

# **Delaware Energy Plan 2009-2014**

**Submitted to  
Governor Jack Markell  
by**

**The Governor's Energy Advisory Council**

March 26, 2009

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## Council Chair’s Introduction – David R. Hodas

In 2003, the Delaware General Assembly recognized the need for a “comprehensive energy policy which will ensure an adequate, reliable and continuous supply of energy...which [protects] public health and the environment and which promotes our general welfare and economic well-being.”<sup>1</sup> A little over a year later the General Assembly established the Governor’s Energy Advisory Council and charged it, among other things, to update the Delaware Energy Plan every five years.<sup>2</sup> In the spring 2007, the Council began the extensive task of drafting a new plan, building on the 2003 Governor’s Energy Task Force Report, *Bright Ideas for Delaware’s Energy Future*. The range of issues that needed to be considered included energy costs associated with urban sprawl, the projected effects of climate change on Delaware, an analysis of energy trends in Delaware, the potential to increase energy efficiency and renewable sources of energy, the need for an improved and smarter electricity transmission system, the link between energy policy and economic development, the energy implications of our transportation system, the strengths and weaknesses of current Delaware laws, policies, and programs – and a comparison with the “best practices” developed in other states-- and a review of the energy related governance structure in Delaware to identify the opportunities for improved effectiveness.

The goal for the energy plan was to identify where Delaware’s energy system should be headed over the next 20 – 30 years, and to identify what can and ought to be done over the next five years to move Delaware in that direction. The process of developing the energy plan was governed by five Guiding Principles that the Council established at the outset:

- Increasing energy end-use efficiency and conservation
- Reducing the environmental impacts (footprint) of energy used and generated in Delaware
- Reducing energy used for transportation
- Maximizing clean energy economic development opportunities
- Maintaining and improving the reliability and security of Delaware’s energy systems
- Minimizing energy-related costs and impacts on Delaware citizens

As an important first step, the Council surveyed Delawareans about their priorities in setting Delaware’s energy future, with more than a thousand people responding. The results, reported in Appendix C, confirmed the General Assembly’s findings in 2003 and guided the Council in setting up five work groups: 1) Reducing Energy Use, 2) Reducing the Environmental Footprint of Energy Used by Delawareans, 3) Reducing Transportation Energy Use, 4) Ensuring Efficient and Effective Energy Transmission and Distribution systems, and 5) Supporting and Growing Delaware’s Clean Energy Businesses. Each work group was comprised of about 20 –30 volunteers and a chair. The groups met monthly, working diligently to evaluate a wide range of data and information, identify specific energy issues, needs, and goals, and finally to develop consensus-based recommendations for the Council to consider. The Council debated the recommendations, accepting some, rewriting others, rejecting some, and adding a number of its own. The final result is the set of Recommendations for the Governor. Each recommendation in this report represents the unanimous vote of the Governor’s Energy Advisory Council.

We believe that Delaware is in a position to be a national leader and innovator, and that the State has the opportunity to grow new fields of business and jobs. In our view, the energy plan can be a core piece of Delaware’s response to the economic emergency we now face. Implementation of the recommendations in the energy plan, by promoting energy efficiency and renewable energy, can expand Delaware’s economic

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<sup>1</sup> 74 Del. Laws ch. 38 §1 (2003)

<sup>2</sup> 29 Del. C. § 8055.

base, create many new, good, green jobs, and help Delaware prosper in both the short and the long run. The energy planning process revealed that a shift to a greener energy economy presents a remarkable opportunity to ensure a prosperous, healthy, vital Delaware in the 21<sup>st</sup> century.

This energy plan represents the emergence of a new generation of energy policy that will begin to move us from a fossil fuel dependent society to a sustainable energy future. Several energy storms are headed in our direction. First, global warming requires that we drastically reduce our greenhouse gas emissions from burning fossil fuels. Second, we need to worry about our dependence on foreign oil. The price of oil has dropped, due to a collapse of demand in response to the global recession, but as the world's economy picks up, demand will rapidly rise, and oil prices will soar again. We must face the fundamental fact that the global demand for petroleum in a healthy world economy will rapidly bump up against real limits on the total oil supply. While Delaware is far too small to affect global climate change or world energy markets, it can prepare itself to be more resilient and less dependent on fossil fuels.

Energy from the sun and wind, although currently more expensive to use than fossil fuels, does not go up in price. Investments today in energy efficiency and renewable energy will produce a secure, long-term yield. The yield will manifest itself in energy savings, in economic growth, in new businesses and jobs, in healthier air, in a better place to live, and in long-term capital savings that can be reinvested to strengthen Delaware's social fabric, and make Delaware ready to meet future challenges.

However, if Delaware were to proceed in its business-as-usual fashion, its future would be worrisome. Delaware and Delawareans spend much more money on energy today than we need to. According to the U.S. Energy Information Agency, in 2006<sup>3</sup>, Delaware spent just over \$3.6 billion on energy, ranking us as the 20<sup>th</sup> highest energy use per capita of all the states. Delaware ranks last in the nation in renewable energy production; overall, less than .05% of our energy in 2006 came from renewable sources. We are so low, that the next lowest state, Rhode Island, with a population slightly larger than Delaware's, generated more than 50 times the amount of electricity from renewable energy than did Delaware. Nor can we be proud of our efforts to use electricity efficiently; for many years, Delaware was tied for last in the nation with regard to money spent on energy efficient investments. We have improved slightly since then; we are now tied at 32<sup>nd</sup> with Virginia, but have a very long way to go to even become average.

With respect to energy use in transportation, in 2006 we burned 539 gallons of gasoline per person, an amount higher than all of our neighbors.<sup>4</sup> New York, a state with a mixture of urban, suburban and rural communities and which has about the same land area per person as Delaware, burned 42% fewer gallons per person than Delaware. Even the size and remoteness of a state does not account for gasoline use patterns. For instance, Montana, over 60 times more sparsely populated than Delaware, used less gasoline per capita than did Delaware. Delaware wastes dollars in its use of energy. We Delawareans burn almost 150,000,000 gallons more than we would if our gasoline consumption was similar to Rhode Island. At \$2.00 per gallon, our driving habits cost us about \$300 million dollars more each year just on gasoline than do Rhode Island's. Even if we were to only reduce our gasoline consumption by 10%, we would save 48.5 million gallons of gasoline each year, saving nearly \$100 million.

