaware, natural gas consumption would be much higher than indicated by the forecast. Natural gas is also expected to be the preferred fuel for distributed power generation. Increases in distributed generation capacity at end user sites could also affect natural gas consumption forecasts.

Unlike electricity and natural gas, regulated companies do not distribute distillate heating oil and propane. Fuel oil and propane distributors consider their forecasts confidential business information, and do not make them available.

[16] Natural gas pipeline transportation customers are those who purchase the gas commodity from a supplier other than the local gas distribution company (LDC). The LDC provides transportation service only in these cases. The EIA does not distinguish between transportation-only and full service LDC customers when recording gas consumption data for the various sectors. Since transportation customers are almost exclusively in the industrial sector in Delaware, their gas consumption is included in the industrial sector.

Distillate heating oil and propane use is expected to increase in Delaware, although they cannot be forecast with confidence. Consumption of both fuels varies significantly because of weather, electricity prices, and natural gas availability. Both fuels are important alternatives to electricity and natural gas. Current annual consumption of propane in Delaware is approximately 4 trillion BTUs. Propane is especially important in rural areas for residential and commercial space heating, water heating and cooking. Propane is also unique since it is a byproduct of natural gas production and oil refining. This makes it relatively price inelastic because supply cannot easily be increased as demand increases.

Current annual distillate heating oil consumption is approximately 11.5 trillion BTUs. This type of fuel is used for residential and commercial space heating in many areas where gas service is unavailable. It is also used in some industrial and commercial facilities as a back up fuel when natural gas is purchased on an interruptible basis. Distillate oil is also used to by electric utilities to generate small amounts of electricity, primarily during peak demand periods.

II. An Alternative to "Business-As-Usual"

If the business-as-usual forecasts are accepted, Delaware can expect the following increases by about 2010:

- Growth in electricity consumption from 11,900 to 14,100 GWh, or about 18.5%
- An increase in peak electricity demand of approximately 800 MW, or about 18%
- Growth in natural gas consumption from 33,900,000 to 36,900,000 MCF, or about 8.8%
- Increased total fuel oil consumption for residential, commercial and industrial use from about 1.98 to 2.10 million barrels, or about 6.1%[17]
- Increased motor fuel consumption from about 9.83 to 12.07 million barrels or about 23%.[18]

If correct, these figures represent a total increase in end-use consumption of nearly 17% in less than eight years. Electricity and petroleum-based transportation fuels would supply much of this increase. The increased environmental impacts can be expected to be proportional to higher consumption levels.

The alternative proposed by the DCCAP is based on three scenarios tied to a wide range of energy efficiency measures. The three scenarios represented different penetration levels of the efficiency measures: "Modest Commitment" (35%), "Major Commitment" (65%) and "Full Implementation" (100%).

The "Major Commitment" scenario reflects reducing total end-use consumption to a level of 161.9 trillion BTUs over the ten-year period beginning in 2000 and ending in 2010. The total reduction from the business-as-usual forecast in 2010 would be approximately 31% at this level.

[17] Applied Energy Group, Inc. Delaware Non-Transportation Energy Supply Forecasts. November 2002. (Forecasts for electricity, natural gas and fuel oil)
[18] Derived from EIA forecasts shown in Figure 22.

Could Delaware achieve such a reduction? Although the Task Force does not propose adopting a specific efficiency target, it should be noted that the most energy-efficient states are already 25% or more below Delaware's per capita energy consumption level. On this basis, such efficiency levels are achievable, and the DCCAP played an important role in developing detailed recommendations for conservation and efficiency measures by providing a reasonable framework.

The basis for measuring Delaware's energy efficiency will require further study. This should include a discussion on the best measures for evaluating Delaware's energy consumption in each of its sectors, and evaluating on-going trends in production, consumption and end-uses. However, there are clearly opportunities to improve efficiency and reduce energy intensity, regardless of how the overall results are measured.

Chapter 4: Findings and Recommendations

Faced with the challenges of improving energy efficiency, increasing diversity, protecting the environment, maintaining reliability and enhancing economic development, the Task Force and the Working Groups embarked on fact finding and analysis, followed by the development of policy options in all areas. Detailed findings and supporting information for the individual working groups are available in Appendices C through F.

This chapter summarizes the findings and recommendations of the Delaware Energy Task Force. It is divided according to nine strategy areas described in the Introduction section:

- Strategy 1: Reduce the Environmental and Economic Costs of Energy Consumption Through Improvements in End-Use Efficiency and Conservation
- Strategy 2: Reduce the Environmental Impacts of Electricity Generation by Encouraging Clean and Renewable Energy Generation
- Strategy 3: Reduce the Economic Impacts of Transmission Congestion
- Strategy 4: Promote Clean Distributed Generation
- Strategy 5: Promote the Availability of Natural Gas
- Strategy 6: Promote Alternative Transportation Fuels
- Strategy 7: Promote Economic Development by Encouraging Advanced Energy Technology Development
- Strategy 8: Implement Energy Efficiency, conservation and Renewable Energy in State Government
- Strategy 9: Continue the Planning Effort to Insure that the Long-Term Goals are Met

Within each area, findings and background information are provided first, followed by current activities, recommendations and items identified for further study. Each recommendation is prioritized and supporting recommendations and costs and benefits are also provided, if applicable.

The sections are organized into broad issue areas since there is considerable overlap in many of the recommendations submitted by the working groups for the Task Force's consideration.

I. Strategy 1: Reduce the Environmental and Economic Costs of Energy Consumption Through Improvements in End-Use Efficiency and Conservation

Conservation and efficiency improvements are the foundation on which many other options are based. In fact, continued efficiency improvements have been responsible for "supplying" most of the increased demand for energy services for many years. In this sense, energy efficiency is Delaware's largest potential energy resource. This is illustrated by Figure 17, which shows the relative contributions of conventional resources and energy efficiency towards meeting the demand for energy services in the U.S. since 1970. Another way of looking at this figure is that if "business-as-usual" had continued from 1970 to the present, annual energy consumption would be approximately 40% higher than it is today.

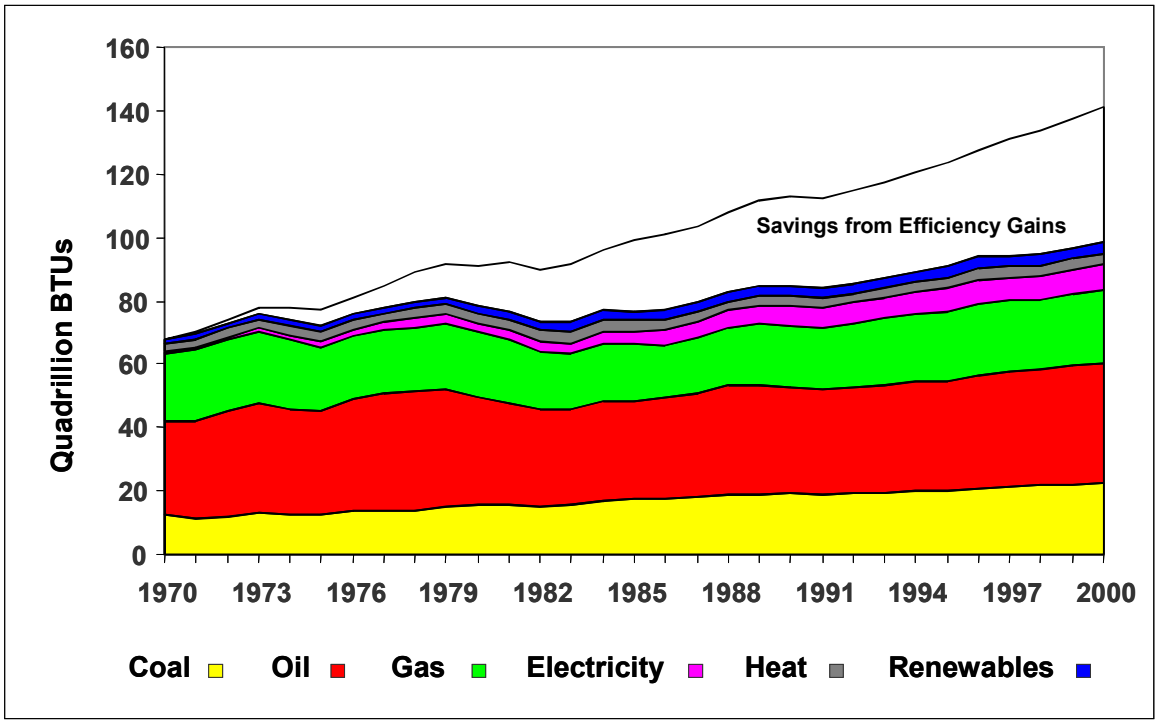


Figure 17: U.S. Energy Efficiency Gains Since 1970[19]

One of the implications of this figure is that economic growth and energy consumption are not inextricably linked. During the same period, the U.S. Gross Domestic Product grew by 157% in real terms while energy consumption increased by approximately 46%.[20] It is also important to note that the efficiency improvements represented here are not the result of market forces alone; policies intended to foster higher efficiency also played an important role.

[19] From "Energy Efficiency, Renewable Energy and Economic Development: Trends and Prospects," presented to the Economic Development Working Group by Dr. John Byrne, Director, University of Delaware CEEP, October 3, 2002.

[20] GDP statistics available from U.S. Bureau of Economic Analysis (www.bea.gov). U.S GDP growth is based on 1996 dollars for the period from 1970 through 2000.

Numerous policies and measures intended to promote energy conservation and efficiency were considered. Effective measures that can improve efficiency at the state level can be categorized as follows:

- *Education and Outreach:* Educational programs provide the core of many other types of programs, including financial incentives, and are viewed as the first step towards achieving higher efficiency. Education takes place at many levels, ranging from advertising programs for individual residential consumers to energy audits for industrial end-users

- *Building Codes:* Most buildings are constructed to last for at least several decades. Energy efficiency codes, which prescribe minimum design and construction standards, therefore have a very large influence on building stock efficiency for many years into the future.

- *Incentive Programs:* Incentive programs include both non-financial and financial incentives. Non-financial programs generally provide recognition of efforts that go beyond conventional practices. Financial and tax incentives are powerful tools which should be used to encourage adopting technologies or products that have clear energy and environmental benefits but face significant market barriers. Incentives can be used to increase the efficiency of important end-use equipment in each sector. They should not be used to promote technologies or products that are clearly cost effective or are already in widespread use.

- *Funding:* In order to implement programs in all of the categories, funding will be required. Funding can include various Federal, State, and private sources and several different mechanisms for collecting and distributing money.

A. Actions in Progress

Delaware's First Privately Owned LEED Building is Dedicated: The first building constructed to the U.S Green Building Council's "Leadership in Energy and Environmental Design" (LEED) Gold standards was dedicated by PFPC, Inc. in the Bellevue Corporate Center north of Wilmington in June 2003.

Senate Bill 93 Earmarks $1,000,000 of Additional funding for Low Income Programs: the passage of Senate Bill 93 in June 2003 dedicate $1,000,000 of existing funds for additional low-income energy programs. This funding will provide much needed support at a time when other sources are increasingly uncertain.

B. Education and Outreach Program Recommendations

i. Residential consumers need to be educated about the impacts of energy consumption

Priority: High

Consumers are generally unaware of the economic and environmental impacts of energy use in their homes. The terms used to discuss energy can be confusing and the concepts can be daunting, and information is often fragmented. In order to begin making informed decisions about energy use, equipment selection and other related issues there is a need for a basic understanding of the impacts of energy use.

The State should:

- Develop and implement a comprehensive consumer education program regarding the use of energy in residential settings. The program should prominently feature the economic and environmental benefits of energy efficiency, conservation and renewable energy options.

- Sponsor the development of a "self-audit" website, energy hotline and/or other tools and information kits for residential energy consumers.

Costs for these activities will depend on the level and type of information offered. In many cases, resources and information are already available and can be utilized at little or no cost. A conceptual outline should be prepared prior to finalizing the scope of this effort.

ii. Information about fuel sources, emissions, and costs should be more completely disclosed to consumers

Priority: High

Education on the advantages and disadvantages of various energy supply options, conservation and efficiency, and disclosure about fuel sources, emissions, and costs are critical to the creation and support of a rational state energy policy.

The State Energy Office, in consultation with other governmental agencies, universities, the private sector, and the public, should develop an education and disclosure program that meets the public's need for information without revealing customer- or utility-specific confidential information.

iii. The State should take full advantage of existing U.S. DOE programs targeting industrial efficiency

Priority: High

The U.S. DOE offers industrial efficiency programs targeting the largest energy end-uses within the sector: motors, steam generation, compressed air and process heating. The industrial sector is typically far more sensitive to energy costs because they make up a much larger share of total operating costs. Efficiency measures play an important role in managing these costs and enhancing industrial sector productivity and competitiveness, and reducing energy-related emissions. The Motor, Steam, Compressed Air and Process Heating Best Practices Programs target efficiency improvements in these areas by providing site audits and information about the costs and benefits of efficiency upgrades. In particular, smaller companies benefit from these programs because they provide access to expertise that would ordinarily be too expensive or unavailable.

The State should fully engage the U.S. DOE's Motor, Steam, Compressed Air and Process Heating Best Practices programs provided through the Office of Industrial Technologies. Use of these programs would be coordinated through the State Energy Office, with assistance from the U.S DOE Regional Office in Philadelphia.

Direct costs to the State are expected to be minimal. If recommended projects were implemented, they would yield significant savings to the individual companies.

iv. The State should take full advantage of the U.S. EPA/DOE Energy Star Program

Priority: High

The U.S. EPA/DOE Energy Star Program is a federally sponsored program to help minimize the environmental impacts of energy consumption through the use of energy efficiency. The program covers primarily the residential and commercial sectors with information, technical support and labeling. The Energy Star Program is underutilized within the State. The Energy Star Program provides considerable support in key areas of energy efficiency and conservation, from individual appliances and consumer information to building construction practices, building materials and benchmarking.

The State government should join the Energy Star Program as a partner and make full use of available Energy Star resources. The State would be required to sign a Memorandum of Understanding to join the program. As part of joining Energy Star, the State should also urge other government and business entities to join the Energy Star Program.

There is no direct cost to the State for joining the EPA's Energy Star Program. The State will benefit from positive public relations and by positioning itself to "lead by example." In addition, the State will have full access to all national Energy Star Program marketing materials.

v. An aggressive consumer education program should be developed to promote Energy Star appliances and equipment in the Residential and Commercial sectors

Priority: High

Energy savings from the promotion of Energy Star labeled appliances and equipment could be significant. It is important to note that Energy Star appliances are available for nearly all major residential appliances, heating and air conditioning equipment, computers, televisions and a wide range of other consumer electronics. Consumers, builders and contractors are often unaware of the cost-savings and environmental benefits of available energy-saving equipment. In addition, contractors often do not promote cost-effective energy-efficient appliances and equipment for new construction because they frequently have higher initial costs.

The State should aggressively promote the use of Energy Star Program rated appliances, space conditioning equipment, office equipment, and construction practices. A concentrated public relations and advertising campaign should be initiated to raise awareness among energy users at all levels. Energy Star should also be promoted through the use of conferences, workshops, training and benchmarking tools available through the EPA.

Earlier proposals for public relations and advertising indicate that annual costs for such an effort would be approximately $400,000 per year. As part of the program, costs in later years would be borne in part by retailers and builders who benefit from the program. Benefits for this type of program would be measured by tracking sales of Energy Star equipment before and after specific campaign steps.

vi. The State should promote the Energy Star Program to potential private sector partners

Priority: Medium

The Energy Star Program is also a valuable source of information for the private sector, especially when it is publicized through a state partner. State partners add credibility to the program, and can also offer projects and programs that "lead by example."

The State should promote and provide training and/or information to local businesses and stakeholders on the Energy Star Program. This should include the State Energy Office working with EPA Region 3 to develop and present workshops to offer to the private and public sectors.

vii. Home buyers should be educated about the advantages of "Energy-Efficient" Mortgages

Priority: Medium

Energy efficient mortgages are available from several lenders, although they are not widely used. Energy efficient mortgages offer buyers a lower interest rate in return for purchasing a home meeting certain energy efficiency levels based on Home Energy Rating System (HERS) audit.

The State should develop outreach programs to builders, lenders and consumers to increase awareness of energy-efficient mortgages. Successful promotion of energy efficient mortgages may also require the training of additional HERS auditors.

Information provided by FNMA indicate that an average home spends $1,900 per year on energy and that an efficient home can save up to 50% on energy bills. Energy efficient homes make mortgages more affordable and have higher market value.

viii. Commercial building owners should be provided with information and services to help them operate more efficiently

Priority: Medium

Many building owners and operators do not fully appreciate the value of energy efficiency in day-to-day operations or in the design and construction of new facilities. Cost-effective energy efficiency options are often not considered because of a lack of information and technical support.

The State, through the State Energy Office, should sponsor a program of commercial building energy audits, web-based information and other forms of information to help commercial building owners and operators identify and evaluate energy efficiency options. The program should include the promotion of building operator education and certification programs, such as those developed by Associate of Energy Engineers (AEE).

Costs will depend on the level of demand for audits. Contractors could support auditing services and training, and costs could be met partially through participation fees.

ix. Small and medium-sized industrial consumers should be offered audits to help improve energy efficiency

Priority: Low

Many small and medium sized industrial energy users do not fully appreciate the value of energy efficiency. Like commercial building owners, small and medium sized industrial companies often do not have access to information and technical support on energy efficiency options.

The State, through the State Energy Office, should sponsor a program of industrial audits, web-based information and other forms of information to help industrial consumers evaluate energy efficiency options, and to facilitate aggregation of energy saving opportunities.

In particular, the State should take full advantage of the U.S. DOE's industrial assessment programs to assist small and medium sized manufacturers identify energy efficiency opportunities. The Delaware Manufacturing Extension Partnership (DMEP) should be enlisted to help promote energy efficiency and conservation in the industrial sector, especially for small to medium sized firms. As the primary point-of-contact, the State Energy Office will also need additional resources to support these activities.

C. Building Code Recommendations

i. Residential and commercial building energy codes in Delaware should be updated

Priority: High

Several different versions of building and energy codes are in use across the State. To date, only New Castle County has adopted the latest residential building codes. Residential energy codes throughout the State are still based on the 1993 Model Energy Code; commercial energy codes are still based on ASHRAE 90.1-1989. Updating building codes is an effective way to establish minimum standards for building performance. This is especially important since residential and commercial buildings are designed to last for decades, and have a long-term impact on the State's total energy consumption.

The 2000 International Building Code (IBC) and the 2000 International Energy Conservation Code (IECC) should be adopted in each county and municipality having jurisdiction over building and energy codes. The State should develop legislation that mandates adoption of uniform energy codes in each jurisdiction within a specific time frame. Updated building codes should also be adapted to the extent possible. Code officials should be trained about these updates so that the new codes are enforced. The Delaware Home Builders Association and other building trade groups should be targeted for outreach activities prior to the introduction of any legislation.

Costs to adopt the new building and energy codes are expected to be minimal. Although some construction costs may increase, energy codes have alternative compliance mechanisms that allow deviations from prescriptive aspects of the codes. For example, higher insulation values may be traded for higher efficiency heating equipment. In the long run, residential and commercial building owners will benefit from lower energy costs overall.

ii. Building energy code officials must be trained to enforce updated energy codes

Priority: Medium

Building inspectors are in positions to inform builders and affect decisions regarding energy efficiency in design and equipment selection. Residential and commercial energy code compliance is uneven and enforcement is not uniform across the State. This is partly due to heavy workloads for building inspectors and the priority place on structural safety.