More broadly, in 2006, Delaware's total energy use per person was 11% higher than Pennsylvania, 17% higher than New Jersey, 36% higher than Maryland, and 40% higher than Rhode Island. Given that we spent some \$3.6 billion on energy in 2006, an 11% reduction would save us \$400 million each year. If we used New Jersey as the standard to meet, we would see a \$600 million annual savings. Matching Maryland means a \$940 million savings. If Delaware wanted to be a leader with a per capita energy consumption rate equivalent to Rhode Island, we would have saved Delawareans over \$1.5 billion dollars in 2006 alone!

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<sup>3</sup> 2006 is the most recent year that full data is available

<sup>4</sup> New Jersey used 539 gallons/person, Pennsylvania 440, Maryland 520.

Considering that we, and the nation, now face daunting economic challenges and need to restructure our economy to create many good new jobs, we can no longer afford to needlessly burn our money. If we continue along our current path, the state's economic future will be held hostage to the global fossil fuel market and we will have little resilience to respond to energy price spikes or to future federal mandates to reduce our greenhouse gas emissions from burning fossil fuel. Instead, we will continue burning money that could be put to important, productive uses. On the other hand, the opportunities for improvement are dramatic if we make a full-fledged commitment to improve our energy efficiency and shift to renewable energy. The potential to create new green energy industries and reduce our energy waste is enormous. But these changes will not occur on their own. The reason some states are efficient and have more renewable energy is primarily the result of the laws, policies and institutional frameworks that a state adopts.

Our present energy use creates pollution, contributes to climate change, creates a risk to our national security, and is a drag on our economic well-being. Delaware's prosperity depends on having a reliable, adequate, safe, clean, continuous supply of energy at a reasonable, nonvolatile cost. Inefficient use of fossil fuels exposes us to the risks of price swings, especially in a world economy with so many emerging and rapidly growing economies. By using energy efficiently we can make our economy more productive, the air cleaner, reduce our emissions of greenhouse gases, and make the shift to renewable energy more affordable.

This Energy Plan for Delaware faces these challenges directly. It proposes major, innovative changes in the laws and policies that determine how we go about using energy. This plan is intended to put us on a new path. It is the start of a long journey, but contains the concrete first steps to start us on our way to a prosperous Delaware driven by green and clean energy. The plan's recommendations, if implemented, will propel our transition to a state powered by efficient use of renewable energy - a green energy future. The extent to which we achieve these goals, how much more efficient we can be, and how much money we save over time depends on how, and the extent to which, we implement this plan. The choice is ours.

Before I finish, I'd like to take a moment to acknowledge the many people who helped to create this plan. All the work group chairs, work group members, and appointed members of the Council and their designees served in a volunteer capacity. These busy people generously devoted remarkable time and energy to this huge project —attending meetings, reading reports, drafting, debating, editing, and assembling excellent final reports. No volunteer was paid, even for their travel expenses, which were not trivial. Their public spiritedness, collegiality, hard work, thoughtful input, and genuine concern for the well-being of Delaware now and into the future was outstanding. We all owe each of these people a full measure of appreciation for the time and diligent effort they devoted to this project. Each Work Group chair rose to an enormous challenge and deserves special thanks for their exceptional efforts. I use this occasion to convey my personal thanks to chairs William Pelham (Reducing Energy Use), Mark Barteau (Energy Footprint), Bill Osborne (Transportation Energy Use), Dallas Winslow (Transmission and Distribution), and Mike Bowman (Clean Energy Businesses). This report has benefited from the Delawareans who responded to the survey, attended meetings, asked questions, offered comments, and whose participation and interest helped to make this an open, transparent policy making process. The public comments pointed out a couple of issues which are not addressed in this plan – Agriculture and Freight Transportation. These issues deserve review, either under the purview of the recommended Climate Change Commission or in the next update of the energy plan.

Lastly, but importantly, the creation of this energy plan would not have been possible without the outstanding efforts from everyone in the already overwhelmed Delaware Energy Office. In particular, Suzanne Sebastian, assisted by Jacqueline Bryant, did yeoman work on this project. They met the many, diverse requests for data, information, and administrative and logistical support that this large, fast-paced, multi-work group project required; and they handled the challenges with skill, on time, and with ever present tact and friendliness. Finally, Andrea Kreiner, our tireless consultant, work group facilitator, and translator of work group and Council

recommendations and findings into a report drafts, was a critical ingredient in the formulation of this energy plan. Thank you.



## Summary of Recommendations

The following is a short description of each recommendation included in the Energy Plan. The full texts of the recommendations can be found beginning on page 30.

### Energy Planning Governance Recommendation

Recommendation G-1: Create a Governor's Executive Office for Energy Policy

### Recommendations to Reduce Energy Use through Energy Efficiency and Conservation

Recommendation EE-1: Adopt an Energy Reduction Goal & Vision to achieve energy self-sufficiency and carbon neutrality in Delaware's built environment by 2030

#### **Building Codes for Energy Efficiency**

Recommendation EE-2: Continually adopt the most current edition of the International Energy Conservation Code (IECC) as Delaware's Residential Energy Code

Recommendation EE-3: Continually adopt the most recent ASHRAE standards as Delaware's Commercial Energy and Ventilation Codes

#### **Residential Energy Use Reduction**

Recommendation EE-4: Offer tax credits for enhanced energy efficient construction of New Homes

Recommendation EE-5: Expand the Weatherization Assistance Program to provide substantially more weatherization services to low-income owner-occupied and rental households as rapidly as possible

Recommendation EE-6: Develop a requirement for utilization of Geothermal (ground water source heat pumps) in a percentage of New Home Construction

#### **State Government Energy Use Reduction**

Recommendation EE-7: Develop and implement a State Energy Efficiency Policy to optimize energy efficiency in the building and operations of State funded facilities

Recommendation EE-8: Develop and implement a Public Buildings and Facilities Renewable Energy Policy that sets standards and requires cost effective renewable energy systems to be incorporated in new construction and renovations of public facilities

Recommendation EE-9: Conduct a Demonstration Project to design, build and operate a school to LEED silver or gold standards

#### **Industrial Energy Use Reduction**

Recommendation EE-10: Develop Combined Heat and Power regulations for boilers/power plants and Incentivize Combined Heat and Power through existing pollutant trading programs

### **Recommendations under the purview of the Sustainable Energy Utility**

The following are the recommendations to reduce energy use for which the Sustainable Energy Utility (SEU) is envisioned as the primary vehicle for delivery of the services detailed in the recommendations. The Governor and the Council should closely monitor progress on the recommendations and, if necessary, assess how best to move forward on achieving the objectives of the recommendations, should alternative approaches be required.

Recommendation SEU1-1: The Sustainable Energy Utility (SEU) should defray the cost of installing customer-sited renewable energy

Recommendation SEU-2: The SEU should defray energy efficiency investments to retrofit existing homes

Recommendation SEU-3: Explore Energy Efficiency Financing options for New and Existing Homes

Recommendation SEU-4: The SEU should defray the incremental investments required for meeting the EPA Energy Star Program requirements for New Home construction

Recommendation SEU-5: The SEU should provide economic incentives for fleet purchases and home infrastructure for highly energy efficient and advanced alternative fuel vehicles

### **Energy Education & Outreach**

Recommendation EO-1: Develop and implement a comprehensive Energy Education and Outreach Program

### **Recommendations to Reduce Delaware's Transportation Energy Use**

#### **Reducing Vehicle Miles Travelled**

Recommendation TE-1: Adopt the goal that by 2030, the total vehicle miles travelled in Delaware will not exceed the levels in 2009

Recommendation TE-2: Develop standards and incentives for employer participation in commute alternatives programs

Recommendation TE-3: Bus Transportation System improvement, including combing services with other bus systems in overlapping areas and adding small bus/van routes to connect to longer distance, express oriented transit routes

Recommendation TE-4: Convene an ad hoc panel to evaluate and recommend options to improve energy-efficiency and cost-effective implementation of the State's policies regarding non-ADA Para transit service

Recommendation TE-5: Raise fixed-route transit capital spending to at least 20% of total transportation spending in the region and create a dedicated funding stream for the system

Recommendation TE-6: Explore the feasibility of creating a phased Bus Rapid Transit system throughout the Mid-Atlantic Area

Recommendation TE-7: Implement policies and funding to require expanded Bicycle and Pedestrian Transportation systems and encourage bicycling and walking as alternative transportation

### **Increasing Vehicle Efficiency/Reducing Energy Use per Mile**

Recommendation TE-8: Develop and propose vehicle-related fees and/or fuel taxes which encourage increased fuel efficiency and decrease miles travelled

Recommendation TE-9: Establish high standards for fuel efficiency and environmental impacts for new fleet purchases by the State and provide support infrastructure for new alternative fuel vehicle technologies

Recommendation TE-10: Incorporate HOV (High Occupancy Vehicle) Lanes into new roadways or expansion projects

### **Reducing the Impact of Land Use on Energy Use**

Recommendation LU-1: Strengthen Delaware's efforts to effectively direct growth into growth zones and require Smart Growth

Recommendation LU-2: Promote Transit-Oriented Development

Recommendation LU-3: Establish an "Emissions Standard and Mitigation Regulation" for land use development

### **Reducing the Environmental Footprint of Delaware's Energy Use Recommendations**

#### **The Need to Address Climate Change**

Recommendation FP-1: Establish a greenhouse gas reduction goal and a Climate Change Commission to develop a detailed Climate Action Plan for Delaware

#### **Increasing Renewable Energy Use**

Recommendation FP-2: Align the Green Energy Program to complement other state and federal programs to help achieve Delaware's renewable energy goals

Recommendation FP-3: Enact legislation to eliminate forfeiture provisions from the Net Metering Law

Recommendation FP-4: Enact legislation addressing deed restrictions and/or covenants that unduly prohibit the use of renewable energy sources

Recommendation FP-5: Examine and revise the Renewable Energy Portfolio Standards

Recommendation FP-6: Gather updated supply data and remove legislative restriction on environmentally beneficial Biomass Energy utilization

#### **Improving Existing Energy Facilities**

Recommendation FP-7: Reduce the carbon emissions from the State's existing coal facilities

## **Clean Energy Economic Development Recommendations**

Recommendation CE-1: Develop and implement a Clean Energy Business Development Initiative

Recommendation CE-2: Develop and implement a Comprehensive Energy Workforce Training Strategy

### **Technology Specific Recommendations**

Recommendation CE-3: Fund targeted Wind and Solar industry business development initiatives

Recommendation CE-4: Facilitate public and private sector funding for Clean Energy Research at Delaware's universities

Recommendation CE-5: Convene an advisory group to determine the infrastructure, incentives and rules needed to facilitate Vehicle-to-Grid (V2G) development and implementation

Recommendation CE-6: Encourage expanded Biofuels research and business leadership in the State

Recommendation CE-7: Establish a support effort for Energy Storage research and development, incentives for suppliers to locate in Delaware, and efforts to raise awareness of energy storage technologies and opportunities

### **Emerging Technology Pilot Projects**

Recommendation CE-8: Conduct a Vehicle-to-Grid large fleet demonstration project

Recommendation CE-9: Create a public/private partnership to fund a fast fill Hydrogen station at the I-95 rest area

Recommendation CE-10: Conduct a pilot project to install Hydrogen fuel pumps and utilize Fuel Cell vehicles

## **Transmission & Distribution System Recommendations**

Recommendation TD-1: Permitting, Siting & Right-of-Way Coordination for electric and natural gas transmission and distribution projects

Recommendation TD-2: Facilitate expansion of the Delaware's Natural Gas transmission and distribution system

# Delaware's Energy Challenges and Issues

The energy challenges facing Delaware in 2009 can be grouped into three main areas:

## Increasing Energy Demand

Although population growth is slower than at the time of the last energy plan, Delaware's growth is still higher than the national average, resulting in increased demand for energy services. Although many new homes are being built more energy efficiently, average house size has increased, and the number of electricity-based products in homes is increasing.<sup>56</sup>

## Increased and Variable Energy Cost

Removal of the electricity price caps, oil that recently topped \$130/barrel, and fluctuating natural gas prices<sup>7</sup> have significantly increased average home and business energy costs in Delaware since the initial energy plan in 2003. This challenge is more significant now than during development of "Delaware's Energy Future".<sup>8</sup>

## Environmental Issues & Climate Change

Energy generation and use is the single largest contributor to pollution, smog and greenhouse gases. Public awareness of the link between energy generation and consumption and climate change has grown considerably over the past 5 years.

## Energy Issues

The Governor's Energy Advisory Council began the energy planning process with an internal exercise to identify the key energy issues in Delaware over the next 5 to 10 year timeframe. There were 18 issues identified by the Council:

*Energy Efficiency* - Energy efficiency includes using energy efficient appliances, lighting, heating and cooling systems, and building design in homes, commercial and public buildings

*Land Use Issue/Sprawl* - The impacts of sprawl on energy use through increased driving/commuting and on the energy infrastructure; i.e. the ability to get the electricity and heating fuels out to the homes

*Residential Energy Costs* - Impact on residents of the cost of electricity, heating fuels, and means to mitigate cost increases

*Climate Change* - Evaluating and preparing for impacts on Delaware and Delawareans of changing temperatures, weather and sea level rise

*Greenhouse Gas Emissions* - Reducing releases of greenhouse gases, such as carbon dioxide and methane, from people, transportation, and businesses

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<sup>5</sup>National Association of Home Builders. [http://www.nahb.org/fileUpload\\_details.aspx?contentID=80051](http://www.nahb.org/fileUpload_details.aspx?contentID=80051)

<sup>6</sup> Though average electric usage per customer has been on the rise, average use per natural gas customer has been on a steady decline for the past several years due to building practices and equipment efficiency improvements.