Training on the IECC for code inspectors, builders and developers is needed in order to comply with and enforce energy codes. The State should provide funding to support training in conjunction with an implementation timetable.

Previous costs to provide training for the adoption of the 1993 Model Energy Code were approximately $60,000. Costs are expected to be higher since residential and commercial sectors will be affected simultaneously. A reasonable range is $150,000 to $200,000. Funding to offset these costs is available under the U.S. DOE's State Energy Plan Special Projects Solicitation.

D. Incentive Program Recommendations

i. The State should recognize outstanding energy efficient design and construction

Priority: High

Energy codes establish minimum performance standards for residential and commercial buildings. However, buildings can be designed to significantly exceed the minimum standards so that very large energy and environmental benefits can accrue over the life of the buildings.

The State should sponsor a “Governor's Award” program to recognize the efforts of builders and building owners who design in accordance with Energy Star (for residential construction) and U.S. Green Building Council (“LEED” commercial construction) standards. Design of the award program should include separate categories, e.g., small business, large business, residential, school, hospital, etc. The award may also be done in conjunction with the annual Delaware Contractors Association building award, which is co-sponsored by the Department of Administrative Services.

The cost to establish an award program will be minimal. Benefits include positive public relations for builders, building owners, and the State for promoting design practices that exceed minimum standards.

ii. Direct incentives should be provided to encourage the purchase of selected high efficiency residential appliances and equipment

Priority: High

Air conditioners, heat pumps and major electric appliances account for approximately 40% of total statewide residential electricity consumption, and space heating accounts for over one-third of residential sector energy consumption. In most cases, more energy efficient appliances also have higher initial costs, although energy savings over the life of the equipment result in lower lifetime operating costs that outweigh initial costs. These higher initial costs are often a barrier when residential customers make purchasing decisions about major appliances, space heating and air conditioning equipment.

Direct incentives for selected heating equipment, air conditioning equipment and major electric appliances should be established to reduce the initial cost barrier. Incentives may be directed to retail or wholesale purchasers, builders or contractors. Incentives should be provided for Energy Star rated air conditioners, furnaces, heat pumps, hot water heaters, refrigerators and freezers and clothes washers.

The initial step should be to evaluate the Delaware market to insure that such incentives are appropriate for local conditions. The level of incentives, payment mechanisms, target markets and all other aspects of program design should be developed separately as part of a comprehensive energy planning process.

A preliminary assessment of energy savings based on a New Jersey rebate program indicates that electricity savings start at 3,000 to 4,000 MWh per year and gas savings start at 14,000 to 15,000 MMBTU per year at an investment of $2,000,000 to $3,000,000 per year. The Delaware Climate Change Action Plan indicates that higher potential is possible depending on incentive levels and available funding. (NOTE: The results of the New Jersey Program were used to provide a general indication of potential program performance in Delaware. New Jersey's experience may not be directly applicable to Delaware.)

iii. Develop commercial tax incentives and credits for energy-efficient equipment purchases

Priority: Medium

Like the residential sector, the initial costs of energy-efficient equipment (e.g., lighting, motors, HVAC equipment, refrigeration equipment, etc.) are often a barrier when commercial buildings are constructed or renovated.

Rebates or tax incentives, including tax credits and accelerated depreciation should be developed to encourage the procurement and use of cost-effective, energy-efficient equipment, particularly heating, air conditioning, commercial refrigeration and lighting equipment.

The level of incentives, payment mechanisms, target markets and other aspects of program design should be developed separately as part of a comprehensive energy planning process.

iv. Develop commercial tax incentives and credits to encourage LEED-certified buildings

Priority: Low

Commercial buildings can be designed to significantly exceed the standards established in energy codes, however, there are no tangible incentives to do so.

In addition to official recognition through a Governor's Award, rebates or tax incentives, including tax credits and accelerated depreciation should be developed to encourage commercial building design in accordance with LEED certification standards. Such an incentive should be structured differently than the equipment incentives described previously. In this case it could be designed to encourage builders to achieve specific levels of total building efficiency, which influences equipment selection, building envelope performance and other features.

v. Develop a rebate program specifically for energy-efficient motors and variable speed drives in the commercial and industrial sectors

Priority: Low

Motors are used throughout the commercial and industrial sectors and are major electricity consumers. Motors account for nearly half of industrial electricity consumption in Delaware, making them a primary target for efficiency upgrades. In the commercial sector, motors are used extensively in heating, ventilating and air conditioning systems. Motor efficiencies have improved substantially since the early 1990s. However, motors also have very long lives and there are significant opportunities to replace older, less efficient motors.

Variable speed drives also provide opportunities to save large amounts of electricity, especially for motor-driven pumps and fans. Most electric motors operate at a constant speed, regardless of the load on the driven equipment. This type of operation, while simple, can waste significant amounts of electricity. Variable speed drives work by controlling the speed of electric motors in order to match the equipment load thereby saving energy that would otherwise be wasted. Motors and variable speed drives are designed to meet specific standards for performance and interchangeability, simplifying procurement and installation.

An incentive program should be established to promote the procurement and installation of energy-efficient motors, variable speed drives and other motor efficiency improvement measures. Such a program should be based on a simple schedule of readily available motor types and sizes, variable speed drives and other appropriate measures.

vi. Design a custom incentive program for industrial energy users

Priority: Low

Industrial consumers are often very difficult to characterize as a group. Consequently, it is also difficult to target specific end uses for incentives based on more generic approaches. Therefore, financial incentives must be very flexible to account for the diversity in this sector.

A custom rebate/incentive plan should be developed based on energy saved through the implementation of appropriate energy-efficiency measures. Measures would be selected on the basis of an energy audit, and could include upgrades and retrofits ranging from lighting to specific process improvements. In this way, packages of energy efficiency measures can be evaluated based on maximizing the benefits of improvements to a specific end user.

E. Recommendations for Further Investigation

i. Study development of electric rates that encourage efficiency

Priority: Medium

Utility rate structures can be used to encourage energy efficiency and load control for customers. This is a complex area requiring additional investigation, but examples include various types of time-of-use rates, real time pricing, and new information technologies that provide price signals to certain customers. Utility rates, such as real time energy pricing, that encourage higher efficiency should be investigated. Pilot programs should be developed to assess viable alternatives. These activities should be coordinated with on-going Public Service Commission studies

ii. Develop a pilot program for demonstrating Energy Star construction practices

Priority: High

Energy Star construction practices in the residential sector can be showcased in public housing projects, thus providing builders and lenders tangible examples of how to construct such housing.

The State should establish a pilot project that encourages construction of at least some publicly funded housing to Energy Star standards.

The costs and benefits of a demonstration project would be determined following an analysis of how the standards could be applied and their benefits to low-income consumers on a project specific basis.

iii. Study implementation of demand response technologies for reducing peak electric loads

Priority: Low

Load reduction programs were originally used by vertically integrated utilities as a way to avoid or defer the need for power plant construction. They have been employed on the Delmarva Peninsula with varying degrees of success since the late 1980s. Depending on the type of technology used, load reduction programs can reduce peak demand by cycling air conditioners, controlling thermostats, shutting off electric hot water heaters and controlling other equipment, especially during hot weather. More recently, they have been used to help control the costs of purchasing electricity during peak periods. Now described as "demand response programs," PJM offers incentives under certain conditions to transmission customers with controllable loads. Demand response can be a very effective way of controlling peak loads and insuring reliability during high demand periods. A range of technologies are now available that also improve on the performance of older programs and reduce the impacts on individual customers.

A study should be undertaken to investigate the most effective means of implementing demand response/direct load control technologies for the purpose of reducing peak loads, especially in high growth areas.

F. Funding Recommendations

i. Develop funding sources and mechanisms to pay for energy efficiency and renewable energy programs

Priority: High

There are several sources and methods that can be used to help fund energy efficiency and renewable energy programs at the State level. These include:

- Public benefits funds
- Taxes and/or fees on certain activities
- Oil overcharge funds
- State budget appropriations

- Low interest loans
- Federal energy program grants and cost sharing
- Competitive private sector and foundation grants and loans

The majority of funding for energy efficiency and renewable energy programs in Delaware currently comes from public benefits funds, the U.S. Department of Energy's State Energy Program and oil overcharge funds.

Delaware's public benefits fund was established in 1999 as part of electric utility restructuring. Originally called the Environmental Incentive Fund (EIF), the fund was recently overhauled in June 2003 by the State legislature to increase flexibility and improve fund administration. Now called the "Green Energy Fund," its primary use is to encourage the adoption of renewable energy technologies through direct incentives. The State Energy Office manages day-to-day operations, including processing applications for rebates. Funds are collected through an electric bill surcharge on Conectiv Power Delivery customers of $0.000178 per kilowatt-hour. Approximately $1,500,000 is collected annually. The average impact on Conectiv Power Delivery customers is small – about $3.00 per year for residential customers, and $22.00 per year for commercial customers.

Recent changes to the Green Energy Fund are intended to streamline program regulations governing project qualifications, which were criticized as complicated and burdensome to potential users. In addition, funds may now be used for research and development projects, technology demonstrations and to promote the availability of rebates and grants. The ability to promote the program should help to correct a problem with low public awareness. However, there are still several important restrictions on the Green Energy Fund that limit its use:

- Funds can be collected from and used by Conectiv Power Delivery customers only.

- Funds can be applied only to photovoltaic, solar thermal, small-scale wind, and ground source heat pump projects.

- Current rebate levels may be unable to attract a significant level of interest, as shown by the very small amount of activity in the residential sector.[21]

The potential demands on the Green Energy Fund are also high. If the above issues are resolved with no expansion of contributors or higher funding rates, it is very probable that only a small number of renewable energy projects could be done each year. The problem would be greater if energy efficiency projects are included under the scope of the Green Energy Fund.

The U.S DOE State Energy Program provides funds to the State Energy Office to support a variety of operating costs including salaries, reporting costs, and special projects. The State Energy Program does not typically support incentive programs.

[21] Since its creation, the Green Energy Fund has funded only five residential PV systems in the State

Oil overcharge funds have been used to support low-income weatherization and fuel assistance, upgrades to various State-owned buildings, and a number of special projects in renewable energy. However, oil overcharge funds are dwindling, and have very specific limitations on how they can be used.

To close the gap between the possible need for funding, especially if additional incentive programs are established, the following specific recommendations should be considered:

- Consideration should be given to expanding the number of customers contributing to the Green Energy Fund. This would allow non-Conectiv customers to participate in renewable energy projects currently allowed by the Fund. Any consideration of expanding the Fund should include all stakeholders.

- The State Energy Office should also analyze the Green Energy Fund collection rates and incentive levels to determine whether it has adequate revenue to accommodate anticipated demand. Incentives should be set at levels that aid market transformation. The analysis should also determine whether additional fund resources would encourage more significant consumer investments in renewable energy.[22]

- Other funding sources and mechanisms, outside of the Green Energy Fund, should be considered to provide resources for energy efficiency and conservation programs. Funding sources and mechanism should be broadly based since energy efficiency and conservation programs would apply to all fuels, not just electricity.

- One of the high priority areas is energy education because it provides a foundation for other activities. There are numerous resources available to support energy education programs. The Federal government and numerous non-government organizations can provide funding and other types of support for public information and education programs. In addition, many of these organizations have already developed programs that can be modified for use in Delaware, saving both time and money. The State should, whenever available, pursue alternative sources of funding, especially to augment education and public information programs.

- The Federal government is also a source of competitive grant money, especially for research and development activities. Federal funding opportunities should be carefully monitored and, where opportunities match the State's priorities, proposals should be developed and supported.

[22] If all Delaware electric customers contributed at the current rate, Green Energy Fund revenues would increase from $1.5 million per year to approximately $1.9 million per year. If, for example, an annual budget of $6,000,000 were established with all electricity customers participating, the current collection rate would have to increase from $0.000178/kWh to $0.00056/kWh. This would increase the impact on average residential and commercial ratepayers by about a factor of three.

Any additional funding programs need to be examined in light of costs and benefits to all affected consumers to avoid potentially disproportionate impacts on certain types of energy users.

ii. The State should prioritize continued funding for low income energy and weatherization assistance

Priority: High

Low-income households in the Delaware typically spend about 15 to 20% of their total household income on energy. Elderly consumers on fixed incomes often spend amounts in excess of 20%.[23] In comparison, other households spend an average of 3.5% on energy.

A recent analysis of low income energy expenditures also shows that the overall efficiency, as measured by space heating intensity, for low income households is much lower than average. Space heating energy consumption for households below the poverty line are more than 35% higher per square foot than average households.[24]

The State helps low income consumers manage their energy bills in three ways:

1. The first is the Low Income Heating Energy Assistance Program (LIHEAP), which helps eligible consumers directly with heating bills.

2. The second is the Weatherization Assistance Program. Typically, weatherization helps to correct basic problems with heating equipment and the building envelope. The effectiveness of measures like tuning furnaces, weather stripping, caulking and others is significant. The U.S. Department of Energy estimates that average savings per home for space heating alone are 25 to 30%, and energy benefits of $1.80 are returned for every $1.00 invested.

   The current budget for weatherization in Delaware is approximately $1.3 million annually, with contributions from the following sources:

U.S. Department of Energy	$514,000
Oil Overcharge Funds	$83,000
LIHEAP	$400,000
Conectiv Power Delivery	$267,000[25]
Delaware Electric Cooperative	$25,000[26]

[23] U.S. Department of Energy, Office of Weatherization and Intergovernmental Program Energy Efficiency and Renewable Energy and discussions with Delaware Weatherization Program.
[24] FSC's Law & Economic Insights. May/June 2001.
[25] Funds are provided through at $0.000094/kWh charge on Conectiv Power Delivery customers to support low-income energy programs. Funds from this source may be used only for Conectiv customers.
[26] DEC funding is provided on an as-needed basis from unclaimed capital credits. The most recent commitment was for $25,000. The State's Weatherization Program office administers the funds and provides services to DEC customers with electric heat.

The current budget allows weatherization services to be provided to approximately 500 low-income households per year. For budgetary reasons, the State limits the use of weatherization funds to consumers who are already receiving LIHEAP assistance and live in owner-occupied homes. Priority is given to the elderly, disabled and lowest income households with children. In spite of the limitations placed on eligibility, there is a nearly constant backlog of 3,500 homes. Future funding is also uncertain. Oil overcharge funds are expected to be exhausted in the near future, and there are considerable uncertainties in future State and Federal budgets. Without additional funding to at least replace oil overcharge funds, the backlog is expected to increase.

3. Thirdly, the Delaware State Housing Authority (DSHA) manages the renovation of publicly supported low-income rental housing. Although the renovation process is very competitive, DSHA does not currently include energy efficiency in ranking multi-family housing renovation projects. While a large portion of low-income households rent their homes, there are no mechanisms available to reduce energy consumption in this type of housing.

The following specific recommendations should be considered:

- Funding for weatherization programs comes from several different sources. In some cases, contributions are uncertain from year to year. The current backlog and anticipated need for low-income weatherization services should be more carefully evaluated. As part of this evaluation, the need for additional funds should also be assessed. Evaluation of needs, services and funding should include all stakeholders.

- Federal contributions make up a large portion of total funding to weatherization assistance programs. In the face of uncertain Federal budgets, the State should make maintaining and increasing current Federal funding levels a high priority.

- DSHA should include energy efficiency as a criterion for ranking and selecting multi-family renovation projects. Selection criteria should be established in cooperation with DSHA as part of a comprehensive energy planning process.

- The State should investigate participation in the U.S. EPA's Energy Star Bulk Purchasing Program for refrigerators, windows, HVAC and lighting for publicly funded low-income housing renovations.

II. Strategy 2: Reduce the Environmental Impacts of Electricity Generation by Encouraging Clean and Renewable Energy Generation

Delaware's electric power infrastructure is a complex network that includes large central power plants, smaller peaking generators, customer-sited generation and the electric transmission and distribution systems. As the need for electricity grows, especially in the southern part of the State, infrastructure expansion must be addressed. The technical options can be clearly identified:

- Additions and upgrades to the existing electric transmission system
- Increasing large-scale generating capacity
- Increasing the use of clean distributed generation
- Increasing the use of renewable energy resources, both distributed and centralized

Maintaining and judiciously expanding the existing infrastructure components (transmission, distribution and generation) while including new technologies and resources will be important for insuring reliability and Delaware's future environmental and economic health. Although the technical options can be clearly identified, there are numerous issues surrounding each one.

Throughout the discussions and analysis of the electric power system, it became clear that there was no single approach that solves all of the technical, economic, environmental and social issues associated with expanding the electric power infrastructure. Each element of the infrastructure comes with its own set of challenges and opportunities. This section addresses power generation, especially the development of clean, large-scale generation and renewable resources. Electric transmission and distribution are addressed separately in a subsequent section.

A. Clean Large-Scale Power Generation

Meeting electricity demand growth on the Delmarva Peninsula can be done in two basic ways. First, additional electricity can be imported through the transmission system from the nearby region. In this case, the transmission system may need upgrades. Second, generating capacity, either centralized or distributed, can be added. Intuitively, it would make sense to increase generating capacity in the area where it is needed. In reality, the choice between adding generating capacity or transmission capacity is not clear-cut because there are complex technical and economic interactions between generation and transmission. The need for more generating or transmission capacity is tied to the State's economic and population growth, but the balance between them is determined by the operation of wholesale electricity markets in the PJM Interconnection. Also, for purposes of planning generation and transmission projects, Delaware cannot be considered separately from the neighboring parts of Maryland and Virginia that make up the Delmarva Peninsula.

Now that wholesale power generation is unregulated, the decision to make an investment in a power plant resides outside the regulatory regime. Hence, the level of investment, timing, and type of plant are determined by the expected market prices of electricity and perceived financial risks. Investors typically look for faster returns on their investments at higher rates of return than were allowed in a regulated environment. To date, investors in unregulated generation have been mostly unwilling to invest in new, capital-intensive coal-fired power plants due to the uncertainty of long-term electricity prices. As a result, investments in new U.S power plants are almost exclusively natural gas-fueled combustion turbines and combined cycle units. The biggest uncertainty is whether the unregulated wholesale power industry will respond to the price signals currently at work in the region. Although transmission constraints in the southern part of the Peninsula have significant economic impacts on utilities and their customers, it is uncertain if prices are high enough or the competitive environment is conducive to spurring development of sufficient generation with the characteristics needed to have a positive impact.

In the context of the Delmarva Peninsula, there are several factors that will influence investments in new power generation:

- The Peninsula is electrically interconnected to the larger mid-Atlantic region only at its northern end, and is considered a "load pocket" by some. Transportation routes in and out of the Peninsula also affect fuel delivery costs. In the case of rail deliveries, there is only one north-south line capable of handling bulk fuels. The combined effects of these factors are to make the costs of energy production and delivery on the Delmarva Peninsula more sensitive to infrastructure limitations due to its geography.

- The practicalities of siting and environmental licensing must be considered, including: potential aggravation of existing ambient air quality problems.

- To be acceptable to the communities in which new plants are sited, the definition of "clean" may also need to be expanded beyond compliance with established standards. This would most likely increase the level of capital investment.

- Although total generating capacity on the Peninsula is approximately equal to peak load, the Delmarva Peninsula imports nearly half of its electricity from PJM for economic reasons. The availability of low cost electricity outside of the Delmarva Peninsula will influence the sizes and types of plants that investors would consider.

- New power plants on the Delmarva Peninsula, even with lower fuel and O&M costs, do not guarantee reduced congestion. The installation of new generating facilities in the wrong locations can actually increase congested operation.[27] Finally, prices that are bid by wholesale suppliers in the unregulated electricity market are not always related to costs. Assurance of lower costs would require the presence of multiple generators of sufficient size, bidding against each other, to lower prices in areas of high LMP pricing.