<sup>7</sup>It should be noted that natural gas prices steadily fell during the latter part of 2008 and are currently near 2003 price levels.

<sup>8</sup> This challenge incorporates three of the challenges identified in "Delaware's Energy Future": Increased Energy Cost, Utility Deregulation, and Electricity Prices and Removal of Electricity Rate Caps.

*Industrial and Commercial Energy Use and Costs* - Impacts of energy costs on costs of goods produced, industrial energy efficiency, prices relative to neighboring states, etc.

*Transportation Energy Costs* - Impact on residents and businesses of the cost of transportation fuels

*Transportation-Related Energy Use* - Mass transit (buses, light rail), vehicle fuel efficiency, alternatives for reducing overall energy consumption in the transportation sector, and transportation-related pollution in urban areas

*Transportation Fuels* - Availability of fuels, cost of alternative fuels v. gasoline and diesel, production of bio-diesel, ethanol or other bio-based fuels, alternative fuel vehicles

*Agricultural Energy Use* - Impact of cost of fuel and energy on food prices, crops for food or fuel, impact of corn being grown for fuel on Delaware's poultry industry

*Electricity Generation* - Developing and maintaining capacity to meet future electricity needs in Delaware, including reliability, price stability and cost effectiveness

*Environmental Impact of Electricity Generation* - Types of fuels used to generate electricity (coal, natural gas, oil, wind, biomass, solar) and their resultant environmental impacts

*Localized Heating and Electricity Generation (i.e. Distributed Generation)* - Increasing the use of solar electricity generation, solar hot water, fuel cells, geothermal, small wind, etc

*Electricity Transmission and Distribution* - New/expanded transmission through Delaware, right-of-way issues, and developing system capacity infrastructure to serve all areas of the State

*Natural Gas Availability* - Increasing areas of the state where natural gas is available for residential, commercial and industrial use, where economically feasible

*Energy Technology-Based Economic Development* - Encouraging the location and growth of businesses researching, developing, and producing advanced and alternative energy technologies

*Energy Education* - Educating students, residents and businesses about energy issues and response options

*Recycling*- Developing feasible alternatives for residents and providing convenient recycling infrastructure

Following the internal exercise, the Council conducted a web-based survey to ascertain the energy priorities of Delawareans and obtain feedback on the energy issues identified by the Council. Beginning in the spring 2008, there were over 1080 surveys submitted, with 46% of the surveys from respondents between the ages of 46 and 65. The issues which received more than 50% of their rankings as "most important" were:

- Localized Heating and Electricity Generation (i.e. Distributed Generation) (64%)
- Energy Efficiency (59%)
- Environmental Impact of Electricity Generation (55%)
- Residential Energy Cost (54%)
- Electricity Generation (52%)
- Transportation-related Energy Use (51%)

The survey response summary is included as Appendix C.

# Energy Planning in Delaware

## Bright Ideas for Delaware’s Energy Future

“Bright Ideas for Delaware’s Energy Future”, Delaware’s first energy planning process in over 20 years, was completed in 2003. “Delaware’s Energy Future” was a comprehensive review of the status of energy usage, electricity generation, transmission and distribution, and fuels in Delaware. The Governor’s Energy Task Force, created by Governor Ruth Ann Minner to undertake the 2003 energy planning process, was assigned the following goals to be addressed in the plan:

- 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 the 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

The energy plan included a laundry list of specific actions (approximately 80) to be taken by government to achieve the goals of reducing the quantity and environmental impacts of energy usage. As of 2005, action was being taken on approximately three-quarters of the recommendations in the report, although significant funding for conservation and efficiency programs was still a ‘future’ item. Numerous pieces of legislation were enacted as a result of the energy plan, including creation of the Governor’s Energy Advisory Council (a listing of energy-related legislation enacted since the “Bright Ideas” report is included in Appendix B). Among other things, the Council was tasked with monitoring the progress on energy plan implementation and developing a new energy plan for Delaware every five years. This plan is the first energy plan to be developed by the Council.

## Ensuring Delaware’s Energy Future

The “Ensuring Delaware’s Energy Future” report, issued in 2006, was developed in response to the electricity rate increases following the removal of the electricity rate caps. The report included recommendations for specific actions to address the impacts of the rate increases on customers. The major recommendations from the report have been implemented; several of the key recommendations implemented the conservation and efficiency recommendations in “Delaware’s Energy Future” that had heretofore not been funded.

## Major Legislation Enacted

In addition to the legislation implementing recommendations from the two energy reports, three other substantial pieces of energy legislation have been enacted; a Renewable Portfolio Standard was enacted in 2005 and amended in 2007<sup>9</sup>, the Electric Utility Retail Customer Supply Act was enacted in 2006, and the Sustainable Energy Utility was created in 2007<sup>10</sup>.

### Renewable Portfolio Standard

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<sup>9</sup> 26 Del C Ch 1 Subchapter III.

<sup>10</sup> 29 Del C §8059.

Delaware's Renewable Portfolio Standard (RPS) law requires a minimum percentage of electrical energy sales to Delaware end-use customers from renewable energy resources through the year 2019, with a minimum of 20% from renewable energy resources by 2019. The amended law requires that, between 2009 and 2019, the minimum percentage of sales from solar photovoltaics increase from 0.03% to 2%.

### **Electric Utility Retail Customer Supply Act of 2006**

In response to the announcement of a large electric supply rate increase for the customers of Delmarva Power (DP), the Delaware General Assembly in March 2006 passed the Electric Utility Retail Customer Supply Act of 2006 (EURCSA). In part, EURCSA required DP to develop an Integrated Resource Plan (IRP) every two years, beginning in December 2006. In its IRP, DP is required to evaluate available electricity supply options during a 10-year planning period in order to acquire sufficient, efficient and reliable resources over time to meet its customers' needs "at a minimal cost" and "at the lowest reasonable cost." DP filed its first IRP in December 2006, with the most recent filing on December 1, 2008.