[27] The interactions between large, central power plants and the electric transmission system are very complex, and there are no "rules-of-thumb" to guide the selection of plant locations with respect to congestion. Each plant must be modeled individually to ascertain its impacts on the transmission system. However, any means of offsetting loads, either through load reductions or customer-sited generation, do have a positive impact on congestion.

The options for adding large-scale centralized generating capacity on the Peninsula will have to be balanced technically, economically and environmentally against improvements to the transmission system. The range of generation options that fit into these circumstances include the following:

- *Incremental Capacity Increases:* Existing Delmarva Peninsula generating units may, in certain cases, have the ability to produce more output with appropriate modifications.

- *New Natural Gas-Fueled Power Plants:* Natural gas-fueled combustion turbines or combined cycle power plants could be added at existing power plant sites or at new sites on the Peninsula

- *Centralized Renewable Resources:* Renewable resource generating facilities could be added at existing or new sites. There are also proposals to develop a large offshore wind energy project.

- *Customer-Sited Generation:* Distributed generation units could be added at strategic utility and/or customer locations.

Given the preceding issues, constraints and uncertainties, it likely that potential investors and licensing authorities will prefer natural gas. Depending on location and size, a major new natural gas-fueled generating plant may also require an upgrade to existing natural gas transmission capacity. This has been under discussion between various parties several times in the past few years. The cost of upgrading gas transmission could be a major factor in the overall cost of a new facility.

Significance of Indian River Power Plant

Much attention was given to the possible need for new power generation. However, it was recognized that the Indian River Power Plant in Millsboro, Delaware plays a special role as a key generating facility on the Delmarva Peninsula. The combined capacity of the plant's four coal-fired units is 767 MW, about 20% of the generating capacity on the Delmarva Peninsula. The units were constructed from 1954 to 1980. Indian River's importance arises from three key characteristics:

- Indian River is the largest generating facility on the Peninsula outside of New Castle County. The loss of an Indian River unit could greatly increase the amount of congestion on the Peninsula, with commensurate increases in costs.

- Indian River is in compliance with its emissions permits, designed to meet ambient air quality standards. However, the plant is also one of the State's major sources of air emissions. When compared to all other electric generation emission sources in the State, the units at the plant produced approximately 48% of the total sulfur dioxide (SO_2) emissions and 37% of the total oxides of nitrogen (NO_x) emissions.

- Given the recent concerns about growing dependence on natural gas for new electric power plants, Indian River's coal-fired units help to provide a more diverse fuel balance in the overall generating unit portfolio and provide a regional energy price hedge.

It is in the State's interest to insure that Indian River Power Plant continues to operate reliably in order to maintain the integrity of the electricity infrastructure. In the long run, the State's air quality and compliance with National Ambient Air Quality Standards may require that additional measures be employed to reduce the plant's environmental impacts. Options could include switching part or all of the plant to natural gas or other fossil fuels, or adding other emission control devices. All of these could be costly. Natural gas conversion could also adversely affect overall fuel diversity. A natural gas conversion may also have unintended consequences, especially making rail transportation on the Peninsula uneconomic without an "anchor" customer. These factors must be considered against the potential benefits of natural gas conversion including reduced emissions and expansion of the natural gas infrastructure into southeastern Sussex County.

The status of the Indian River Plant needs to be followed closely and creative ways of reducing its environmental impacts and methods for cost recovery should be explored.

B. Renewable Resources for Electric Power Generation

Renewable energy resources such as wind, solar and biomass can be used as alternatives to generate electric power. Renewable resource availability in Delaware is significant:

- The most ubiquitous renewable resource in the state is solar energy, the energy available from sunlight. The amount of energy falling on Delaware in the form of sunlight over the course of an average year is 36.4 quadrillion BTUs. This is roughly *one-third* of current total U.S. energy consumption and *130 times* the 280 trillion BTUs of energy consumed annually in the state including transportation fuels and electricity system losses.

- Based on a recent evaluation by the National Renewable Energy Laboratory, Delaware's best wind resources are offshore, extending approximately 60 miles from Woodland Beach to Fenwick Island. A rough estimate for the theoretical potential within this 300 square mile area is 6,000 to 15,000 MW. Even a relatively small project of 100 to 200 MW could generate as much as 250 to 500 GWh of electricity, approximately 2.5 to 5% of current total annual electricity consumption.

- Biomass includes a wide variety of resources including forestry residues, energy crops, crop residues, wood and wood wastes, and landfill gas. The current potential for biomass electricity generation, excluding landfill gas, is estimated to be about 40 MW. Landfill gas has been more accurately quantified, and up to 10 MW of additional electric generating capacity will be added using this resource.

Each of these resources has specific characteristics that can be exploited under the right circumstances. Renewables also share two advantages:

- The costs of renewable "fuels" are stable (for biomass) or zero (for wind and solar). For this reason, renewables help to dampen price fluctuations due to fuel price volatility.

- Renewables have important environmental advantages. Wind and solar emit no air pollutants. Wind, solar and sustainably harvested biomass also emit no net carbon dioxide.

Depending on the specific resource and application, renewables may not be "dispatchable," i.e., available to provide power on demand.

The characteristics and availability of renewable energy resources for Delaware are summarized in Table 4.

Table 4: Characteristics of Delaware's Renewable Energy Resources

Resource	Utilization Technologies	Applications	Availability	Responsiveness to Demand	Cost	Environmental
Solar Energy 	End User-Sited Photovoltaics	§ Stand-alone off-grid power § Residential and commercial buildings to displace utility power § PV/UPS systems for residential and small commercial applications	Widely available; good solar resource in Delaware, although not suitable for concentrating collectors.	Usually not dispatchable, although batteries can be used for peak shaving. Most common application is to displace utility supplied power when sun is available.	High ($6,000 to $20,000/kW)	§ No air emissions or water discharges § No CO_2 emissions
	Large-scale central PV facility ("PV Power Plants")	§ Central PV power generation		No	High ($6,000/kW)	§ No air emissions or water discharges § No CO2 emissions § Land availability and use restrictions will affect applicability
	End User-Sited Solar thermal	§ Residential, commercial and institutional hot water heating § Space heating § Boiler feedwater preheating		No, but hot water storage minimizes the need for supplemental fuel. Properly sized systems provide about 80% of hot water energy requirements.	Moderate ($3,000 to $4,000 for a residential hot water system)	§ No air emissions or water discharges
Wind 	Wind turbines	§ Large-scale power generation for interconnection with transmission system § Small-scale off-grid and grid-interconnected residential and commercial systems.	Moderate to good resource available in coastal areas and Delaware Bay. Interior Delaware resource suitable only for small-scale turbines.	No	$1,000 to $1,500/kW on land for large turbines (>250 kW). Offshore costs depend on other factors. Small turbines in excess of $2,000/kW.	§ No air emissions or water discharges § No CO_2 emissions § Noise, visual impacts may be important siting issues § Impacts on bird populations may also be a siting issue

Resource	Utilization Technologies	Applications	Availability	Responsiveness to Demand	Cost	Environmental
Geothermal 	Ground source heat pumps	§ Residential and commercial space and water heating	Indirect form of solar energy; good resource available throughout the state.	Yes, heating or air conditioning is supplied on demand.	Varies depending on application	§ No emissions at point of use § Resource availability may be restricting by land area adjacent to building § Most efficient electric heating available. Emissions at power plant depend on regional fuel mix
Direct-Fired Biomass Wastes 	Solid-fueled stoves, furnaces and boilers	§ Best applications are commercial, institutional and industrial process, space heating and CHP where end-user is not far from point of waste production. § May also be co-fired in existing power boilers	Moderated to good in-state resource available based on studies. Regional resources also available, but not quantified.	Yes, as long as fuel is available.	Costs vary widely; primarily dependent on type of waste, costs of collection, transportation and processing.	§ Same considerations as direct fired biomass wastes § Land use for "energy plantations" may be a consideration. § CO_2 neutral when harvested sustainably
Direct-Fired Energy Crops 	Solid-fueled stoves, furnaces and boilers	§ Similar to biomass wastes, but best applications may be co-firing in existing power boilers if close to the point of production.	Moderate to good in-state resource available based on studies; includes switchgrasses and fast-growing hybrid woody plants. Regional resources also available, but not quantified.	Yes, as long as fuel is available.	Costs vary widely; primarily dependent on the cost of growing harvesting, transportation and processing.	§ Same considerations as direct fired biomass wastes § Land use for "energy plantations" may be a consideration. § CO_2 neutral when harvested sustainably

Resource	Utilization Technologies	Applications	Availability	Responsiveness to Demand	Cost	Environmental
Biofuels 	Conventional furnaces, boilers and IC engines	§ Bio-diesel for use in space heating, process heat, CHP, transportation and power generation. § Ethanol for gasoline supplement.	Commodity feed stocks (e.g. soybeans, corn, etc.) widely available throughout the region. Not state limited	Yes, as long as fuel is available.	Cost is mainly for development of bio-fuels processing plants	§ Same considerations as direct fired biomass wastes § Land use for "energy plantations" may be a consideration. § CO_2 neutral when harvested sustainably
Landfill Gas 	Conventional furnaces, boilers and IC engines	§ Power generation	Limited to DSWA landfills	Yes, as long as fuel is available.	Costs depend on costs of collecting and processing the gas on site	§ Utilization subject to permitting regulations governing air emissions from point sources for large projects § Reduces methane emissions substantially § Will eliminate emissions from existing flares § Power generation will slightly offset emissions from regional conventional power generation

Resource	Utilization Technologies	Applications	Availability	Responsiveness to Demand	Cost	Environmental
Fuel Cells 	Fuel Cells	§ Distributed power generation § Combined heat & power generation		Yes, as long as fuel is available	High: unsubsidized costs range from $4,500 to over $8,000 per kW	§ Virtually no criteria pollutant emissions on natural gas § High efficiency reduces global warming impact on fossil fuels § Emissions are water only when using hydrogen
Small Scale Hydro 	Small hydro turbines	§ Power generation	No formal assessment done, but small applications would probably be limited to northern areas of State due to topography	No. Small hydro is typically subject to stream flow variations	Highly variable	§ No air or water emissions, although aquatic habitats may be affected.
Ocean Energy 	Tidal (mechanical) energy conversion and thermal conversion	§ Power generation	No formal assessment done, but potentially significant	Tidal conversion is subject to daily and seasonal variation in tidal levels; thermal conversion is potentially demand responsive.	Not known, expected to be highly variable.	§ No air or water emissions, although aquatic habitats may be affected.

In spite of the advantages of renewable energy resources, there are several important obstacles that must be addressed. The Worldwatch Institute summarizes these obstacles as:[28]

- Lack of access to the electric grid
- High cost
- Lack of information
- Biased, inappropriate and inconsistent government policies

Cost is often cited as the most important barrier and renewable energy resources are often assumed to be more expensive than conventional resources. However, this is not always the case:

- First, the real costs of renewable energy to end-users have declined steadily. Great strides have been made in the cost-effective utilization of biomass; wind energy is becoming more competitive with conventional resources; and photovoltaics is often more cost-effective than grid-supplied electricity if a line extension is required to serve a small load. When used for hot water and building heating applications, solar thermal energy can yield simple paybacks as low as four or five years.

- Second, conventional resources also receive substantial direct Federal subsidies in the forms of tax breaks, direct subsidies, and research and development funding. In 1999, the Energy Information Administration estimated that combined subsidies for fossil fuels, nuclear energy and electricity totaled approximately $4.3 billion annually. In comparison, subsidies for wind, solar and other renewable energy were $1.1 billion. Of the Federal support for renewable energy, $725 million were dedicated to excise tax reductions for ethanol and methanol in motor fuels. All other renewable energy resources received $386 million, mostly to fund research.[29]

Also, the figures compiled by the EIA do not include other Federal subsidies, such as defense expenditures related to energy security. When indirect subsidies are included, estimates of total subsidies range from $10 to $40 billion per year. Environmental externalities are also excluded from the EIA's summary. Various estimates and studies indicate that if the costs of environmental damages from using fossil and nuclear energy were included, the cost of fuels and electricity would increase significantly. The Worldwatch Institute estimates, for example, that the cost of electricity generated from coal would be 50% to 300% higher if externalities were included.[30]

The playing field between renewable energy and conventional resources is not level, and Delaware cannot address the issues of Federal subsidies and externalities alone. However, there

[28] Ibid. pg. 98.
[29] "Federal Financial Interventions and Subsidies in Energy Markets 1999: Energy Transformation and End-Use." www.eia.doe.gov/oiaf/servicerpt/subsidy1/estbl_3.html. Table ES3.
[30] "State of the World 2003." The Worldwatch Institute. pg. 89.

are many other policy tools that can be used at the State level to help promote renewable energy. In fact, Delaware already employs several of these mechanisms including:

- Rebate Programs (through the Green Energy Fund)
- Outreach Programs (including the Million Solar Roofs Partnership and various renewable energy workshops)
- Generation Disclosure Rules
- Net Metering
- Public Benefits Fund (Green Energy Fund)

Several other options were also considered including:

- *Residential End-User Tax Incentives:* Residential renewable energy systems are ineligible for Federal tax credits and accelerated depreciation that are available to non-residential systems. To address this, the State could offer tax credits to residential end users. Similar tax credits are already offered by some states, including New York.

- *Renewable Portfolio Standards:* Several states have established mandatory portfolio requirements for their electric utilities. These require a utility to generate or purchase a prescribed percentage of its electricity from renewable resources.

- *Utility Green Pricing Programs:* Utilities can also offer voluntary programs that allow individual customers to purchase renewable energy at a premium.

- *Aggregated Green Power Purchasing:* State and local governments can aggregate their loads to purchase renewable energy from retail suppliers.

- *Expanded Rebate Programs:* Like many other states, Delaware currently offers a rebate program for selected renewable energy technologies. Consideration was given to expanding this program.

- *Renewable Energy in Buildings:* Certain renewable energy resources are much more likely to be used in individual buildings rather than for bulk production. These include photovoltaics and solar thermal technologies. Although not directly related to conservation and efficiency, the use of renewables in buildings is made considerably more effective when done in conjunction with efficiency improvements.

In addition, Delaware businesses, utilities and government entities are eligible for several Federal incentive programs:

- Investment tax credit of 10% for corporations for solar thermal, PV, and wind systems (non-expiring)

- Modified Accelerated Cost Recovery System (MACRS) depreciation for corporations for solar thermal, PV and wind systems (non-expiring)

- Additional accelerated depreciation of 30% in the first year for corporations for solar thermal, PV, and wind systems through 2004 (authorized by the Job Creation and Worker Assistance Act of 2002)

- Renewable Energy Production Incentive (REPI) for local governments, state governments and utilities of 1.5 cents per kWh (adjusted for inflation) over 10 tens years for landfill gas, wind and biomass, except municipal solid waste combustion (non-expiring, subject to the availability of annual Federal appropriations)

- Wind and Biomass Renewable Electricity Production Credit (REPC) or Wind Energy Production Tax Credit (PTC) for corporations of 1.5 cents per kWh (adjusted for inflation) for wind, closed-loop biomass and poultry waste (expires end of 2003)

C. Actions in Progress

Delaware Joins a Regional Plan to Cut Carbon Dioxide Emissions from Power Plants:
Governor Minner joined with nine other Northeastern and Mid-Atlantic states in May 2003 to help develop a regional, market-based program to limit carbon dioxide emissions from power plants. Carbon dioxide comes from the combustion of fossil fuels and is a major contributor to global warming. The other states include New York, Pennsylvania, New Jersey, Connecticut, Rhode Island, Vermont, New Hampshire and Maine.

Contracts to Purchase Electricity from Landfill Gas: In fulfillment of an early recommendation by the Task Force, DSWA signed contracts in July 2003 to develop landfill gas from the Jones Crossing and Sandtown landfills, for a total generation of 10MW of power. This will be an important contribution to renewable energy production in the State. Landfill gas is already being utilized at the DSWA's New Castle County landfills. This form of energy generation should be credited towards a renewable portfolio goal.

D. Clean and Renewable Energy Recommendations

i. Develop a "Green Pricing" program for electricity

Priority: High

There are currently no "green energy" suppliers participating in the Delaware electricity market. This effectively precludes customers from securing electricity from renewable energy sources.

The State should consider mandating a green pricing program so that citizens and businesses wishing to pay the incremental cost of green power may do so.

Two types of programs should be explored. In the first type, the electric utility purchases electricity from renewable resources for re-sale to subscribing customers. In the second type,

customers voluntarily contribute to a fund for the purpose of developing specific projects or resources. In either case, in-State renewable generation preferences should be examined. Because these programs may interact with existing utility electricity purchasing and billing systems, discussions about Green Pricing should include the State's utilities as well as other stakeholders.

ii. The State government should join the U.S. EPA Green Power Partnership Program

Priority: High

The U.S. Environmental Protection Agency (EPA) has created the Green Power Partnership to assist and promote organizations that want to commit to using green power for a portion of their electricity needs. Organizations interested in becoming Partners in the program pledge to procure an amount of renewable energy proportional to their annual electricity use. Partners may use any combination of direct green power purchase, tradable renewable energy certificates (green tags), or on-site generation to fulfill their obligation. The Green Power Partnership counts only electricity generated from renewable energy toward the partnership commitment. In addition, at least 5% of the renewable energy commitment must come from new renewable energy sources. Annual commitment levels are based on total consumption for the participating facilities or departments:

Consumption Level (kWh)	Annual Commitment Level
> 100,000,000	2%
< 100,000,000	3%
< 10,000,000	6%
< 1,000,000	10%
< 100,000	15%

For example, the State could accomplish this by buying or generating renewable energy for individual facilities, a group of facilities, an entire department, a school district, or for the State government as a whole.

The State should join the US EPA's Green Power Partnership Program as a State Partner. This would involve:

a) Signing a one-page Letter of Intent

b) Choosing a green power supplier, green-tag marketer or on-site generation option

c) Procuring or generating an amount of renewable energy that is proportional to annual electricity use

d) Reviewing and reporting electricity use annually to EPA. The State would then commit to purchase a percentage of its electricity from renewable energy resources (green power).

The State should give preference to renewable energy sources in Delaware. The cost of purchasing green power should be offset by an amount equal to or greater than the savings from appropriate conservation and efficiency improvements in State facilities. Savings should be generated from the positive cash flow available from performance contracts or direct capital investments in energy efficiency.

The cost would depend on the level of commitment made by the State. A typical premium for Green Power is 2 to 3 cents per kilowatt-hour of electricity. The State would gain recognition for this effort, as have our neighboring states of Maryland, New Jersey and Pennsylvania, all of whom buy some green power.

iii. PV system rebates from the State's Green Energy Fund should be re-assessed

Priority: High

To date, most of the photovoltaic capacity installed in the State under the Green Energy Fund has been in commercial applications. There have been only four residential photovoltaic systems installed over a 13-month period. With aggressive marketing, enhanced rebates for residential, agricultural and other small PV end-users, and proper staff to promote and administer the program these statistics can be dramatically improved.

Delaware should strive to have 500 photovoltaic systems by 2010. This goal is in agreement with the Delaware Million Solar Roofs Partnership. The rebate program to support this goal should have similar qualification criteria and rebate levels as our neighboring states. Rebate levels were recently changed by the passage of SB 145 in June 2003, although the effects are uncertain. Additionally, this recommendation would require builders to provide average energy performance information to all prospective customers for new homes. This information would be required to be displayed prominently in the home and communicated to the customer at the time of contract. The success of the home energy performance education program greatly depends on the ability to educate consumers so that they request this information and are able to evaluate the cost savings to them. In addition, homebuilders will need access to technical resources and services that allow them to accurately assess the energy performance of the house. Money should be set aside to develop and execute contractor education programs for all technologies supported by the fund. These educational opportunities should be done in cooperation with surrounding state energy programs to lower the overall cost and share resources.

iv. Assess biomass resource potential for Delaware

Priority: High

Biomass resources include wood, dedicated energy crops and agricultural wastes. Estimates vary, but sustainable biomass resources could fuel 40 MW or more of electric generating capacity in Delaware. Sustainably harvested biomass could also be used for space heating, process heating and other commercial and industrial applications.