As part of the 2006 IRP process, EURCSA also required DP to conduct a request for proposals for the construction of new generation resources within Delaware to serve its customers taking standard offer service through a power purchase agreement (PPA). This process led to the DP/Bluewater Wind PPA.

### **Sustainable Energy Utility**

The Sustainable Energy Utility (SEU) was created by the Legislature in 2007. The SEU is a pioneering effort by the State of Delaware to create an institution to comprehensively plan, develop and implement energy efficiency, energy conservation and distributed renewable energy programs in a self-sustaining manner. As shown in Figure 1, the SEU model is an alternative to the conventional approach to energy efficiency, which has treated various aspects of the energy system as distinct "silos" with limited overlap and coordination between them.

In addition to a comprehensive institutional structure, the SEU was created with a mechanism to channel investments to these areas in a self-sustaining manner. Realizing energy efficiency requires investments at the time of building construction, retrofitting or appliance purchase. For transportation, a host of additional decision points can be targeted for investment incentives. Efforts to "green" the vehicle fleets of government and large companies and to incentivize use of public transit, car-sharing, van pooling and employee commute options that can lower emissions could be supported through SEU investments.

From a financial perspective of risk and return on investment, the merits of energy efficiency are now clearly recognized. As seen in Figure 2, the only investment that offers lower risk than energy efficiency is US treasury bills (T-Bills). In terms of rate of return, energy efficiency outperforms all financial instruments. But unlike T-Bills, energy efficiency maximizes return on investment while minimizing risk.

**Figure 1: A Comprehensive Institutional Framework for Energy Efficiency<sup>11</sup>**

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<sup>11</sup> Citi Municipal Securities, Green Community Program, p. 64.



## Delaware SEU: Our Nations *First* Demand Reduction Utility

The SEU is a new utility serving the interests of community sustainability. It can partner with existing utilities while building and investing in a comprehensive sustainable energy infrastructure.

- SEU was established by the State of Delaware on June 28, 2007 to:
  - Promote, provide and invest in Energy Efficiency Services – **Legislated Target: 30% Reduction in Energy Use by 2020** (for participants)
  - Promote, provide and invest in increased deployment of Distributed Renewable Generation – **Legislated Target: 10-20% of Electricity Sales from Distributed Renewables by 2020**
- SEU exists as a public/private partnership combining the best of both worlds
  - SEU is organized as a non-profit tax-exempt 501(c)(4) organization
  - Day to day operations are conducted by for-profit companies, non-profits & others specializing in the energy sector
  - Eliminates silos and provides solutions throughout the energy spectrum

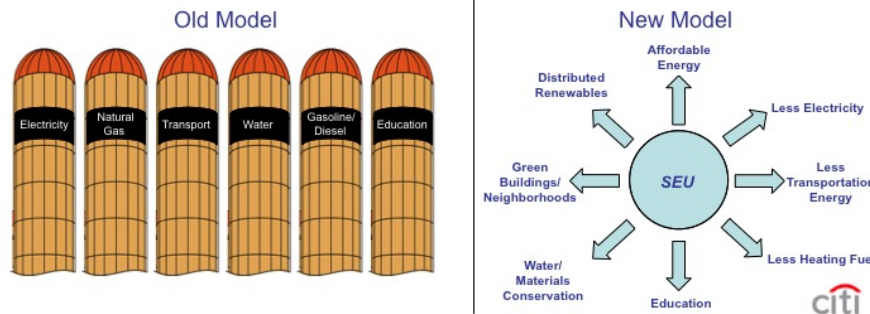
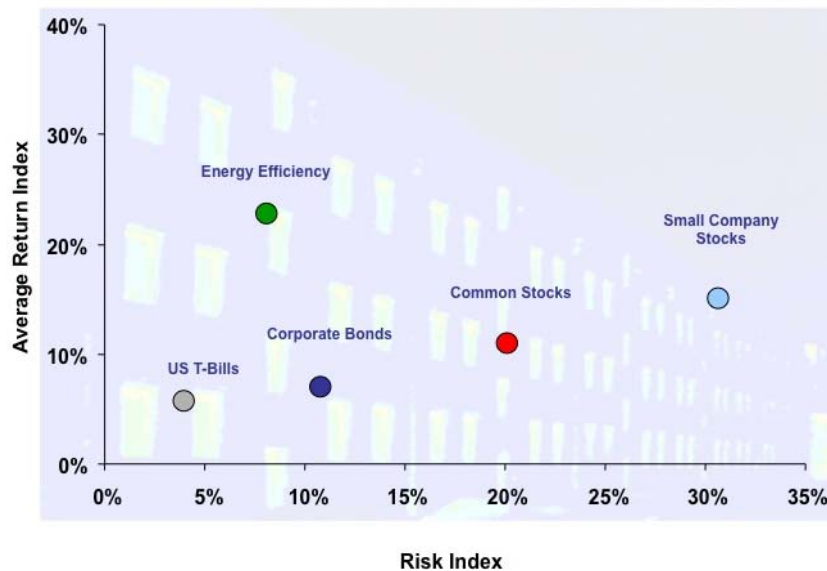


Figure 2: Comparative Risk/Return of Typical Investments<sup>12</sup>



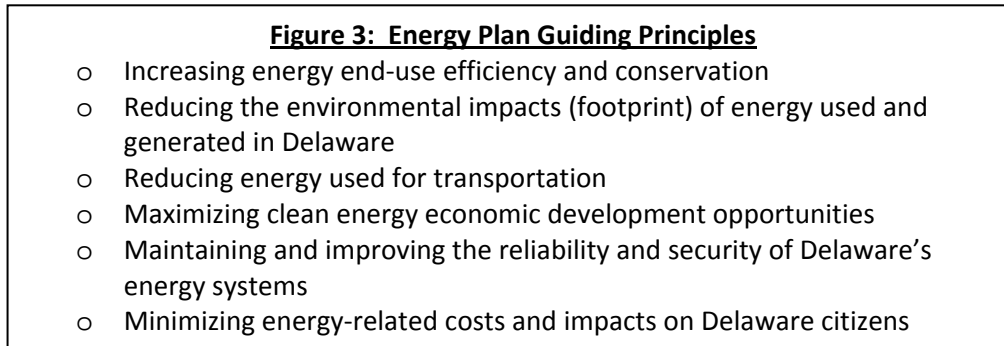
Building on the strong financial foundations of energy efficiency investments, the SEU will incentivize energy efficiency investments in all sectors and for all fuels by providing the investment required to install energy efficiency measures at reduced or no initial cost to residents, businesses, state and local governments, school districts, community organizations, etc. This is enabled by a mechanism that shares the savings for a limited time between the participant and the SEU. This arrangement helps refinance the SEU, which is then able to further incentivize a new round of energy efficiency investments. After the shared savings period, all savings will accrue to the participant.