Although the potential for biomass may be high, sustainable biomass resource potential has not been fully assessed in the region. The state should establish a study group to determine the types and quantities of sustainable biomass resources and their best use.

The costs of a thorough study of biomass resources and economics in Delaware and the nearby region would be covered through the U.S. Department of Energy.

v. A renewable energy goal should be established for electricity consumed in the State

Priority: High

To date, eleven states have established mandatory renewable portfolio standards (RPS) and two states have established voluntary renewable portfolio goals. Mandatory renewable portfolio standards require that specific amounts of electricity sold within a state must be supplied from renewable energy resources, thus guaranteeing a share of the market for renewable energy. Usually, the renewable energy must be supplied from new rather than existing resources, and there may also be specific standards for the amounts of energy supplied from particular types of renewables. Once standards have been set, bidding is frequently used to secure renewable resources at the lowest prices. Renewable portfolio standards are enforceable and can quickly increase the amounts of renewable energy used. Voluntary renewable portfolio goals can be structured in similar ways, at least concerning how resources are counted towards achieving the goal, but they are not the same as enforceable standards and have a less direct impact.

However, there are concerns about the use of mandatory standards in Delaware at this time. The first concern is that renewable energy supplies in the region are limited. To date, most of the new renewable energy supplies originate from wind farms in western and central Pennsylvania. Development of these supplies is not currently keeping up with demand, and it is likely that mandatory renewable portfolio standards would increase prices. Second, pricing and availability concerns may be exacerbated by very aggressive renewable portfolio standards recently passed in New Jersey. Finally, there are concerns that establishing a mandatory standard without other supporting policies could undermine a primary objective: sustainable growth in renewable energy market share. Mandatory renewable energy targets have a mixed performance record. According to the Worldwatch Institute, targets have been established in many countries, and have frequently been missed by wide margins, in the absence of a supporting policy framework. One of the most important features of supporting policies, such as fair access to the electric grid

and proper incentives, is long-term consistency. Without consistency, renewable energy development in the U.S. and other parts of the world has experienced "boom-bust" cycles and discouraged native development of renewable energy technologies. [31]

A voluntary renewable energy goal should be established as a benchmark to measure progress towards growth in renewable energy. Goals for specific classes of renewable resources (solar, wind, sustainable biomass, etc.) should be established as part of the overall goal. The targets should be set in conjunction with the development of other policies that help to set the foundation for long-term, sustainable growth in renewable energy development. Several specific features should be included:

- The use of fuel cells fueled with renewable energy (e.g., methane from biomass) should be credited toward attainment of the goal.

- Co-firing of renewable fuels in electric generating units should be credited at a rate proportional to the BTU input of the renewable fuel.

The cost of achieving a specific renewable energy goal is difficult to quantify. Current renewable energy premiums (based on "green tags" for wind power) range from 2 to 3 cents per kWh at the retail level. At the current level of electricity sales in the State (approximately 11,900 GWh per year), each percentage point of a renewable portfolio goal would cost between $2.4 and $3.6 million annually. The mix and availability of resources will have a significant effect on overall costs.

vi. Review Delaware laws on the use of sustainable biomass resources

Priority: Medium

Current laws may inadvertently restrict use of desirable biomass resources. Delaware laws should be reviewed for their impact on the use of sustainable biomass and energy crops in an environmentally acceptable manner. Following the completion of a biomass resource study, Delaware should identify a first tier of biomass resources that will be acceptable for use in energy production.

vii. Potential power plant sites should be cataloged

Priority: Medium

Power plant sites can be developed from new "greenfield" sites, or can be redeveloped from existing power plant and/or industrial sites. As the state develops, fewer new or existing sites will be available for a variety of land-use and environmental reasons.

[31] Op. cit. The Worldwatch Institute. pp. 98-100.

The State should catalog future potential power generation sites, possibly through existing industrial siting efforts at DEDO, from the standpoints of environmental impacts, access to and the ability to license electric transmission, road and rail transportation infrastructure and natural gas delivery infrastructure. If a particular area or parcel is identified as a promising generation site or targeted for construction of a project, state and local leaders should convey why such an installation could be beneficial on a local and statewide basis.

viii. Innovative funding should be explored for energy-related environmental improvement projects

Priority: Medium

To help maintain diversity of fuel sources, the State should explore innovative means of providing incentives or funding to energy-related facilities to reduce environmental impacts beyond regulatory requirements.

III. Strategy 3: Reduce the Economic Impacts of Transmission Congestion

As discussed under Strategy2, the electric power infrastructure is an extensive system of generating plants, transmission lines, substations and distribution networks. Each component plays an important role in maintaining reliable and affordable electric service for Delaware. This section focuses on the electric transmission and distribution system, a complicated network that delivers power from generating facilities to end-users.

A. Transmission and Distribution

Electric and gas transmission and distribution in Delaware are the responsibility of many different groups, including PJM, individual energy companies and federal and state regulatory agencies. It is a difficult process to ensure both adequacy of energy and the continuance of low energy costs for Delaware consumers. But it is clear that new investment will be needed to meet future needs considering the following:

- Delaware population growth exceeds U.S. averages, particularly in Sussex County where growth has averaged approximately 3% per year.[32]

- Congested electric operations and related economic consequences have become more apparent on the Delmarva Peninsula with the implementation of PJM's Locational Marginal Pricing ("LMP"). To limit these constraints, additional investment in either generation or transmission facilities will be necessary.

[32] 2000 U.S. Census Report

- Delaware energy consumers expect to have reliable energy supplies at reasonable prices. Electric and gas utilities have routinely provided a quality level of reliability while regulation and rate caps ensured reasonable pricing. With the deregulation of the electric industry and the expiration of electric rate caps in 2005/2006, electric distribution companies could recover congestion and supply cost increases via rate proceedings that may escalate consumer energy costs.

How this investment will take place is a complex issue due to deregulation at the State and Federal levels. Various portions of the energy industry were deregulated in 1999 and the continued evolution of this process has resulted in new merchant supply and transmission companies in competition with regulated entities. Deregulation, with new marketplace rules, forms the foundation upon which the new energy companies will make business investment decisions and which will establish energy service levels consistent with market value.

Some of the issues addressed were:

- *Electric Transmission System Congestion:* Electric transmission planning is based on established reliability standards with only recent regard for economic impact. Off-cost generation[33], required due to system congestion, has occurred approximately 10-15% of the time[34]. When transmission congestion exists, energy costs may be significantly higher across the entire Delmarva Peninsula.

- *Innovative Financial Investment Recovery Mechanisms:* For companies willing to make infrastructure investment in a restructured business environment with regulated rate caps, there is the potential risk of not securing cost recovery via rate proceedings. Regulated investment recovery mechanisms continue to be limited to conventional rate processes. Gas transmission expansion is dependent on customers willing to pay the cost of the expansion. Under current investment practices there are limited incentives to provide this energy source in rural Delaware areas.

- *Electric System Maintenance and Operation Coordination:* Routine coordination among utilities for maintenance and operational concerns is limited. Maintenance outages and operating guidelines often result in extended periods of congestion and increased energy costs.

- *Infrastructure Security:* Energy transport mechanisms are spread across large areas of Delaware and potentially subject to natural or man-made disasters. The application of new technologies for system monitoring and the development of new coordinated approaches to energy related emergencies have been limited by availability of resources.

- *The Siting Process:* Siting and permitting for new or upgraded facilities is a complex process requiring coordination with multiple agencies, communities and individuals. Even the additional or expanded use of existing rights-of-way requires a similar process.

[33] Off-cost generation is generation that is dispatched out of normal economic order, typically the selection of a specific generator at a higher cost than the next least expensive generator on the system.
[34] PJM Delmarva Peninsula Congestion Study (Attachment C)

There is no eminent domain for the construction of electric facilities, which may result in more costly investments and delays in project completion.

- *Alternative Technologies:* New electric transmission and distribution technologies can help to alleviate congestion and reduce or delay capital investments.

- *Federal Regulatory Activities:* New regulations and business practices are being proposed across all areas of the energy spectrum. The Federal Energy Regulatory Commission ("FERC") and state regulatory agencies are proposing new Standard Market Design ("SMD") and Generator Interconnection rules. PJM is proposing new merchant transmission business rules. The industry is in a continual state of change, and these changes will undoubtedly impact the price and availability of energy for Delaware consumers.

B. Actions in Progress

FERC Ruling on Oxychem: In June 2003, the Federal Energy Regulatory Commission ruled that PJM's Locational Marginal Pricing (LMP) mechanism as it applied to the Delmarva Peninsula must be changed. Oxychem, which consumes approximately 13% of all of the electricity used in the industrial sector in Delaware, requested that FERC address the method used to calculate average prices across the Peninsula. FERC decided in favor of Oxychem by ruling that the Locational Marginal Price in the Delmarva Zone should not be averaged across the entire zone. Instead, LMP should differentiate prices between the northern and southern parts of the Peninsula to reflect the higher costs of delivering electricity to the southern area. Conectiv Power Delivery and PJM were given 120 days to assess the impacts of this ruling and to respond to FERC.

FERC Opens Docket to Investigate Peninsula Pricing: Also in June 2003, FERC opened a docket to investigate the causes and impacts of transmission congestion on the Delmarva Peninsula. The FERC has requested the administrative law judge overseeing the case to issue a report by August 12, 2003.

Transmission Improvements for Economic Purposes: In March 2003, PJM filed a proposal with the FERC that outlines its proposed methods for determining transmission projects to be built to address congestion. This proposal is still under review by the FERC. Subsequently, the PJM transmission owners, including Conectiv, filed in support of PJM's economic planning proposal designed to address congestion and also provided a rate formula to apply to new transmission investments. The FERC accepted the transmission owners' filing in June 2003 and it will go into effect on November 11, 2003.

Conectiv Announces Start of a Major Transmission Project: The Conectiv-PEPCO merger settlement accelerated the completion of a major 230 kV transmission project between Red Lion, Milford and Indian River from 2007 to 2006. In May 2003, Conectiv announced that it would begin work on the project to meet the schedule.

C. Transmission and Distribution Infrastructure Recommendations

i. Simplify permitting and right-of-way acquisition for transmission and distribution projects

Priority: High

Siting for new infrastructure projects can be difficult and time consuming. In certain cases, needed projects can be delayed by the requirement to seek permits from multiple county and municipal authorities. In other cases, individual landowners can block projects indefinitely by withholding approvals for easements.

Delaware should simplify the permitting, siting and right-of-way acquisition process. One way to address this would be to add transmission and distribution projects to those Land Use Planning Act (LUPA) process. The LUPA process provides for early feedback and input from all permitting agencies.

Additionally, Delaware should:

- Establish a comprehensive, cohesive and effective approach to acquiring permits and land rights
- Explore non-traditional options for payment for rights-of-way
- Consider the expanded use of state highway system rights-of-way

ii. Delaware should review the cost recovery process for transmission and distribution investments

Priority: High

The investment recovery process was straightforward when electric utilities were fully regulated and had the exclusive responsibility for constructing needed projects. However, deregulation of wholesale power generation and proposed new rules for merchant transmission have changed the conditions under which investments are made.

Delaware should ensure there is an investment recovery process that provides regulated utilities with fair and equitable returns and does not hinder unregulated utilities from achieving a return commensurate with the level of business risk and consistent with the new marketplace rules/practices. In particular, Delaware should:

- Conduct a review of potential alternatives for financing utility infrastructure development, including surcharges, state funding and reverting to a regulatory regime for generation

- Examine the possibility of a pre-approval process by which infrastructure investment is certified for rate recovery in the next rate case proceeding

- Support PJM's method of private financing or an alternative that meets Delaware needs

iii. The State and energy companies should continue to ensure the physical security of the energy infrastructure

Priority: High

Infrastructure security has become a high priority issue for State, the companies that supply electric and gas service and energy users.

Delaware agencies (particularly, the Delaware Emergency Management Agency) should continue to coordinate with Homeland Security and others appropriate agencies to assure the security of existing energy transport facilities. Specifically, the State should:

- Review potential energy disasters and continue to refine emergency plans related to energy transport

- Review existing security plans for energy utilities and potential for improvements via new technologies

- Continue to conduct emergency drills coordinated with electric utilities

- Consider restricting access to energy facilities in hazard mitigation plans

iv. Advanced transmission and distribution technologies should be encouraged

Priority: Medium

Advanced transmission and distribution technologies are available and are being developed to help reduce losses, improve reliability and increase capacity. Investments in these technologies may help to delay or reduce the need to invest in conventional transmission and distribution options.

Since newer technologies may also have higher technical or economic risks associated with them, Delaware regulatory agencies should support the development and application of new cost-effective technologies for energy transport facilities. This includes:

- Encouraging energy companies to employ new technologies that are cost effective
- Mitigating the financial risk associated with new technology investment via regulatory pre-approval or financial incentives

v. Encourage proactive communications between PJM, Load Serving Entities and Transmission Owners

Priority: Medium

Delaware should encourage and support proactive communications among Transmission Owners ("TOs"), Load Serving Entities ("LSEs") and PJM through the development of a working group to examine operational opportunities to minimize congestion, especially during planned maintenance outages.

- Encourage PJM to improve coordination efforts and the sharing of more information on operations and maintenance.
- Establish a stakeholder working group to help improve the regional maintenance and operations processes and practices to help mitigate congestion.
- Encourage PJM, LSEs and TOs to help mitigate the impacts of congestion by highlighting planned work that could result in significant congestion, well in advance of any outages.
- Consider establishing a work group to review the definition of transmission and distribution facilities.

IV. Strategy 4: Promote Clean Distributed Generation

A. Distributed Generation

Distributed Generation (DG) can currently be described as small-scale power generation located close to the end user. DG technologies include diesel and natural gas fueled reciprocating engine-generators, small industrial gas turbines and micro turbines, photovoltaics, and fuel cells. "Small-scale" in the context of DG is not strictly defined, although DG systems are unlikely to be more than 5 or 10 MW even in relatively large commercial applications. While alternative energy, such as solar and wind, are included in the spectrum of resources, natural gas is likely to play a very important role in the spread of DG technologies. Some of the applications most frequently cited by DG developers and proponents are:

- Remote (off-grid) power
- Emergency back-up power generation
- On-site power generation for peak shaving
- Small-scale combined heat and power (CHP) applications
- Power quality enhancement

DG is currently used in Delaware to help reduce the effects of peak loads and transmission constraints. According to a survey conducted by DNREC, there are approximately 33 MW of DG capacity in Delaware. Although current DG units provide positive operating benefits, they also have negative environmental impacts since nearly all of the DG units in use today burn diesel fuel.

DG can play an important role in Delaware as long as future projects can use clean fuels and technologies. The fastest growing parts of Delaware are in Kent and Sussex counties. As energy consumption grows in these areas, they contribute to increased transmission congestion and associated higher costs. Benefits of DG specifically to Delaware could include:

- Siting generation close to end users in fast growing southern Delaware to help minimize transmission constraints
- Reducing or delaying the need for larger central generating facilities
- Opportunities to promote DG in conjunction with very high efficiency combined heat and power (CHP) applications

However, DG faces several problems in spite of its advantages. These include:

- Unfavorable project economics in many cases
- Lack of natural gas in eastern Sussex County, where the potential benefit could be very large
- Opposition by neighbors due to concerns about noise and emissions
- Regulatory hurdles

Options considered to address these problems were discussed in detail:

- *"DG-Friendly" Tariffs:* Both electric and natural gas utility tariffs can be used to encourage clean DG without negatively impacting utility revenues. Such tariffs could include special off-peak rates to encourage economic self-generation.

- *Identifying CHP Opportunities:* One of the most desirable DG applications is Combined Heat and Power (CHP). Fuel efficiency for energy intensive end-users can be dramatically improved when CHP is used, and there are likely to be significant opportunities throughout the State.

- *Adopting Interconnection Standards:* In order to allow the widest possible range of equipment and practices in the market without compromising safety or reliability for other electric customers, utility interconnection standards must be evaluated and modified where needed. However, it is not likely to be beneficial for Delaware to develop unique requirements. Model interconnection standards are available from several sources.

- *Developing Delaware-Based DG Institutions:* Delaware can play a pivotal role in promoting the information technologies that support deployment of DG both inside and outside of Delaware.

B. Distributed Generation Recommendations

i. Distributed generation should be encouraged as an alternative to electric transmission and distribution system expansion

Priority: High

Delaware should encourage the development and use of energy capacity alternatives, especially distributed generation, by providing economic incentives, incorporating the use of alternatives in the regional energy planning process and, when necessary, mandating beneficial programs. Such programs, supported by other recommendations, include:

- Consider supporting natural gas expansion projects via federal & state funding

- Consider cost reduction subsidies for new generation or gas expansion where economic benefit would be achieved

- Actively support clean energy and energy efficiency programs-Encourage the development of merchant transmission

- Consider implementing educational or outreach programs for energy conservations

- Support broader applications of demand response programs to retail markets

- Explore the possibility of legislation authorizing the PSC to mandate cost effective demand response programs

ii. Electric and gas utilities should develop rates that encourage distributed generation

Priority: High

Customer-sited distributed generation using clean fuels and/or renewable resources can help to diversify the generation base within the State. Electric and gas utilities can help to foster the growth of distributed generation and small combined heat and power (CHP) applications through their rate designs. Areas where rates can be made more "DG friendly" include on/off peak incentives and reduced back-up rates.

Utilities should be asked to file new DG tariffs (or to modify existing tariffs) to encourage the development of clean DG while insuring fairness in utility cost recovery. Rates should be established such that the net effects on utilities would be neutral. Ratepayers taking advantage of these rates would see savings commensurate with their individual project economics. Benefits could include reductions in customer electric loads at peak times, and improved fuel utilization efficiency for CHP projects.

iii. Combined heat and power (CHP) opportunities should be identified and encouraged

Priority: High

CHP applications make very efficient use of fuel for meeting the simultaneous on-site electric power and thermal energy requirements of certain types of facilities. CHP is already used at several large industrial plants in Delaware. The use of CHP can be expanded to smaller industrial and commercial facilities to significantly reduce their total energy requirements. These include hospitals, university campuses, food processing plants, and others. However, the market potential for smaller CHP projects is largely unknown in Delaware.

Combined heat and power applications should be promoted as a means of increasing fuel utilization efficiency and opportunities for the potential use of CHP technologies should be inventoried.

iv. The Public Service Commission and the State's utilities should closely follow development in distributed generation interconnection standards

Priority: High

Interconnection of DG systems can be very costly and are often subject to utility-specific or state-specific rules and regulations. Interconnection standards for DG need to be established to insure safety and reliability while reducing potential cost barriers and increasing consistency. Current standards cover mainly small renewable energy systems, which comply with IEEE and UL requirements. Larger DG systems are not currently covered by similar standards, although significant activity is under way in this area nationwide.

Representatives from the state's electric utilities and the PSC should participate in on-going interconnection standard discussions. The work group believes that it will be especially valuable to consider standards already adopted by other states, including California's Rule 21.

Costs to investigate DG standards are expected to be minimal. Compliance costs could actually be reduced, with savings accruing to DG projects.

v. The State should establish a distributed generation registry

Priority: High

Customer-sited DG projects can make utility planning uncertain. If DG installations increase significantly, problems could arise that will cause utilities to over- or under-forecast demand.

A DG registry should be established to permit efficient tracking of installations throughout the state. The State Energy Office could maintain the registry. Costs are expected be minimal initially, although significant DG market penetration could result in the need for additional information technology infrastructure at the utility level.

V. Strategy 5: Promote the Availability of Natural Gas

Large parts of the State are currently not served by natural gas distribution. The development of the natural gas infrastructure is important for three reasons:

- Natural gas is an important fuel for residential and commercial space heating, water heating and industrial process heating and steam generation. In residential and commercial applications, it is often a direct substitute for electricity, and can play a role in managing electric load growth. From the standpoint of resource efficiency, it also makes sense to use natural gas directly for these applications rather than using it to generate electricity.

- Natural gas is expected to play an important role in the expansion of distributed generation, as explained elsewhere in this report.

- Natural gas is being used to fuel new central power plants throughout the PJM region and nationally for a variety of reasons already discussed, and this trend is expected to continue.

The means of promoting gas infrastructure development are not clear, although Chesapeake Utilities provided suggestions based on development programs in other states. However, there are significant issues that remain to be addressed including the fairness of cost recovery mechanisms and competition with other fuels, and further study will be needed.

A. Actions in Progress

Cross-Bay Natural Gas Transmission Line Under Study: Delaware and Maryland are jointly funding a study to investigate the feasibility of a natural gas pipeline under the Chesapeake Bay.

B. Natural Gas Infrastructure Recommendations

i. The State should evaluate possible incentives for expanding residential and commercial natural gas service

Priority: High

In many parts of the State, natural gas is unavailable for residential and commercial uses. The State should examine possible incentives to extend the natural gas infrastructure to areas where residential and commercial customers are currently not served.

ii. The State should evaluate possible project-specific incentives for clean power generation

Priority: Medium

For economic reasons, base load electricity requirements for the Peninsula are mostly imported from large coal and nuclear facilities located elsewhere in PJM. Plants located on the Peninsula are either "load following" or peaking facilities. Because of this, it is likely that natural gas will be the preferred fuel for conventional power plants. The natural gas infrastructure is expanded as needed, based on the requirements of specific customers and projects, and may not be available in areas desirable for power plant development.

The State should examine possible incentives to expand the natural gas infrastructure on a project-specific basis to develop clean power generation when and where it is needed. These could include:

- Federal, state and/or participant funding of such a project
- Encouraging the FERC to allow the expansion of the natural gas lines and agreeing to support the natural gas supplier's application to include the cost of the expansion in its rates. Obviously, the rate impact of this option is a major consideration.
- Sharing cost reduction benefits (transmission and congestions savings) collected from the load with the proposed generator
- Gas pipeline fuel availability to a generator at costs comparable to other locations where infrastructure exists, subsidized by state funding or rates paid by gas and/or electric customers

In addition, Delaware's public and private sectors should engage and enlist our U.S. Senators and Congressman to actively support policies on a federal level that would mitigate potential national natural gas supply deficit and resultant pricing pressures on natural gas supply. The development of additional natural gas fueled electric power generation should also consider the impacts of fuel diversity and greater reliance on natural gas.

Costs will vary, depending on the magnitude of the project(s) and incentive mechanisms used. Incentives could include tax credits or public funding through revenue bonds to make up shortfall for the "non-economic" portion of investment. Benefits include reduced emissions from power plants. Where natural gas can be used for DG at customer sites, there may also be benefits from reduced transmission congestion.

VI. Strategy 6: Promote Alternative Transportation Fuels

The transportation sector is almost completely dependent on petroleum for its energy supply. In order to improve diversity in this sector and to reduce its environmental impacts, a range of alternative fuels was examined. All of the fuels considered are currently produced and will work in available vehicles.

For the foreseeable future, vehicles using gasoline and diesel fuel are expected to dominate the market. However, alternative vehicle sales, which include, electric, electric hybrid, propane, and compressed natural gas autos, are expected to increase from 3.4% to 11.2% of total market share over the next 10 years. Similar patterns are expected for light duty trucks, vans and SUVs. Alternative vehicle sales in this category are expected to increase from 4.9 to 12.9% of total sales. This is shown in Figure 18.

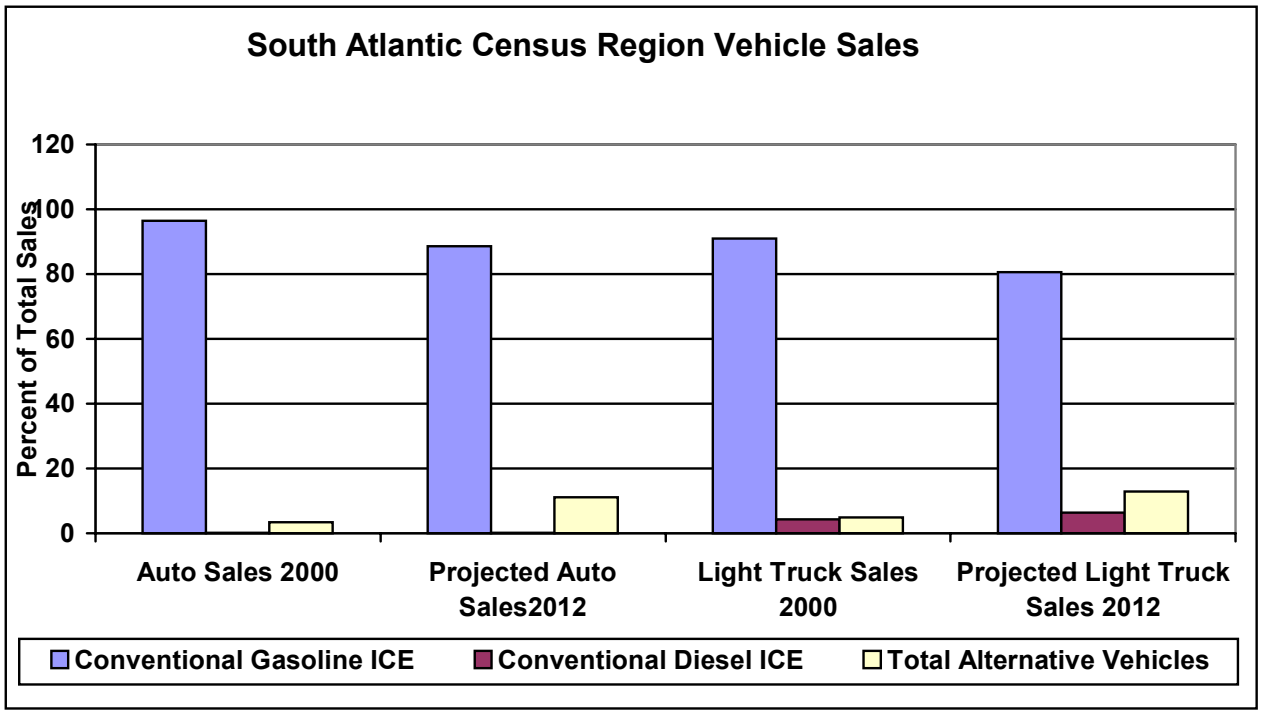


Figure 18: South Atlantic Vehicle Sales Forecasts

The types of alternative vehicles sold will affect transportation fuels policies. About two-thirds of total alternative vehicle sales in 2000 were of so-called "Flex-Fuel" vehicles. These are, for the most part, ordinary gasoline-powered automobiles and light duty trucks designed to operate on fuels with up to 85% ethanol. In the same year, propane and compressed natural gas vehicles accounted for nearly one-quarter of alternative vehicles. The remainder was mainly gasoline-electric hybrid vehicles. Very small numbers of vehicles were sold that were capable of operating on pure ethanol or electricity.

By 2012, the overall mixture of alternative vehicles is expected to change significantly. Flex-Fuel vehicles are still expected to account for about half of alternative vehicle sales, but there is also expected to be dramatic growth in gasoline-electric hybrids. Hybrids are projected to account for over one-third of alternative vehicle sales by 2012.

Projected trends in alternative vehicle sales indicate that the existing refueling infrastructure will remain an important feature in the transportation system. Flex-Fuel, gasoline-electric hybrids and diesel vehicles can take advantage of the existing refueling infrastructure. Delaware's vehicle market is also very small in comparison to the regional and national markets, making it unlikely that the State could effectively promote specific vehicle technologies. For these reasons, emphasis is placed on alternative fuels that fit within the existing infrastructure. Options considered included:

- *Mandates and Incentives for Soy Diesel and Ethanol Blended Fuels:* A combination of mandates for low percentage blends of bio-diesel and ethanol would dramatically increase production and consumption of these fuels. Incentives could be provided to further increase consumption above minimum requirements.

- *Soy Diesel and Ethanol Production:* Both gasoline and diesel fuel can be directly displaced by alternatives from renewable sources, and Delaware can promote development of production facilities within the State. The advantages of these fuels are reduced emissions for certain pollutants and compatibility with the existing fuel distribution infrastructure. Ethanol can be produced from a wide variety of biomass feed stocks containing sugars, starches and cellulose. Bio-diesel can be produced from a number of feedstocks including waste frying oil and grease, animal fats and oil seeds, especially soybeans.

- *Neighborhood Electric Vehicles (NEVs):* Battery-powered electric vehicles (EVs) potentially offer a means to drastically reduce emissions from the transportation sector, depending on the sources of primary energy used to charge the batteries. However, available battery technologies have constrained the practical applications of EVs. Nevertheless, battery-powered EVs can be effectively used in short-haul, low speed urban applications where range and performance specifications are not as important. A number of barriers need to be addressed to promote NEVs in niche applications including charging infrastructure and State registration requirements.

- *Compressed Natural Gas (CNG):* Compressed natural gas (CNG) shows significant promise for reducing dependence on petroleum for transportation and reducing tailpipe emissions. CNG has been used successfully in heavy-duty urban vehicles, such as delivery trucks and transit buses, and in conventional automobiles and light trucks. The primary advantage of CNG is lower exhaust emissions. This is especially true when used in heavy-duty applications, which often use large diesel engines. Major limitations are the availability of refueling stations and vehicles.

A. Actions in Progress

Activities on Bio-Diesel Accelerate: There were numerous activities related to advancing bio-diesel production and consumption in Delaware including:

- The Governor appeared in a series of television commercial promoting bio-diesel in September 2002
- Developing a bio-diesel production facility in Delaware has been actively pursued
- Conectiv Power Delivery and the Delaware Electric Cooperative are using bio-diesel in their fleet trucks
- DNREC, DelDOT and Department of Agriculture fleets use bio-diesel in vehicle fleets and the State's dredge
- DSWA converted to bio-diesel for its diesel-powered equipment
- Emissions testing on bio-diesel from high-oleic oil produced from genetically modified soybeans
- Emissions testing on bio-diesel used as heating oil in the Appoquinimick School District
- Uncle Willies began selling bio-diesel a 3 service stations in southern Delaware in February 2003

State Signs a Contract for Ethanol Refueling: The State signed a contract for supplying E-85 for refueling State-owned Flex-Fuel vehicles in July 2002

B. Transportation Fuels Recommendations

i. The State should mandate that all diesel fuel sold in Delaware must be at least two percent bio-diesel

Priority: High

The use of renewable energy can be greatly increased through the use of bio-diesel blended in relatively small quantities with conventional diesel fuels. The State should adopt legislation that mandates the sale of bio-diesel blended with conventional diesel fuels at a level of 2% (a B-2 blend) for taxable and non-taxable purposes. The deadline for implementation should be one year prior to Federal mandates to reduce the sulfur content of conventional diesel fuels. Further, the bio-diesel content should be increased to a B-4 blend as soon as economically possible. Bio-diesel is defined in American Society for Testing Materials (ASTM) Standard D6751.

The cost of B-2 bio-diesel will be approximately $0.02 per gallon higher than conventional diesel. Based on current total diesel consumption for all purposes, the added costs to consumers will be approximately $3.6 million per year. Benefits from bio-diesel include reduced particulate matter, carbon monoxide, and hydrocarbon emissions, including air toxics. Use of bio-diesel is also expected to have positive impacts on the State's agricultural economy. Based on USDA estimates, a five million gallon per year bio-diesel production plant could increase the income of

Delaware farmers by $7.5 million per year and create 325 new jobs. The extra income to soybean producers equates to $34 per acre for every acre of soybeans grown in the State.

ii. State government should use B-20 bio-diesel in State-owned vehicles

Priority: High

Requiring the use of higher blends (up to B-20) in diesel-powered vehicle fleets can further increase the use of bio-diesel). The Governor should mandate the use of B-20 in State-owned fleets, including school buses (State-owned and contract), public transportation fleets, DelDOT, and other fleets using diesel fuel if and when available. The State should also encourage the use of B-20 bio-diesel in private fleets.

iii. Bio-diesel should be officially recognized in the Delaware Code for taxation purposes

Priority: High

Bio-diesel is not currently incorporated in the Delaware Code. This will be necessary for bio-diesel used in taxable motor fuel applications. Bio-diesel should be officially recognized for taxation purposes in the Delaware Code

iv. The State should provide training and education on the availability and use of alternative transportation fuels

Priority: High

The use of bio-fuels is partially limited by the lack of information available to private and public vehicle owners about fuel availability, blends, prices, changes in vehicle performance and maintenance.

The State should provide training for public and private fleet managers on the use of ethanol and bio-diesel. In addition, a public information campaign should be employed to educate consumers and vehicle retailers about the current availability of Flex-Fuel (i.e., ethanol [E-85], CNG and propane) vehicles.

v. Future State fuel procurement contracts should require access to E-85 ethanol re-fueling stations

Priority: Medium

Most state-owned and private auto fleets use Flex-Fuel vehicles, which are capable of using fuels with up to 85% ethanol (E-85). The E-85 refueling infrastructure is currently limited to one station in Wilmington. The development of additional E-85 refueling stations will be slow without an incentive to develop such stations.

Future contracts for state motor fuel purchases should require bidders to include access to E-85 refueling stations in return for a minimum purchase amount. The State should also provide incentives, such as direct grants and/or low-interest loans, to encourage the development of the E-85 refueling infrastructure for private fleets.

vi. The State should provide funding to aid purchases of Neighborhood Electric Vehicles (NEVs) for public and private urban fleets

Priority: Medium

Certain electric vehicles (e.g., "neighborhood" EVs) are well suited for short-haul use in congested urban areas while emitting no pollutants. The State should provide funds to encourage the purchase of low speed urban electric vehicles by public and private fleets. Funds can be provided as direct grants to fleet operators using Federal funds available through the Department of Energy.

vii. State motor vehicle laws should be amended to remove barriers to the use of NEVs

Priority: Medium

Neighborhood EVs are not suitable for use on high-speed roadways, but can be used safely on urban and suburban streets. Legislation should be passed to ease restrictions of neighborhood EVs to roads for which they are appropriate. Restrictions could be based on speed limits (e.g. roadways with speed limits of 35 MPH or lower) or other criteria to insure that they are used where safe and appropriate.

viii. The State should ban the use of MTBE and encourage ethanol as the primary substitute

Priority: Medium

The use of Methyl Tertiary Butyl Ether (MTBE) as an oxygenate in gasoline has been problematic since its introduction. MTBE is a carcinogen and presents significant problems once it enters groundwater. It is likely that MTBE will be prohibited for use in gasoline in the near future. Alternative renewable fuels can replace MTBE as a safe, effective oxygenate.

The State should ban the use of MTBE by 2006. The State should encourage the use of ethanol as the primary substitute for MTBE at a level regionally acceptable. The State should explore the appropriate blend levels with other states in the region that are also required to use oxygenates in gasoline, and should encourage the production of ethanol in the Mid-Atlantic/Northeast region. Use of ethanol as a substitute for MTBE will avoid further groundwater contamination.

VII. Strategy 7: Promote Economic Development by Encouraging Advanced Energy Technology Development

The Task Force explored ways to encourage adoption of new energy technologies and promoting economic growth by attracting high-paying jobs to the State that are involved in manufacturing these technologies. In addition, the State is interested in maintaining reasonable prices and high levels of reliability for businesses already located here.

Delaware is home to several institutions and major businesses that are already heavily involved in energy policy and technology, and that support economic development opportunities for the State. These include:

- DuPont and W. L. Gore, major developers and producers of fuel cell materials
- AstroPower, sixth largest photovoltaic manufacturer in the world
- DG Interconnect, a nationally known information technology company focusing on the needs of the emerging distributed generation business
- Center for Energy and Environmental Policy, one of the most prominent energy policy research and graduate studies institutions in the world
- Institute for Energy Conversion, a major internationally recognized thin-film photovoltaic research and development center
- Delaware Biotechnology Institute, a University and industry sponsored institute focused on biotechnologies, including genetically modified crops for energy production
- Apex Piping, a manufacturer of piping components for fuel cells
- Fraunhofer Center for Manufacturing and Advanced Materials
- Air Products

Options considered for promoting economic growth in these new areas included:

- *Developing Research and Development Centers in Delaware:* One of Delaware's assets is a strong research and development community, including large corporations, small businesses and university research centers. It is natural to extend and consolidate these capabilities by developing specialized research centers in areas such as fuel cells and distributed generation.

- *Developing a Fuel Cell Demonstration Project:* Although Delaware companies play an important role in fuel cell material production, there are no fuel cells installed in the State. A demonstration project would help to promote fuel cell technology inside the State and within the region.

- *Encouraging Adoption of New Technologies:* Several options were explored to encourage adoption of both fuel cell and photovoltaic technologies. These included increasing existing photovoltaic system subsidies, reducing the regulatory permitting requirements for fuel cells, and requiring the State Department of Administrative Service and/or the State Energy Office to assess opportunities for using fuel cells in State facilities.

- *Focusing on Reliability:* Delaware's economy is moving towards businesses that require very clean, reliable power. These include business with sensitive manufacturing processes and computer-intensive operations supporting banking and financial centers. Power quality may of as much importance as price to these customers, and it is in the State's interest to insure that resources are available to support their needs.

A. Actions in Progress

U.S. DOE Awards Delaware an "Industries of the Future" Research Grant: The U.S. Department of Energy awarded a contract to a public-private consortium to investigate biotechnologies and energy efficiency for Delaware's agricultural sector. The consortium includes the State Energy Office, the University of Delaware Center for Energy and Environmental Policy and DuPont Biosciences.

Delaware's U.S. Congressional Delegation Secures $9.5 Million for Fuel Cell Research: With the help of Delaware's Congressional delegation, two Delaware companies, Ion Power and DuPont, will receive combined funding of $9.5 million. Ion Power, in partnership with DuPont and the University of Delaware will receive approximately $2.5 million to develop fuel cell membrane recycling/remanufacturing technology that will help to recover valuable platinum catalyst materials. DuPont will receive approximately $7.0 million to develop a 40,000-hour, high-efficiency proton exchange membrane fuel cell stack.

B. Economic Development Recommendations

i. As part of its economic development strategy, the State should recruit advanced energy technology companies and end-users with targeted financial incentives

Priority: High

In order to effectively recruit targeted companies, there must be a focused economic development effort coupled with monetary incentives to successfully attract existing or startup companies to Delaware and be able to retain the ones we have. While the mechanism is fairly straightforward to retain and attract this industry segment, the specific types of companies that will be targeted will require a significant amount of discussion and thought.

Recruit producers and users of energy technologies and energy efficient products by providing financial incentives in the form of enhanced tax credits, installed system rebates and low-interest loans and equity investments.