<sup>12</sup>Ehrhard-Martinez, Karen and John A. "Skip" Laitner "The Size of the US Energy Efficiency Market: Generating a More Complete Picture." (ACEEE). May 2008.

This financing structure is the key to the SEU self-sustainability model. It provides the potential to self-finance so that investments in energy efficiency and distributed renewable energy are not curtailed based on the availability of limited public funds. In addition to the self-financing model, 65% of the funds raised by the auction of RGGI emission allowances can be utilized by the SEU.

## 2009 Energy Planning Process

The Guiding Principles established by the Council for the process of developing the 2009 Delaware Energy Plan are shown in Figure 3.



### Work Groups

Five work groups were formed to develop the initial sets of recommendations to the Council. The work groups were:

- Reducing Delaware's Energy Use
- Reducing the Environmental Footprint of Energy Use in Delaware
- Having Effective and Efficient Transmission and Distribution Systems
- Reducing Delaware's Transportation Energy Use
- Maximizing Delaware's Clean Economic Development Business Opportunities

The work groups were open to membership to anyone wishing to participate and willing to commit to one meeting per month from May through December, 2008. To encourage participation both by members and non-member participants/observers, all meetings were posted on both the State website and the Energy Plan website.<sup>13</sup> In addition, meeting notes and presentations were posted on the Energy Plan website. The list of work group members is included in each of the work group reports (Appendices F through J).

The work groups held monthly meetings, initially focused on providing background information and education to work group members on relevant topics. Later meetings focused on discussion of goals and objectives, identification of potential recommendation topics, review and discussion of recommendation "strawman proposals" developed by work group members, and finally, decisions on recommendations to forward to the Governor's Energy Advisory Council. The work groups operated through consensus decision making and included non-consensus proposals as attachments to their recommendation reports. The full work group reports are included as Appendices F through J of this report.

### Council Review of Recommendations

In January, 2009, the chairs of each of the work groups presented their recommendations to the Council. A day-long meeting was devoted to gaining Council understanding of the meaning and intent of each of the recommendations. The Council then conducted an internal straw poll on each of the recommendations to aid in

<sup>13</sup> <http://www.dnrec.delaware.gov/Admin/Pages/DelawareEnergyPlan.aspx>

organizing the discussion of the recommendations. The recommendations were grouped according to whether there was full consensus on the recommendation as written, consensus on the recommendation concept with minor changes, general agreement on the concept but issues that needed to be addressed, and significant concerns with the recommendation. A second day-long Council meeting was held in January, 2009 to discuss and determine action on each recommendation. All recommendations achieved consensus as to their final wording and status as to whether or not they would be included in the Council's final report.

The Council prioritized the recommendations based on timing, importance, and anticipated financial impacts of the recommendations. Recommendations were ranked as Tier 1 if they should be implemented in the very short term, based on importance, anticipated high benefit-cost ratios, or no-cost to the state to implement, etc. Tier 2 recommendations would be accomplished in the mid-term, years 2 to 3 or as funding becomes available. Tier 3 recommendations would be accomplished if and when funding opportunities arose.

Since many of the recommendations are presented at the concept level, they have not been subjected to cost-benefit analyses or full costing studies. These will need to be conducted by the accountable entities as the specifics of recommendation implementation are determined.

The draft Council Report was presented at Public Input Sessions in Sussex County on March 2, Kent County on March 4 & New Castle County on March 5. Comments were incorporated into this report as deemed appropriate by the Council. All written comments received by March 12, 2009 are included in Appendix E.

# Delaware's Energy Profile<sup>14</sup>

## Energy Use in Delaware

Annual world energy consumption is approximately 400 Quads<sup>15</sup>, with the US representing about one-quarter of that at approximately 100 Quads per year. Annual energy consumption in Delaware is approximately 0.3% of total US energy consumption.

Total energy use across all sectors of Delaware's economy was 301 trillion BTUs in 2006, with a per capita use of 353 million BTUs. The US average 2006 per capita energy use was 333 million BTUs; Delaware ranked as the 20<sup>th</sup> highest per capita user of energy.<sup>16</sup> Delaware also ranks poorly when compared to neighboring Mid-Atlantic States, as shown in Table 1.

**Table 1: 2006 Per Capita Energy Use in Mid-Atlantic States<sup>17</sup>**

Delaware	353 million BTU
Maryland	259 million BTU
New Jersey	301 million BTU
Pennsylvania	317 million BTU

For the 2003 Bright Ideas for Delaware's Energy Future report, 1999 energy use figures were the most recent available. Total energy use in Delaware in 1999 was 280 trillion BTU's and per capita use was approximately 357 million BTUs. Over the seven year period between 1999 and 2006, there was a 1.1% reduction in energy use. The most energy efficient states, Rhode Island, New York and Massachusetts, have 2006 per capita energy consumption of 204, 204, and 230 million BTUs, respectively.<sup>18</sup> Per capita energy use in each of these states is less than two-thirds of that in Delaware.

One reason why Delaware's per capita energy use is relatively so much higher is the ratio of industrial energy use to the small population as compared to the other states. Even accounting for that, great opportunity exists to increase the energy efficiency of Delawareans.

## Energy Use by Sector

Energy use in Delaware is distributed among the economic sectors similarly to the overall national distribution. In Delaware, less energy is used, relatively, for transportation, and more in the residential and industrial sectors, shown in Figures 4 and 5 below. The change in Delaware between 1999 and 2005 was 3% increases in the percentage of energy used in the residential and commercial sectors (from 20-23% residential and 16-19% commercial) and decreases in the percentages used for industry and transportation (from 39-35% industrial use and 25-23% transportation).