The benefit of this strategy is the attraction and retention of high value, socially and environmentally preferable companies to Delaware, which produce direct and indirect economic and societal benefits. While the mechanism is fairly straightforward to retain and attract this industry segment, the specific types of companies will require a significant amount of discussion and thought.

ii. The State should facilitate the development of a Clean Energy Research Institute focused on basic and applied clean energy technology research

Priority: High

As part of the strategy to retain and recruit producers of clean energy, and energy efficient technologies, a research center should be formed that will serve as a catalyst and nucleus around which these companies will gravitate and find value. In addition, this center will use private and state resources to leverage federal research and product commercialization funding. Delaware is ideally sized and geographically situated to host this center and will allow Delaware to gain national prominence in this area. Delaware currently possesses a number of assets that enable it to effectively launch the Center, including the University of Delaware's Catalysis Center and Center for Composite Materials, Delaware Biotechnology Institute, Fraunhofer's Center for Advanced Materials, DuPont and W.L. Gore's fuel cell membrane research and development, Air Products' mercantile sized hydrogen production facility, a centralized location in the Northeast, and growing demand in the southern part of the State that can benefit from a distributed generation network of clean and efficient power systems.

Create a Clean Energy Research Center that will focus on basic and applied research, as well as field demonstrations of fuel cells, photovoltaic, and other energy efficient power systems that could supply energy to a distributed generation network. The specific areas of research are identified in Appendix B.

The benefits of this Center are numerous. In addition to the ability to leverage federal research and commercial development dollars, the Center would help to retain and attract other companies engaged in R&D, as well as commercial deployment of clean and efficient energy systems. On a macro level, with the establishment of this Center, Delaware could position itself with a niche industry in clean and efficient DG products and networking capabilities. The cost of this center to the State is estimated at $350K/year to be funded over a 5-year period. These sustaining funds would be used to attract private sector research dollars, as well as funding through federal government sources.

iii. The Delaware Economic Development Office and the State's electric utilities should address the needs of "high power quality" customers

Priority: High

Certain electric power customers have needs for power quality and reliability that exceed the requirements for typical electric customers. These customers often have very sensitive manufacturing processes or computer systems. Even very brief power interruptions or power quality problems can result in significant financial losses. From the State's perspective, it is important to attract precisely these types of businesses because they provide high-paying jobs for skilled workers in Delaware's economy. Electric reliability and power quality are therefore important to attract and keep these businesses.

Solutions to address the extremely high reliability needs of special customers are often very site-specific and can be expensive. In addition, it is not always clear that the benefits to specific customers justify expenditures by all electric ratepayers. Nevertheless, the needs of these customers are important to the State's economic development.

The following specific recommendations should be considered:

- The Delaware Economic Development Office should evaluate its potential role in assisting high reliability needs electric customers.

- DEDO should identify resources within the State, especially within Delaware's electric utilities, that are available to assist these customers.

- Other tools, such as special electric rates and contracts should be investigated to allow utilities to recover the costs of investments in customers with special reliability needs.

iv. The State Energy Office should continue to sponsor appropriate energy-related demonstration projects

Priority: High

Targeted technology demonstrations serve an important purpose in establishing the viability and performance of energy efficiency and renewable energy technologies that may be appropriate for Delaware. The State Energy Office has supported this type of activity to date with oil overcharge funds. Since these funds are nearly depleted, additional resources are needed.

The State should continue to sponsor energy efficiency and renewable energy demonstrations, through cost-sharing, competitive grants, and other appropriate mechanisms. Costs/benefits should be determined on a project specific basis.

v. The State should fund a visible fuel cell technology demonstration project

Priority: Medium

A demonstration project would provide education and outreach on fuel cells that would benefit a burgeoning fuel cell industry in Delaware. There has been interest from two entities to install a small fuel cell system and provide an educational component on site to highlight the technology. These include the Innovation and Technology Education Center (ITEC) to be located in Kent County off Rt. 1, and the Blue Ball Stone Barn located off Rt. 202, which is owned and will be operated by DNREC.

The State should identify and fund a highly visible building or other complex that is easily accessed by the public to conduct a fuel cell demonstration and testing project.

While both organizations are interested in installing a fuel cell, the cost may be prohibitive. The cost of this project is largely dependent on the size of the fuel cell selected, and the extent of the educational component. An estimate is between $90K - $150K for a 5kW - 10kW sized system with a corresponding educational exhibit.

VIII. Strategy 8: Implement Energy Efficiency, conservation and Renewable Energy in State Government

There are two roles for state government, improving the State's energy efficiency through procurement practices, and leading by example to help facilitate adoption of energy-efficient products, practices and new technologies. Options considered include:

- *Life Cycle Costing:* Many products, systems and new facilities are evaluated on the basis of lowest bid based on first cost. However, operating costs including energy can often differ substantially between the available options. Life cycle costing accounts for these

differences and can be used in many instances where higher initial costs can be easily justified by lower long-term operating costs. The Federal Energy Management Program and the private sector have used this method of evaluating products and projects successfully for many years.

- *Performance Contracting:* Significant opportunities to improve energy efficiency may be lost because of a lack of capital to pay for upgrades or new equipment. Since the late 1980s, performance contracting has been used to avoid capital constraints. This contracting method allows private sector contractors to make the initial capital investment in energy efficiency improvements in return for a portion of the on-going savings. After the initial investment is paid off, all of the savings revert to the State. This is an especially important tool when the State capital budget is severely constrained.

- *Building Operations:* There are also many opportunities to improve energy efficiency by providing training and information for State employees. Options include training to recognize energy efficiency opportunities, day-to-day conservation techniques, and benchmarking and monitoring long-term facility performance. These options would build upon activities already in progress.

- *Internal Coordination:* Energy efficiency opportunities and ideas cut across all State agencies. A more focused internal effort is needed to insure that good ideas and practices are disseminated throughout State government.

- *Internal Financing:* In cases where efficiency opportunities exist for small projects it may be preferable to finance them internally. The State has the opportunity to establish a revolving loan fund using a portion of remaining Exxon Oil Overcharge money that could be used to internally finance small to medium-sized efficiency projects without requiring new capital. These funds can be used only for schools and hospitals for projects with payback of 10 years or less.

- *Green Energy Purchases:* A key area where the State can lead by example is by purchasing renewable energy. The costs of making green energy purchases can be tied to energy savings in other areas, and could therefore have no net impact on overall energy costs.

- *Use of Available Federal Resources:* The U.S Department of Energy and the Environmental Protection Agency operate several programs that can benefit the State by providing information, funding and expert support. Examples include the EPA's Energy Star and Green Power Partnership Programs. In addition, the U.S. DOE offers financial support and expertise for training, evaluation and personnel. These and other programs can help to leverage State resources, which is especially important during budget constraints.

- *Evaluate Fleet Purchases:* The State's fleet of cars and trucks uses large amounts of gasoline and diesel fuel. There is an opportunity to evaluate using gasoline and diesel hybrid vehicles and improve fuel economy by as much as 50% per vehicle.

A. Actions in Progress

The State Energy Office Moves to DNREC: To improve the effectiveness of the State Energy Office and increase its profile within the State, the office was moved to the Department of Natural Resources and Environmental Control from the Department of Administrative Services following the Governor's signature of Senate Bill 93 on June 2, 2003.

Hybrid Electric Buses: The Delaware Transit Corporation demonstrated use of Diesel-Electric Hybrid Buses in June 2003. Two of these buses will be added to their fleet during the upcoming calendar year.

B. State Government Operations Recommendations

i. State buildings that have the potential to save significant energy should be benchmarked for energy efficiency

Priority: High

Energy is the single largest operating expense for a commercial office building, comprising approximately one third of its operating expenses. By improving the energy performance of its buildings, the State will achieve lower operating costs.

Buildings with high energy consumption and candidates for energy savings should be benchmarked by the Department of Administrative Services under the Energy Star National Building Energy Performance Rating System. To participate fully in this benchmarking program, the State should join the U.S EPA/DOE Energy Star Program.

ii. Allow the use of performance contracting for energy efficiency upgrades in State facilities

Priority: High

Performance contracting is based on the principle that energy-efficiency projects will pay for themselves from the savings produced when done correctly. Under a performance contract agreement, an outside party (often an energy service company, or ESCO) typically conducts an energy audit, designs cost-effective, energy-saving capital improvements, obtains bids, manages the construction, guarantees energy savings, and finances and maintains the improvements. Capital improvements to buildings can include heating and water heating equipment, lighting, and building envelope improvements. The customer pays for the improvements from the resulting energy savings. Performance contracts are often structured as a lease, but with a

guarantee that payments will not exceed energy savings. Thus, the performance of the energy improvements dictates which improvements are installed. Performance contracting includes the following benefits:

- Guaranteed energy savings finance project costs, leading to minimal financial risk for the customer.
- After the performance contractor has been paid, the installed equipment continues to provide energy savings to the customer throughout the life of the equipment.
- The customer obtains all required services from a single source provider such as an ESCO.
- Design and construction phases are closely coordinated, which can accelerate project schedules.

The State should use performance contractors where possible to carry out energy improvements in State buildings. Language should be proposed for inclusion in the Delaware Code to encourage State Agencies and school districts to utilize Energy Savings Performance Contracting (ESPC). The model language developed by the National Association of State Energy Officials (NASEO) could be utilized for this purpose. Language should be included to allow for more flexibility in financing and in consolidating programs in other agencies, such as the Department of Education (16 Delaware Code §7530).

The State Energy Office may utilize Federal dollars to accomplish workshops and training for state project managers and state contractors. Energy savings may be available with no additional capital costs, although additional personnel and related costs would be necessary.

iii. Update energy efficiency standards for State-owned buildings

Priority: High

Current energy efficiency design standards for new construction and renovations are outdated. Department of Administrative Services has begun working on developing an energy efficiency standard for state buildings. The standard was initially developed only for new buildings, but should be broadened to cover additions and major renovations to state buildings, and building construction that uses state funding

Currently the state uses ASHRAE Standard 90.1-1989 to establish energy efficiency design standards for public buildings. The state should change the Delaware Code to adopt the latest version, which is ASHRAE 90.1-1999. The State should provide training to architects, engineers, code officials and commercial builders on this new code. Because there is no mechanism in place for enforcement or review, the extent of its use is difficult to track. Additional assistance to and oversight of state and state-funded building contractors would place the standard in greater use.

In addition to updating minimum building energy efficiency design standards, the State should also:

- Evaluate the LEED standards (Leadership in Energy and Environmental Design Green Building Rating System™) for incorporation into design of new construction and major renovation projects.

- Recommend one or more DAS personnel attend a "Training Workshop" to fully evaluate the potential of LEED standards and make appropriate recommendations for path forward.

The State Energy Office will need additional resources to accomplish training and monitoring. The State can use Federal monies to provide training on these new standards. Costs are expected to be approximately $50,000 using consultants to provide training and materials for workshops.

iv. Require energy life-cycle cost analysis for new construction and renovations

Priority: High

The state does not currently use life cycle cost analysis to determine the optimum level of investment in energy efficiency for new construction and renovations. As a result, the state is missing opportunities to improve energy efficiency in ways that actually reduce the total long-term cost of ownership.

The State should require the use of life cycle costing for all state facility construction and renovation projects. Language to be included in the Delaware Code would have to be developed for this purpose. The use of life cycle costing would save the state significant dollars over the life of a facility.

The Department of Administrative Services will examine the Building Life Cycle Cost software available from the Federal Energy Management Program. Training will be required for those unfamiliar with live-cycle analysis. Costs for training are to be determined, but it is likely that Federal Department of Energy funds are available.

v. Establish a revolving load fund to internally finance energy efficiency projects in State-owned facilities

Priority: High

The State of Delaware has used the Exxon Overcharge Settlement funds to finance energy-saving renovation and minor capital improvement projects. Energy funds saved by the projects were kept by the recipient agency to use for other budget purposes. Exxon Overcharge

Settlement funds may only be used for demonstration projects and for schools and hospitals with a maximum year payback of 10 years. No other specific source of funding such projects is now available.

Instead of allowing agencies to retain the energy dollar savings, these savings should be returned to a revolving fund to be used for energy efficiency projects. The pool of loan funds would be established with remaining Exxon Overcharge funds, where applicable (total amount as of June 30, 2003, approximately $1,130,851.00). The pool would follow the same guidelines now required by the Exxon Overcharge settlement guidelines. If performance contracting covers larger, more complex projects, the loan fund has the potential to be useful for smaller projects or with projects in which energy improvements are fairly simple. A revolving loan fund would require the Budget Office to participate to monitor and recover saved energy.

vi. Require consideration of energy-efficient products in State procurement

Priority: High

Contracts established by the Division of Support Services, Contracting Unit for Statewide use have sporadically identified energy efficient products for purchase by the agency buyers.

Consideration of energy efficiency should occur each time the Division of Support Services, Contracting Unit establishes new contracts or re-bids existing contracts. If applicable the Division shall partner with the State Energy Office which will collaborate with the Public Service Commission, if necessary, to perform life cycle cost analysis to determine if the new energy efficient products are cost effective.

vii. Mandate the procurement of Energy Star rated equipment where possible in State facilities

Priority: High

Considerable energy is consumed by a wide variety of computers, office equipment, appliances and other building equipment. The U.S. EPA, through the Energy Star Program, rates all types of equipment based on its energy efficiency. In general, Energy Star equipment is at least 10% more efficient than non-Energy Star equivalents.

The State should mandate the procurement of Energy Star appliances and equipment in all state office buildings whenever possible. The State would commit to utilizing Energy Star guidelines in its procurement policies relating to equipment for office use and for state facilities (lights, motors and drives, chillers, etc.)

Initial purchase price for Energy Star equipment varies. In some cases, there is little or no cost premium. In the case of large expenditures, or for certain equipment, the premium may be

significant. Generally, the initial premium, if any, is recovered quickly through energy savings over the equipment's life cycle.

viii. Expand training efforts encouraging employees to identify energy saving opportunities and promoting energy-efficient operation in State facilities

Priority: High

There are many measures that can improve energy efficiency and reduce embedded energy levels in buildings. Many of these measures involve employee or maintenance practices that can be implemented with little or no change to the building or equipment, while other measures involve the installation of new equipment or the use of new products in buildings. The Division of Facilities Management, Department of Administrative Services has already investigated opportunities for operational savings through a subcontractor, 2RW, Inc., and has developed a training and marketing plan for Division personnel. The 2RW Program should be expanded to cover all state agencies and school districts.

An expanded program will require additional funding of about $80,000, ¼ full-time equivalent (FTE) employee. Affected personnel will have to assume expanded responsibilities for implementation of this program. It may be possible to offset the costs of implementing this by offering the same training to the private sector for a fee. Contractual costs of operating workshops are estimated to be approximately $50,000.

ix. An Energy Cabinet Committee should be formed to coordinate State government energy activities

Priority: High

Due to the fragmentation of responsibilities regarding facility construction, operation, energy procurement, billing information and equipment procurement, opportunities to save energy are being missed by State agencies that would cost-effectively capture significant energy savings.

An Energy Cabinet Committee that focused solely on energy issues in state government could improve this fragmented approach. A change to the Delaware Code may be needed to establish the Committee, which could act as a subgroup of an existing group within the State government, or could be formed separately by the Department of Administrative Services. This group could not only develop programs for state agencies to achieve some of the goals listed above, it could also set comprehensive goals, prioritize programs based on the cost effectiveness of energy saving measure, and work to further some of the measures described below, including state building standards, energy efficiency in public institutions, the purchase of energy efficient equipment, and the use of transportation energy reduction methods for employees. Although DAS already works on many of these issues (to a greater or lesser extent), a more coordinated and comprehensive approach, with the input and support of other state agencies, could help to move implementation forward more quickly.

No additional costs are expected, although the Committee could help to accelerate both the recognition and implementation of energy savings opportunities.

x. Evaluate the merits and cost effectiveness of stationary fuel cells and photovoltaics as primary or back-up power sources for buildings and remote power applications

Priority: High

The State can facilitate commercialization of fuel cells and photovoltaics by specifically evaluating their use in State-owned facilities.

State agencies should be required to evaluate the merits and cost effectiveness of stationary fuel cells and photovoltaics as primary or back-up power sources for buildings and remote power applications.

This recommendation is not intended to be burdensome or costly. Criteria for these decisions should be developed by the State. It is expected that private engineers would assist the State decision makers in the analysis, which will require additional funding.

xi. Require individual State agencies to enter energy consumption data into the State's tracking system

Priority: High

The State Energy Office is now responsible for entering energy consumption and billing information into the FASER tracking system. This is a time consuming task for Office's small staff.

All state agencies and school districts should enter their own energy billing and consumption data in the State Energy Office's FASER system. This will reduce the Energy Office's administrative burden and free up resources for other duties. Over time, this type of data entry should be automated.

xii. Additional resources should be provided to the State Energy Office to effectively carry out its expanded mission

Priority: High

Additional resources need to be directed to the State Energy Office to play an effective, on-going role in implementing the State's energy plan. Over the past decade, the State Energy Office has lost personnel and funding while faced with an increasing workload.

The State Energy Office has been moved to the Department of Natural Resources and Environmental Control. It should be restructured within this new agency to ensure that the goals of the State's energy planning efforts can be effectively supported. Increased staff and funding commensurate with increased responsibilities should be authorized.

xiii. Encourage environmental permitting flexibility for fuel cells

Priority: Medium

Fuel cells using natural gas, hydrogen and other clean fuels emit extremely low levels of pollutants. The State can facilitate commercialization of fuel cells by reducing environmental permitting requirements.

DNREC should modify the State's regulations governing permits for air pollution to exempt fuel cells. This exemption has been granted by other states in the U.S. in an effort to reduce the commercialization barriers to fuel cells.

It is anticipated that this change would reduce the procedural requirements for fuel cell installers. Today, fuel cells would not require a permit, but the installers still need to interface with DNREC to reach this determination.

xiv. Evaluate the use of hybrid vehicles for the State fleet and develop procurement guidelines for purchasing these vehicles

Priority: Medium

Gasoline and diesel hybrid electric vehicles are rapidly gaining acceptance, and several models are already available to consumers. The major auto manufacturers are now aggressively developing vehicles ranging from small passenger cars to light trucks and SUVs. These vehicles offer fuel economy as much as twice standard vehicles. Hybrid vehicles use a conventional internal combustion engine for cruising and an electric assist for low speed travel and acceleration. Batteries used for electric propulsion are charged on board using the engine and by recapturing energy from the braking system when the vehicle slows. Fuel savings from hybrids can be attributed to much lower idling losses (the engine typically shuts down at stop lights) and the savings inherent in using a smaller engine that doesn't have to be oversized for quick acceleration.

The State now owns gasoline/compressed natural gas vehicles. It should also evaluate the viability of hybrid electric vehicles for use in the State fleets and develop procurement guidelines for purchasing these vehicles.

Costs of currently available vehicles are approximately $2,000 to $4,000 higher than conventional alternatives. Much of this cost is recoverable through fuel savings. In addition, the

use of hybrids may provide emissions credits that will help meet the environmental goals in the State Implementation Plan (SIP).

xv. Require State agencies to seek assistance from the Energy Office and/or Contracting Unit before purchasing high value and/or unique energy-related equipment and services

Priority: Medium

Agencies with unique types of business needs that would not require a statewide contract do not always have the expertise in-house to evaluate energy efficiency opportunities and/or solutions. Examples of these instances are the purchase or new or replacement appliances, window or door replacements on existing structures, entire building system replacements or purchase of replacements parts for systems.

Agencies with unique business needs should coordinate with the Department of Administrative Services, Contracting Unit and the State Energy Office to request life cycle cost analysis and technical guidance prior to the purchase of energy-related equipment and services.

xvi. Use life-cycle cost analysis to assess products with potential to save significant amounts of energy, that are not Energy Star labeled, before they are purchased

Priority: Low

Life cycle costing is a decision making tool that allows for a more thorough comparison of different products during the purchasing process. With life cycle costing, a product's purchase and installation price, annual operation, maintenance, and energy costs, periodic equipment replacement costs, and salvage or disposal costs are considered, along with fuel price escalation, inflation, and the projected life span of the product. In the most complete type of life cycle costing, external costs are also considered. Using life cycle costing to compare options gives a better sense of the full cost of each product, and often can identify energy-efficient items that are more cost-effective than less efficient products which have a lower initial cost. Using life cycle costing to compare and purchase items can result in significant cost and energy savings.

Life cycle cost analysis should be used to evaluate energy-using products that are not Energy Star rated. The State Energy Office should develop guidelines on the types of products that life cycle cost analysis should be performed on and should develop, distribute, and maintain an up-to-date, comprehensive description of the life cycle costing methods, with the appropriate data documentation (including external cost estimates, fuel price escalation, etc.). In this way, purchasing managers in the state agencies will be informed and encouraged to use life cycle costing when making energy-using investments. A change to the Delaware Code to require this

coordination effort would assist in promoting the positive long-term effects of considering energy efficient products.

The State Energy Office will need an increase in resources of approximately ½ FTE to be able to adequately assist all agency requests.

xvii. Evaluate the use of recycled products to reduce "embedded energy"

Priority: Low

Recycling and purchasing recycled goods is an important energy savings strategy because each product we use contains "embedded energy," the energy used to create and deliver the product. Reducing embedded energy levels by reusing products, using recycled products, and recycling what we use can result in significant energy savings to society, although we may not experience the energy savings directly.

An analysis should be done in a joint effort with DNREC's Office of Pollution Prevention and the State Energy Office.

IX. Strategy 9: Continue the Planning Effort to Insure that the Long-Term Goals are Met

Planning is important as a means of avoiding long-term problems and providing appropriate information to help guide both public and private investments in the energy infrastructure.

Prior to 1999 and electricity restructuring in Delaware, utilities were required to submit integrated resource plans (IRPs) to the Public Service Commission describing how they would balance supply- and demand-side resources in the most economically and environmentally efficient manner. Following restructuring, generation was deregulated. Transmission and distribution are still regulated, but traditional integrated resource planning is no longer used since the regulated "wires companies" no longer make decisions about constructing new power plants.

Although the IRP process was not perfect, its main advantages were that it looked at both sides of the supply-demand equation, and it included the societal perspective in decision-making. These are important advantages given the capital-intensive nature and long-term economic and environmental impacts of electric power industry investments.

Today, planning is primarily a corporate function. The chief risk in the absence of coordinated planning is that uneconomic investments could be made in the electricity infrastructure with long-term consequences for both ratepayers and corporate stockholders. But coordinated planning between regulated wires companies and unregulated wholesale electricity producers runs afoul of important regulatory and legal barriers intended to prevent unfair competition. In the meantime, the State has a legitimate need to understand larger trends and to anticipate, for

example, how to encourage a balanced portfolio of supply- and demand-side resources to effectively meet growth and environmental goals.

- *State Energy Planning Process:* The State should engage in "energy planning" in the broadest sense. This means that it should evaluate trends, needs and policy measures to meet societal goals without intervening in well functioning markets. In addition, the State should perform this function for all resources, not just electricity.

- *State and Regional Infrastructure Planning:* Prior to deregulation, infrastructure planning was done by utilities as part of a regulatory process. Now, electric transmission planning is conducted by PJM in cooperation with the individual member energy companies. Gas and electric distribution planning is company based, to meet their individual customer needs. Unregulated wholesale power producers do generation planning in response to market-based price signals. There are no Delaware or regional entities responsible for consolidated "energy" planning. Regional planning is especially important for electricity.

A. Planning and Tracking Recommendations

i. Require on-going energy planning for the State

Priority: High

The State's energy planning effort should be made a permanent, on-going function. Legislation should be developed to establish a formal requirement for periodic updates, with public input, to the plan and tracking progress towards goals

ii. The State Energy Office should establish and maintain an energy end-use data collection and analysis program

Priority: High

End-use data collection, monitoring and analysis are not currently done in Delaware. Data collection at the national level often "regionalizes" Delaware in ways that obscure how energy is actually used within the state. End-use information is vital to on-going efficiency efforts.

The State Energy Office should establish and maintain a data collection and analysis system that can be used to detect progress towards efficiency goals, emerging trends and the impacts of specific programs and policies. The Delaware Climate Change Action Plan, which was developed by the University of Delaware, initiated a significant data collection effort, which can be used as the foundation for future data collection and analysis.

iii. Delaware should establish a State Energy Coordination Stakeholder Group

Priority: High

Delaware should establish a State Energy Coordination Stakeholder Group that monitors Delaware's energy transport systems, drafts and implements actions necessary to enhance energy systems, and provides energy counsel to the Governor's Office and the recommended Multi-State Energy Commission to promote an economic, reliable and competitive energy market for all Delaware consumers. As part of this effort, Delaware should:

- Identify Stakeholder Group participants, energy responsibilities, organizational structure and implement
- Provide legislation or executive authority and resources authorizing the State Energy Coordination Group consistent with desired objectives
- Monitor federal, state and regional energy issues and provide Delaware input
- Coordinate with FERC and PJM on new proposals for economic project planning
- Monitor Locational Marginal Pricing ("LMP") issues and support improved energy management and costing
- Consider the adoption of legislation authorizing the state to mandate projects for economic benefit after further review and monitoring of PJM efforts

iv. Delaware should support and enhance on-going utility and PJM infrastructure planning processes to insure reliability and cost-effectiveness

Priority: High

Delaware should maintain, and enhance where possible, the energy management process, ensuring continued reliable, cost-effective electric/gas supply and transmission infrastructure, and continuing to meet anticipated consumer load growth requirements. In particular, Delaware should:

- Support PJM reliability planning to NERC/MAAC/regional standards-Establish reliability standards that ensure maintenance of reliable electric service
- Support PJM's development of new marketplace rules for merchants
- Review existing utility planning processes and new infrastructure plans

- Consider a special PSC taskforce to review potential for financial incentives designed to encourage the expansion of generation and electric/gas transmission facilities

v. Delaware should facilitate the establishment of a Multi-State Energy Commission to address regional issues

Priority: Medium

Delaware should help facilitate the establishment of a Multi-State Energy Commission that, in coordination with federal, state, and regional agencies, utilities and energy consumers, identifies and, where appropriate, mandates and finances the infrastructure requirements needed to ensure the long-term sustainability of cost competitive energy supply, transport and delivery on the Delmarva Peninsula. Delaware should:

- Identify states and stakeholders interested in establishing a joint commission
- Draft and execute a joint state resolution of intent to create a Multi-State Energy Commission
- Establish Delaware legislative or executive authority for the commission identifying scope, planning responsibility and authority, resources and on-going funding mechanism
- Continue to coordinate with NARUC, MACRUC and PJM on energy planning and management issues

Cost of establishing a multi-State electricity planning commission is estimated by the T&D Working Group at $1.2 million annually, based on a full time staff of five and a part-time commission of nine members. Delaware's portion of these costs would be about $400,000. Additional costs would be incurred to cover planning for Delaware-specific energy planning activities, e.g., DG, renewables, conservation, efficiency, etc. Total cost for Delaware could be expected to be around $800,000 annually.

vi. Future energy planning efforts should include a more comprehensive treatment of the transportation sector

Priority: Medium

The Governor's Executive Order did not address the transportation sector except for transportation fuels. Approximately 25% of all primary energy consumed in Delaware is used in the transportation sector. Future energy planning efforts should include a comprehensive examination of measures that reduce energy consumption and emissions in the transportation sector, improve transportation efficiency and offer more transportation options for Delaware citizens.

vii. Water consumption should be included in future energy planning efforts

Priority: Low

Energy use in all sectors is often directly related to water consumption. In addition, the water supply and treatment infrastructure uses a significant amount of energy. Green building standards, such as LEED certification, include standards for water consumption. Given recent water shortages in Delaware, water conservation is an important goal in itself and can be facilitated by appropriate energy conservation measures.

Water conservation should be further investigated as a means to save energy. Specific measures can be integrated into energy codes and standards, especially where hot water consumption could be affected.

Glossary and Acronyms

"ASHRAE" American Society of Heating, Refrigeration and Air Conditioning Engineers

"AEE" Association of Energy Engineers

"Bio-diesel" is diesel fuel produced from non-petroleum sources including vegetable oils, animal fats, and used cooking oils

"Biofuel" is any liquid or gaseous fuel produced from a biomass source

"Biomass" is defined as any organic matter which is available on a renewable basis including forest residues, agricultural crops and crop wastes, wood and wood wastes, animal wastes, livestock operation residue, aquatic plants and municipal wastes.

"BTU" (British Thermal Unit) A unit of energy equal to the amount of energy necessary to increase the temperature of one pound of water by one Degree Fahrenheit

"CEEP" University of Delaware Center for Energy and Environmental Policy

"Clean Energy" is defined as energy derived from highly efficient, clean technologies, including renewable "green" power and combined heat and power.

"Congestion" means the condition of an energy transport system during which time there are physical limits, transfer constraints or contingencies on the system, and during which other actions are required to maintain the secure operation of the system. Most notably, in the case of electric transmission or distribution, other actions may include operational switching or re-dispatch of generation to manage electric low flows on the limiting facility. Congestion may occur on other transport systems when because of customer demand, physical flow or transport limits are reached. This type of congestion can be resolved by load curtailment, flow rearrangements or the injection of energy supplies at other locations.

"Capacity" means the rated continuous load carrying ability of the energy transport system. In terms of electric energy this is typically expressed in Megawatts (MW) or Megavolt-Amperes (MVA) of generation, transmission, distribution or other electrical equipment. In terms of gas transport it is expressed in Million Cubic Feet per Day (mmcf/d) or decatherms of energy.

"Combined Cycle" means a type of power plant that uses the excess heat available in the exhaust of a combustion turbine to produce steam. The steam is then used in a steam turbine to produce additional electricity.

"CHP" (Combined Heat and Power) is a process in which a fuel is used to generate electricity while simultaneously utilizing waste heat. Waste heat from power generation is then used to provide thermal energy for other processes, including industrial process heating and space heating.

"Combustion Turbine" (CT) is a type of turbine in which a fuel, such as natural gas or oil, is combusted directly to generate electricity or to provide mechanical power. Combustion turbines are essentially the same as jet engines in their principle of operation.

"CNG" Compressed Natural Gas

"CO" Carbon Monoxide, an odorless, colorless gas produced by incomplete combustion.

"CO_2" Carbon Dioxide, an odorless, colorless gas produced by the combustion of any carbon-bearing fuel. CO2 is one of the greenhouse gases implicated in global warming.

"Decatherm" is a measurement of heating value of natural gas, equivalent to 1,000,000 British Thermal Units (BTU).

"Delaware Department of Transportation (DelDOT)" is the State agency responsible for transportation infrastructure including highways, related property rights and public transit systems.

"Delaware Economic Development Office (DEDO)" is the State agency responsible for planning and encouraging economic growth and development.

"Delaware Electric Cooperative (DEC)" is a cooperative public utility that provides electric service to customers throughout Kent and Sussex Counties, Delaware.

"Delaware Manufacturing Extension Partnership (DMEP)" is one of a national network of MEPs. Its purpose is to provide small and mid-sized manufacturers in Delaware with technical assistance in association with universities, community colleges, research organizations, financial institutions and independent consulting firms.

"Delaware Public Service Commission (PSC)" is the State agency responsible for public utility regulation including retail pricing and service levels.

"Delaware Solid Waste Authority (DSWA)" is the State authority charged with managing Delaware's solid waste landfills

"Delaware State Energy Office (SEO)" is part of the Department of Natural Resources and Environmental Control. The SEO is responsible for managing a variety of Federal and State programs related to energy supply, consumption and compliance with Federal mandates.

"Delaware State Housing Authority (DSHA)" is the State agency responsible for publicly funded housing

"Delmarva Peninsula" refers to the peninsula bounded on the west by the Chesapeake Bay and Susquehanna River, on the north by the Delaware and Maryland boundaries with Pennsylvania, on the east by the Delaware River and Bay, and on the south by mouth of the Chesapeake Bay. The Delmarva Peninsula includes all of Delaware, and the eastern shore counties of Maryland

and Virginia. From the standpoint of electric generating capacity, the Peninsula is usually considered as a whole rather than being divided according to state boundaries.

"Delmarva Power & Light Co. (DP&L, a.k.a Conectiv)" is an investor owned public utility that provides electric and natural gas services throughout New Castle County and electric service in throughout the remainder of the Delmarva Peninsula.

"Demand Response" means all activities or programs undertaken by a public utility or its customers to influence the amount or timing of energy use.

"Department of Natural Resources and Environmental Control (DNREC)" is the State agency responsible for managing and conserving the natural resources of Delaware via rules, regulations and enforcement practices.

"DCCAP" Delaware Climate Change Action Plan

"Distributed Generation" (DG) is a general term that typically means electric generation that is close to the end user in comparison to large, central power plants. DG systems can range from a few kW to several MW and can include engine-generators, combustion turbines, photovoltaics, small-scale wind power, fuel cells and other advanced technologies. DG may be used to provide backup for specific end-users, peak shaving or combined heat and power. DG may be installed at a wither customer or utility sites.

"Distribution Facilities" means electric facilities located in Delaware that are owned by a public utility that operate at voltages of 34,500 volts or below and that are used to deliver electricity to customers, up through and including the point of physical connection with electric facilities owned by the customer.

"End Use" refers to equipment, processes, or appliances that consume energy. These can be specific items such as window air conditioners or computers, or categories such as space conditioning equipment or office equipment.

"End User" refers to any individual residential, commercial, or industrial energy consumer.

"Energy" as used in this report broadly includes electric, natural gas, propane, oil, coal, nuclear, or renewables (biomass, wind, photovoltaic) that provide usable power to consumers, usually in the form of heat or electricity.

"EIA" Energy Information Administration is the division of the U.S. Department of Energy chiefly responsible for gathering, publishing and interpreting energy statistics.

"Energy Planning and Management Commission (EPMC)" means the proposed multi-State Commission charged with energy oversight on the Delmarva Peninsula.

"ESCO" Energy Service Company

"Energy Star" is a joint U.S. EPA/DOE program that provides technical support, information and labeling for appliances, equipment, and design and construction practices for the residential and commercial sectors.

"Ethanol" is alcohol usually produced through the fermentation of sugars and starches contained in grains and other agricultural products. Ethanol can be blended with gasoline or used alone for fueling internal combustion engines.

"Federal Energy Regulatory Commission (FERC)" means the Federal agency under the Department of Energy, that regulates the interstate transmission of natural gas, oil and electricity and is responsible for licensing and inspecting hydroelectric projects.

"Federal Natural Gas Act" means the Federal legislation that regulates gas utilities and, for purposes of this report, provides and eminent domain right for facility siting and expansion.

"Flex Fuel Vehicle" is a vehicle designed to meet certain Federal standards that allow burning fuel containing up to 85% ethanol.

"Fossil Fuel" refers to coal, oil or natural gas, or any fuel derived from them.

"Fuel Cell" is a device that uses a catalytic chemical reaction, rather than combustion, to produce electricity from hydrogen and oxygen. Fuel cells promise to be very clean, very efficient sources of electricity.

"Gas Turbine" (see Combustion Turbine)

"Generation (Electric)" means the process of producing electrical energy from other forms of energy; also, the amount of electric energy produced, usually expressed in kilowatt-hours (kWh) or megawatt hours (MWh).

"GEF (Green Energy Fund)" is a fund first established in 1999 by the Delaware Legislature to provide incentives for the installation of photovoltaics, small-scale wind power, solar hot water systems and geothermal heat pumps. Funds are collected through a charge on Conectiv Power Delivery bills, and are therefore distributed only to Conectiv customers.

"Green Energy" is a generic term used to describe energy typically provided from renewable resources including solar, wind, biomass, hydro and geothermal.

"Green Pricing" is a generic term describing a variety of pricing strategies for "green energy." In cases where green energy is more costly than energy provided from conventional sources, green pricing can be used to collect the additional costs, usually voluntarily, from customers who wish to promote the use of green energy.

"Ground Source Heat Pump (Geothermal Heat Pump)" is an electric heat pump that uses the relatively constant temperature of the earth as a source and sink for thermal energy. The chief advantage of this type of heat pump over conventional air-source heat pumps is that they are up to 50% more energy efficient.

"Gigawatt-Hour (GWh)" means a unit or measure of electricity supply or consumption of 1,000,000,000 Watts over the period of one hour; equivalent to 3,412,000,000 Btu.

"HVAC" Heating Ventilating and Air Conditioning

"Hybrid Vehicle" is a vehicle that combines an internal combustion engine with an electric drive and storage batteries. The batteries and electric drive system provide power during low speed operation and acceleration. The electric drive system allows the engine's size and operation to be optimized for maximum efficiency without sacrificing power and drivability. Hybrid vehicle fuel economy can be up to 50% higher than similar vehicles with only internal combustion engines. Because the on-board engine charges the batteries, re-charging stations are not needed.

"Interconnection Standard" is a technical standard governing how electric generating equipment may be connected to the utility grid. The purposes of such standards include protecting safety and property, maintaining electric system reliability and insuring that electricity production is properly metered. Interconnection standards may be relatively simple or complex, depending on the sizes and types of generation equipment involved.

"Integrated Resource Planning (IRP)" means a planning process that provides for the lowest cost energy investment options that are consistent with society and governmental requirements (typically used in the electric industry prior to restructuring and the deregulation of generation).

"Internal Combustion Engine (ICE)" is any engine where the energy contained in a fuel is converted directly to power output without an intermediate step. Examples are gasoline and diesel engines, and combustion turbines. In contrast, steam engines are examples of "external combustion engines" where fuel is burned in a boiler to generate steam. Energy in the steam is then transferred to the turbine to produce power.

"IBC" International Building Code

"IECC" International Energy Conservation Code

"IEC" Institute for Energy Conversion

"LUPA" Land Use Planning Act)

"Leadership in Energy and Environmental Design (LEED)" is a series of standards developed by the U.S. Green Building Council to establish the environmental performance of buildings.

"Low Income Heating Energy Assistance Program (LIHEAP)" is a federally funded, state operated program that provides direct subsidies to low-income consumers for heating energy bills.

"Liquefied Natural Gas (LNG)" is a form of natural gas that is liquefied by cooling to very low temperatures. LNG can be stored and transported by tanker. LNG has been used in Delaware for gas peak shaving during periods of very high demand. Recently, there have been proposals to transport LNG via tanker from other gas-producing countries to the U.S. to supplement domestic production.

"Liquefied Petroleum Gas (LPG)" is also called propane. LPG is a gas similar to natural gas and used in many of the same applications. LPG is largely a by-product of oil and natural gas production and refining. LPG does not require cooling to stay in a liquid state, making it more easily handled than LNG.

"Local Distribution Company (LDC)" is a term used to describe the regulated natural gas distribution utilities within established geographic franchise areas.

"Locational Marginal Pricing (LMP)" means the pricing mechanism that is currently used by PJM for electrical energy purchase and sale between generators and load serving entities or wholesale customers.

"Load Serving Entity (LSE)" means a public utility owning and/or operating transmission and/or distribution facilities in Delaware.

"Mid Atlantic Area Council (MAAC)"means a regional council of the North American Electric Reliability Council ("NERC") that is responsible for Mid Atlantic operational policies and reliability planning standards applicable to PJM and local electric distribution company members.

"Mid-Atlantic Conference of Regulatory Utility Commissioners (MACRUC)" means a regional subset of the NARUC organization that provides regional direction on regulatory issues.