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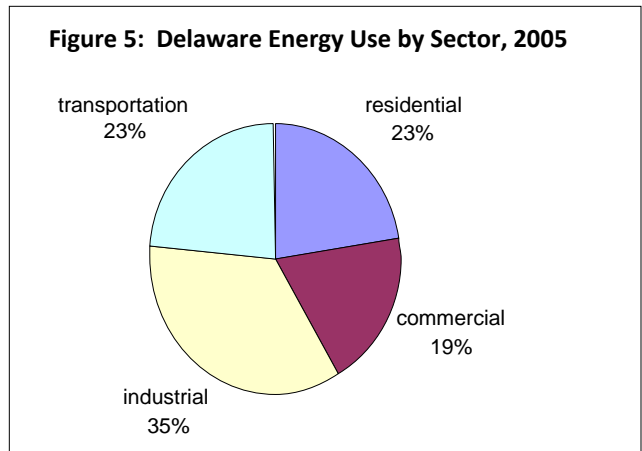
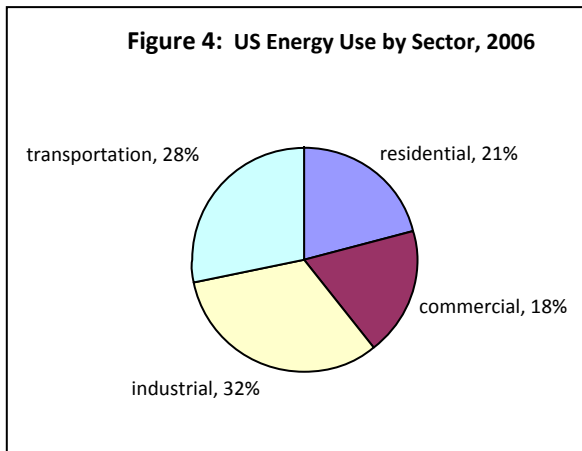
<sup>14</sup> Additional data can be found in the work group reports in Appendices E through I.

<sup>15</sup> One Quad = One quadrillion BTU.

<sup>16</sup> Energy Information Agency. US information: [http://tonto.eia.doe.gov/state/state\\_energy\\_profiles.cfm?sid=DE#Datum](http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=DE#Datum).

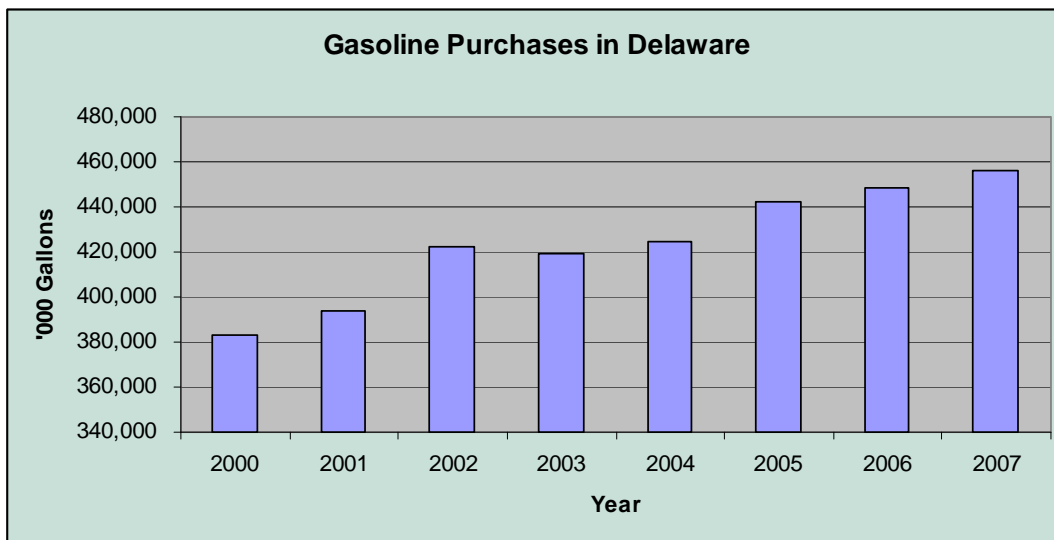
<sup>17</sup> Energy Information Agency. US information: [http://www.eia.doe.gov/emeu/aer/pdf/pages/sec2\\_2.pdf](http://www.eia.doe.gov/emeu/aer/pdf/pages/sec2_2.pdf).

<sup>18</sup> Ibid.



Gasoline purchases in Delaware increased 19% (by 73 million gallons) from 2000 to 2007, an average annual increase of 2.6%. The Division of Motor Vehicles projects a steady 2% annual increase in fuel sales<sup>19</sup>. Even at that conservative estimate, by 2012, over 512 million gallons of gasoline will be purchased annually in Delaware.

**Figure 6: Gasoline Purchases in Delaware<sup>20</sup>**



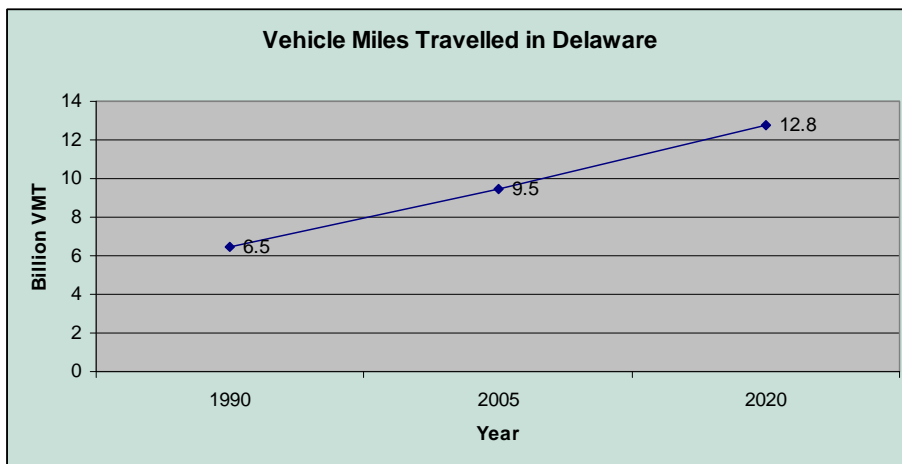
The increase in gasoline purchases reflects the steady growth in vehicle miles travelled (VMT). Travel on Delaware's major highways increased by 45% from 1990 to 2005 (from 6.5 billion VMT to 9.5 billion VMT). As shown in Figure 7, vehicle travel is expected to increase by another 35 percent by 2020, reaching 12.8 billion VMT.<sup>21</sup>

**Figure 7: Vehicle Miles Travelled in Delaware**

<sup>19</sup> Delaware Joint Finance Committee hearing 2/29/2008

<sup>20</sup> Source: Delaware Department of Transportation, Division of Motor Vehicles. Motor Fuel Tax Administration Report. March 6, 2008

<sup>21</sup> "The Cost of Traffic Congestion in Delaware: The State's 25 Worst Traffic Jams and Needed Steps to Relieve Traffic Congestion." TRIP, June 2007. <http://www.tripnet.org/DelawareCongestionReportJune2007.pdf>



## Energy Use Projections<sup>22</sup>

The two main non-transportation forms of energy used by consumers in Delaware are electricity and natural gas. The 2003 Bright Ideas for Delaware’s Energy Future report predicted that by 2010 there would be an 18.5% growth in electricity consumption and an 8.8 % growth in natural gas consumption. Where the State stands on each of those is discussed below. Although other fuels are used, including propane and fuel oil (mainly for heating), the use of these is much smaller than that of electricity and natural gas. Projections for these fuels were not included in the 2003 report, and are not addressed here.