"Million Solar Roofs Partnership" is a U.S. DOE sponsored program that fosters the creation of partnerships within states to encourage the use of solar thermal and PV systems. The goal of the program is to have one million solar energy systems on rooftops in the U.S. by 2010. Delaware joined the program with a commitment of 500 rooftops.

"Megavolt Ampere (MVA)" means a unit of apparent power, equal to 1,000,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

"Megawatt Hour (MW-hr)" means a unit or measure of electricity supply or consumption of 1,000,000 Watts over the period of one hour; equivalent to 3,412,000 Btu.

"Megawatt (MW)" means a standard unit of electrical power equal to one million Watts, or energy consumption at a rate of 1,000,000 Joules per second.

"Merchant Transmission" is the commercial transmission investment made in response to market-based incentives. The return on investment depends on a combination of sales of transmission rights or profits from locational arbitrage of energy prices. The investment does not

add to a regulated rate base or qualify for a regulatory recovery mechanism. The full market risk and reward accrue to the transmission investors.

"Methyl Tertiary Butyl Ether (MTBE)" is a gasoline additive used to reduce certain tailpipe emissions. MTBE has been identified as a carcinogen and, in certain areas, has become a significant groundwater contaminant. MTBE can be replaced by other less harmful additives, including ethanol.

"Million Cubic Feet per Day (mmcf/d)" is a standardized unit used to measure natural gas flow. The unit means a million cubic feet of volume at a standardized pressure of 14.73 pounds per square inch absolute and a standardized temperature of 60 degrees Fahrenheit, transported per day. Gas flows at other pressures and temperatures are corrected to standard pressure and temperature in order to make equitable comparisons.

"Million BTUs (MMBTU)" is equal to one million BTUs of energy.

"Mobile Source" refers to off-road and on-road vehicle emission sources.

"Multi-State Energy Commission (MSEC)" means a multi-State regional entity, legislated into existence by a joint State resolution, and charged with planning, developing, managing and securing the energy needs for the regional area at the lowest cost consistent with society and governmental requirements.

"National Ambient Air Quality Standards (NAAQS)" are health-based standards for specific air pollutants established by the Clean Air Act. The NAAQS define maximum concentrations of these pollutants based on their effects on human health. The pollutants tracked by the NAAQS are SO_2, NO_2, CO, particulate matter less than 10 microns (PM 10), ozone (O_3) and lead.

"National Association of Regulatory Utility Commissioners (NARUC)" means a national nonprofit organization of State regulatory agencies, whose mission is to serve the public interest by improving the quality and effectiveness of public utility regulation.

"Neighborhood Electric Vehicles (NEVs)" are small electric vehicles used in low-speed, short-haul applications where conventional gasoline or diesel-powered vehicles are not necessary.

"North American Electric Reliability Council ('NERC')" means a national nonprofit organization responsible for operational policies and reliability planning standards applicable to national system operations and electric distribution companies, or their successor organizations.

"NO_x (Oxides of Nitrogen)" is a generic term for several gaseous nitrogen-oxygen compounds. These compounds are produced mainly by combustion and are associated with ground-level ozone (smog).

"Office of State Planning Coordination (OSPC)" is a State agency responsible for the continuous improvement of the coordination and effectiveness of land use decisions made by State, county, and municipal governments.

"Old Dominion Electric Cooperative (ODEC, a.k.a. Old Dominion)" is a cooperative energy utility that provides reliable, safe and economical wholesale electric power for member cooperatives.

"Ozone (O_3)" is a highly reactive form of oxygen. In the upper atmosphere, ozone shields the Earth from ultraviolet radiation. In the lower atmosphere, ozone is created when NO_x and VOCs are exposed to sunlight. Ozone is a major component smog and is a severe respiratory irritant.

"Particulates" refer to a large array of small particles in the atmosphere, including sulfates, aerosols, and inert dusts. Human sources of particulates include combustion, construction and farming activities and various industrial processes. Of special concern are small-diameter particulates (PM-10 and smaller) that can be inhaled and lodge deeply in human lungs.

"Photovoltaics" is a solar energy technology that converts sunlight directly into DC electricity.

"PJM Interconnection, L.L.C. ('PJM')" means the independent system operator that is responsible for mid-Atlantic region wholesale energy markets and the interstate transmission of energy, or it's successor organization.

PM2.5 and PM10

"Potomac Electric Power Company (PEPCO)" is an investor owned public utility, recently merged with Conectiv, that provides electric service in Washington DC and the surrounding area.

"Primary Energy" refers to basic energy resources prior to conversion and/or refining. Typically, primary energy is quantified as the energy value of coal, oil, natural gas, nuclear energy, hydropower and other basic resources.

"Propane" (see LPG)

"Quad (Quadrillion BTUs)" is a very large unit of energy equal to 1×10^{12} BTUs (1,000 Billion BTUs). "Quads" are most often used to measure large-scale energy production and consumption at the state, national and international levels.

"Reliability Standards" as used in this report means the acceptable level of performance of the electric system when meeting NERC and MAAC operating criteria.

"Renewable Energy" means energy derived from resources that are regenerative or for all practical purposes cannot be depleted. Types of renewable energy resources include moving water (hydro, tidal and wave power), thermal gradients in ocean water, biomass, geothermal energy, solar energy, and wind energy. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

"Renewable Portfolio Standard" is a policy mechanism used to establish a particular mixture of renewable energy resources for electricity production and/or consumption. Standards may be

legally enforceable or voluntary, and may be applied to specific companies, states or the country as a whole.

"Smog" is a term coined to describe the visible brownish haze that occurs under certain atmospheric conditions. Smog is a mixture of air pollutants, including ozone, oxides of nitrogen and particulates.

"SO_2 (Sulfur Dioxide)" is a gas produced by the combustion of sulfur-bearing fuels such as coal and oil. SO_2 can form sulfate particles and sulfuric acid in the atmosphere. SO_2 emissions are associated with acid rain and human respiratory problems.

"Soy Diesel" is a diesel fuel substitute produced from soybean oil.

"Standard Market Design (SMD)" is the proposed FERC rule making (NOPR) designed to stimulate energy markets and provide a more uniform, nondiscriminatory approach to managing energy systems.

"Stationary Source" refers to emission sources that are not mobile including power plants, industrial plants, commercial boilers, and furnaces.

"Transmission Facilities" means electric facilities located in Delaware and owned by a public utility that operate at voltages above 34,500 volts and that are used to transmit and deliver electricity to customers (including any customers taking electric service under interruptible rate schedules as of December 31, 1998) up through and including the point of physical connection with electric facilities owned by the customer.

"Transmission Owner (TO)" means the utility, merchant company or group of utilities that actually owns the transmission assets, regardless of who controls or operates the facilities.

"Transport Capacity" means the capacity available to transport the various forms of energy.

"Turbine" is a piece of rotating machinery designed to convert the energy in a flowing fluid into mechanical power. The fluid may be water, high or low-pressure steam, or high temperature combustion gases. Turbines are used in many applications including power generation, propulsion and various mechanical drives.

"U.S. Department of Energy (DOE)" is the federal executive department responsible for developing energy policy and programs and for overseeing the nation's nuclear arsenal.

"U.S. Environmental Protection Agency (EPA)" is the federal executive department responsible for developing environmental policy and enforcing the nation's environmental laws.

"VOCs (Volatile Organic Compounds)" refers to various solvents, gases and other organic compounds that can vaporize at normal atmospheric pressures and temperatures, thus becoming pollutants. VOCs in combination with NO_x and sunlight help to create ground level ozone. Certain VOCs are also toxic and/or carcinogenic.

"Weatherization Assistance Program (WAP)" is a federally sponsored, state managed program that pays for various improvements in the homes of low income families to help reduce energy bills. WAP measures include insulation, weather stripping, caulking, windows, doors, and heating and cooling system efficiency improvements.

APPENDICES

Appendix A: Executive Order Number 31 Creating The Delaware Energy Task Force

WHEREAS, reliable and affordable energy is of great importance to all sectors of Delaware's economy; and

WHEREAS, long-term sustainability of energy supply and efficient and effective distribution of energy is becoming increasingly important as the State continues to grow; and

WHEREAS, the State faces challenges in meeting the electricity and heating needs of a rapidly growing population, particularly south of the Chesapeake & Delaware Canal; and

WHEREAS, the existing transmission and distribution systems for electricity and natural gas need to be sufficient to meet long-term needs; and

WHEREAS, environmental constraints impact the State's ability to site new fossil fuel power plants and sole reliance on petroleum-based transportation fuels further impairs Delaware's air quality; and

WHEREAS, these constraints also present opportunities to diversify the State's energy supply and provide new opportunities for agriculturally based products and Delaware-based clean energy technologies;

NOW, THEREFORE, I, RUTH ANN MINNER, by virtue of the authority vested in me as Governor of the State of Delaware do hereby declare and order as follows, this 26th day of April 2002:

1. The Delaware Energy Task Force is hereby created for the purpose of developing the Delaware Energy Plan to recommend to the Governor courses of action to address the State's long-term and short-term energy challenges.

2. The Task Force shall consist of seventeen members, who shall be selected as follows:

a. A Chair of the Task Force, to be selected by the Governor;

b. One representative of the Delaware State Senate, to be appointed by the President *Pro Tempore*;

c. One representative of the Delaware House of Representatives, to be appointed by the Speaker of the House;

d. A representative of the Governor's Office, to be appointed by the Governor;

e. The Chair of the Public Service Commission;

f. A representative from an electricity generation company, to be appointed by the Governor;

g. A representative from an electricity distribution company, to be appointed by the Governor;

h. A representative from an electricity transmission company, to be appointed by the Governor;

i. A representative from a natural gas and/or propane distribution company, to be appointed by the Governor;

j. A representative from a company involved in renewable and/or alternative energy generation or development, to be appointed by the Governor;

k. A representative from the transportation fuels industry, to be appointed by the Governor;

l. A representative from agriculture, representing the bio-fuels industry, to be appointed by the Governor;

m. A representative from an environmental organization, to be appointed by the Governor; and

n. Representatives from each of the following government agencies, who shall be appointed by the Governor: Department of Natural Resources and Environmental Control, Department of Agriculture, Delaware Economic Development Office, and the Department of Administrative Services.

Members of the Task Force shall serve at the pleasure of the persons appointing them.

3. The Chair of the Task Force shall form working groups that shall include members from the Task Force as well as members of the public with interest and/or expertise in the objectives of the Task Force. Each working group shall be chaired by a member of the Task Force.

4. The Task Force shall provide the Delaware Energy Plan to the Governor no later than July 31, 2003.

5. The Delaware Energy Plan shall address the following goals and objectives:

a. The expansion of the diversity of fuels used to meet Delaware's current and future energy needs, through:

i. Encouraging the development of clean, base load electric supply on the Delmarva Peninsula;

ii. Encouraging a diverse fuel mix among electricity supply generation to avoid reliability impacts due to shortages;

iii. Promoting production and use of bioenergy and clean alternative energy;

iv. Broadening the existing diversity and decreasing the environmental impact of fuels that meet Delaware's transportation needs; and

v. Expanding electric generation infrastructure utilizing clean distributed energy resources (*e.g*., natural gas, photovoltaics, fuel cells, micro turbines, combined heat and power and wind energy).

b. The development of conservation programs to reduce the need to build more electricity generation facilities, through:

i. Identification and promotion of business and residential energy use reduction opportunities;

ii. Increasing the usage of energy efficient products and clean energy sources through the State procurement process; and

iii. Incorporating energy efficiency and conservation into the design and operation of State buildings.

c. Ensuring that energy infrastructure will meet Delaware's future needs for efficiently transporting energy resources, through:

i. Increasing transmission capacity in existing rights-of-way;

ii. Developing new transmission lines to provide natural gas to western and eastern Sussex County; and

iii. Upgrading transmission lines below the Chesapeake & Delaware Canal to increase the capacity to transport additional electricity supply from other parts of the PJM transmission grid and eliminate congestion on the Delmarva Peninsula.

d. Encouraging producers of clean energy technologies and producers of energy efficient products to locate their business operations in Delaware, through:

i. Expansion of the market for renewable energy technologies in Delaware; and

ii. Increasing the number of producers/developers of clean energy technologies located in Delaware.

6. The Delaware Energy Plan shall include for each goal:

a. An identification of actions already in process;

b. A prioritized list of recommended non-legislative action items, including estimated costs;

c. Recommended legislative proposals, if necessary, including estimated costs; and

d. An identification of areas on which further evaluation or research is recommended.

Appendix B: Members of the Working Groups

Conservation And Efficiency Working Group

Member	*Affiliation*
Chris Coons, Work Group Chair	**W. L. Gore & Associates**
Diane Jackewicz, Staff Support	**State Planning Office**
Robert Palmer, Staff Support	**DNREC**
Marianne Abdul	Conectiv Power Delivery
Simon Baker	University of Delaware, Center for Energy and Environmental Policy
Sandra Burton	Green Plains Energy
Gordon Carlisle	Delaware State University, High Technology Research Foundation
Alexine Cloonan	Homsey Architects
Gail Donovan	DNREC
Susan Frank	Fannie Mae Foundation
Ken Green	Carl Freeman Homes
Brian Grems	Sierra Club
Jack Hilaman	Blenheim Homes
Andrea Kreiner	Office of the Governor
James Loar	Ciba Specialty Chemicals
Pat Martin	AstroPower
Thomas Marston	Energy Services Group
Brad North	Constellation Energy Source
Mindee Osno	U.S. EPA Region III
Robert Ruggio	Commonwealth Development
Dr. Paul Sample	Technical Advisory Office, Legislative Council
Sue Sebastian	State Energy Office
Anisha Shankar	Delaware Nature Society
Charlie Smission	State Energy Office
Bruce Smith	U.S. EPA Region III
Darren Stevenson	U.S. DOE Philadelphia regional Office
John Tower	GB2 Corporation
Young–Doo Wang	University of Delaware, Center for Energy and Environmental Policy

Transmission and Distribution Working Group

Member	*Affiliation*
Hon. Arnetta McCrae, Work Group Chair	**Delaware Public Service Commission**
Andrea Maucher, Work Group Staff	**Delaware Public Service Commission**
Phil Barefoot	Eastern Shore Natural Gas
Rick Beam	Old Dominion Electric Cooperative
Paul Bienvenue	Delaware Electric Cooperative
Les Blakeman	City of Dover
Bruce Burcat	Delaware Public Service Commission
Kevin Coyle	DNREC
Janis Dillard	Delaware Public Service Commission
Ken Ellers	Delaware Electric Cooperative
Jerry Elliott	Conectiv Power Delivery
Craig Glazer	PJM Interconnection
Connie Holland	State Planning Office
Robert Howatt	Delaware Public Service Commission
Gus Kappatos	Old Dominion Electric Cooperative
Brian Little	PJM Interconnection
Steve Madden	Occidental Chemical
Joseph Marone	Occidental Chemical
Eric Matheson	AEG New Energy
Patrick McCullar	Delaware Municipal Electric Corporation
Bill Mitchell	Conectiv Power Delivery
Bill Moore	Conectiv Power Delivery
Arthur Padmore	Division of Public Advocate
William (Buddy) Pyle	Conectiv Power Delivery
Joe Rigby	Conectiv Power Delivery
Dr. Paul Sample	Technical Advisory Office, Legislative Council
Mike Schuler	Delaware Emergency Management Administration
Jim Smith	Conectiv Power Delivery
Jeff Tietbohl	Chesapeake Utilities
Dick Timmons	Occidental Chemical
Bill Whitehead	PJM Interconnection

Diversity of Fuels Working Group

Member	*Affiliation*
Phil Cherry, Acting Work Group Chair	**DNREC**
Mary Paskey, Work Group Staff	**Delaware Public Service Commission**
Dot Abbott-Donnelly	University of Delaware
Bill Andrews	Delaware Electric Cooperative
David Bacher	NRG Energy
Joseph Barrett	U.S. Department of Energy
Beverley Baxter	Committee of 100
Bruce Burcat	Delaware Public Service Commission
Gordon Carlisle	Delaware State University, High Technology Research Foundation
John Citrolo	Division of the Public Advocate
Janis Dillard	Delaware Public Service Commission
Tony DiPrima	City of Dover
Jerry Elliott	Conectiv Power Delivery
Greg Frankhauser	UTC Fuel Cells
Leigh Glover	University of Delaware, Center for Energy and Environmental Policy
John Holtz	Green Mountain
Andrea Kreiner	Office of the Governor
Susan Lee	Perdue
Dana Lasage	Citisteel
Ali Mirzakhalili	DNREC
Dorrie Moore	Delaware Economic Development Office
Susan Neidig	Delaware Public Service Commission
Mark Nielson	Delaware Electric Cooperative
Seth Powell	Tri-Gas & Oil
Marty Ross	Ross Farms
Seth Ross	Delaware Nature Society
Paul Sample	Technical Advisory Office, Legislative Council
Sue Sebastian	State Energy Office
Steve Thompson	Chesapeake Utilities Corporation
John Tower	GB2 Corporation
Larry Windley	DG Interconnect

Transportation Fuels Working Group

Member	*Affiliation*
Hon. Michael Scuse, Work Group Chair	**Secretary, Department of Agriculture**
Phyllis James, Work Group Staff	**Department of Agriculture**
Dot Abbott-Donnelly	University of Delaware
Robert Baker	Delaware Farm Bureau
Curt Cole	Department of Transportation
Dan Crossman	Conectiv
Ed Hazzouri	Sunoco
Andrea Kreiner	Office of the Governor
Ron Love	Department of Education
Ray Malefant	DNREC, Air Quality Management
Jim Minner	Department of Transportation
Trish Passarella	U.S. Department of Energy
Gary Patterson	Delaware Petroleum Council
Seth Powell	Tri-Gas & Oil, Inc.
Marty Ross	Ross Farms
Ralph Schieferstein	Chesapeake Utilities
Sue Sebastian	Delaware Energy Office
Ray Toto	Sunoco
Philip Wheeler	DNREC, Air Quality Management

Economic Development Working Group

Member	*Affiliation*
Gary Patterson, Work Group Chair	**Delaware Petroleum Council**
Rob Propes, Work Group Staff	**Delaware Economic Development Office**
Rob Book	Delaware Electric Cooperative
Rich Felton	Chesapeake Utilities
Lee Frankel	Conectiv Power Delivery
Dane Holland	AstroPower
Bill Messenger	DuPont (retired)
David Peet	DuPont
Paul Sample	Technical Advisory Committee, Legislative Council
Sue Sebastian	Delaware Energy Office
Charlie Smisson	Delaware Energy Office
John Tower	GB2 Corporation
Larry Windley	DG Interconnect

State Procurement Working Group

Member	*Affiliation*
Hon. Gloria Wernicki Homer, Work Group Chair	**Secretary, Department of Administrative Services**
Mary Schreiber, Work Group Staff	**Department of Administrative Services**
Jennifer Clausius	Chesapeake Utilities
Bobbi Hettel-Minner	Department of Administrative Services
Steve Karlsen	DNREC
Louis McCloskey	Department of Administrative Services
Brad North	Constellation Energy Source
Mindee Osno	U.S. EPA
Robert Palmer, Staff Support	DNREC
Paul Sample	Technical Advisory Committee, Legislative Council
Sue Sebastian	Delaware Energy Office
Charlie Smisson	Delaware Energy Office
Bruce Smith	U.S. EPA
Jim Smith	Conectiv Power Delivery
Stanley Von Essen, Jr.	DNREC

Appendix C: Conservation and Efficiency Working Group – Final Report

Appendix D: Diversity of Fuels Working Group – Final Report

Appendix E: Transmission and Distribution Working Group – Final Report

Appendix F: Transportation Fuels Working Group – Final Report