### Electricity

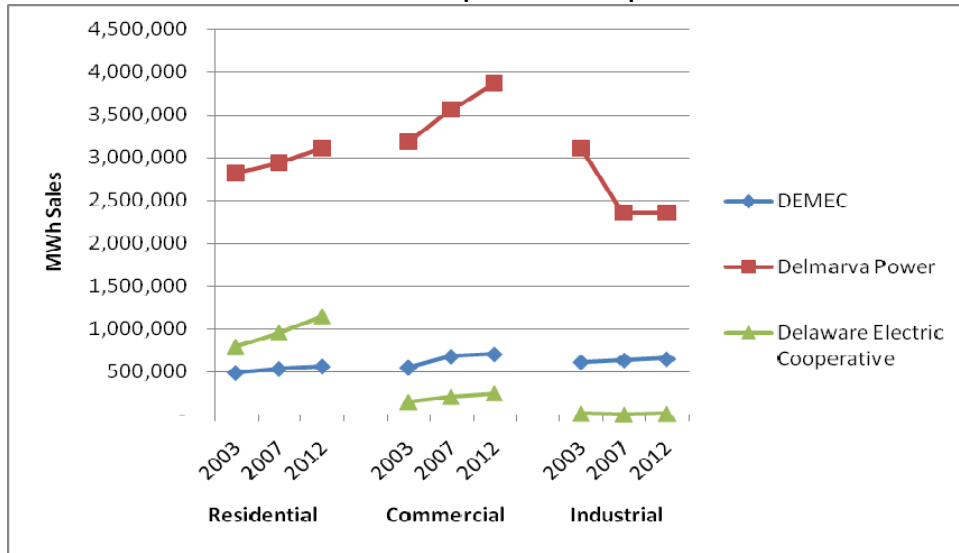
Statewide, electricity sales grew 1% between 2003 and 2007. Sales are projected to grow an additional 7% by 2012, much lower than the 18.5% projection noted above. Sales projections reflect kWh sold, including both changes in consumption and numbers of customers. Both the number of customers and consumption by residential users grew 8% between 2003 and 2007. Commercial use showed the largest growth: 12% in number of customers and 15% in consumption. Industrial sales fell 20%, even though the number of industrial customers increased 101% (the growth in customers is attributable to a large increase in the number of industrial customers purchasing from Delaware Municipal Electric Corporation providers). The reduction in industrial energy use was the main driver for the reduced projection.

Figure 8 represents the growth in electricity sales for Delmarva Power, Delaware Electric Cooperative and Delaware Municipal Electric Corporation (DEMEC). Both actual sales between 2003 and 2007 and projections through 2012 are included. As shown in the graph, both residential and commercial sales have increased and are projected to continue to increase. Industrial sales have either held fairly constant or, in the case of Delmarva Power, significantly decreased between 2003 and 2007, and are projected to remain fairly constant.

**Figure 8: 2003-2007 Electricity Sales for Delmarva Power, Delaware Electric Cooperative**

<sup>22</sup> Data supplied via e-mail by each company/organization.

**& Delaware Municipal Electric Corporation**

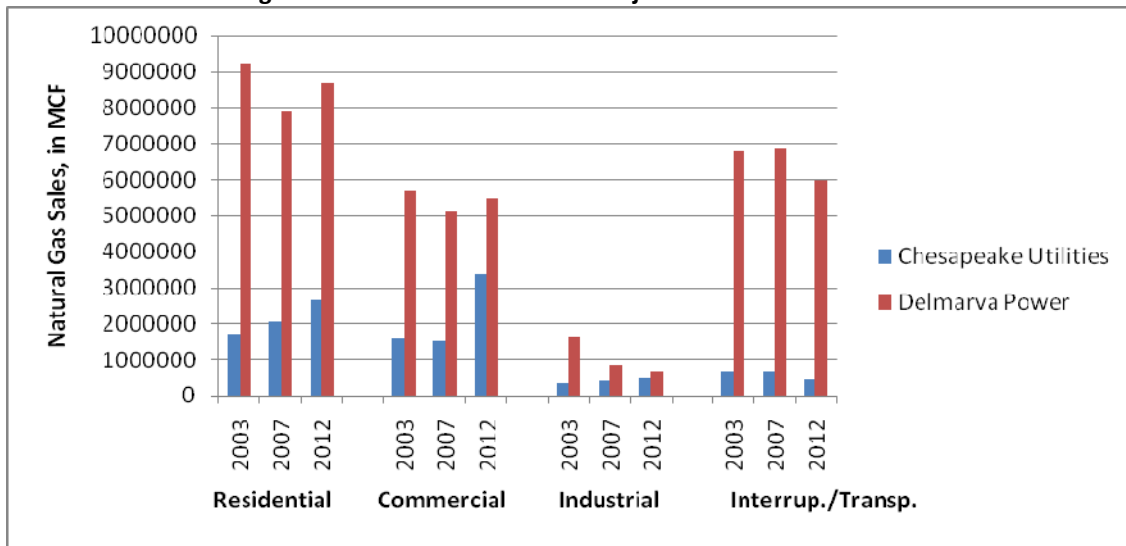


**Natural Gas**

Statewide, natural gas sales fell 8% between 2003 and 2007, with a projected statewide increase of 10% between 2007 and 2012. Sales projections reflect MCF of natural gas sold, thus representing changes in consumption and numbers of customers. The actual and projected sales for Chesapeake Utilities and Delmarva Power, broken out by customer class, are shown in Figure 9.

The sales for the two companies show different trends due mainly to their respective geographic locations. Over the 2003 to 2007 period, sales for Chesapeake Utilities have increased 7.9%. Sales projected for 2012 would represent a 62% increase from 2003 levels. Chesapeake is generally located south of the C&D Canal, where the most growth is occurring. Delmarva Power, located in the mainly grown-out, northern region, saw a decrease in sales of 11% between 2003 and 2007. Less than 1% growth is anticipated between 2007 and 2012.

**Figure 9: 2003-2012 Actual and Projected Natural Gas Sales**



As they are nationally, Delaware’s energy use patterns and pollutant emissions profile (greenhouse gases and other air pollutants) are primary reasons to reduce the environmental footprint from energy use. Delaware’s energy position mirrors other States in many respects, but also includes several situations unique to Delaware or

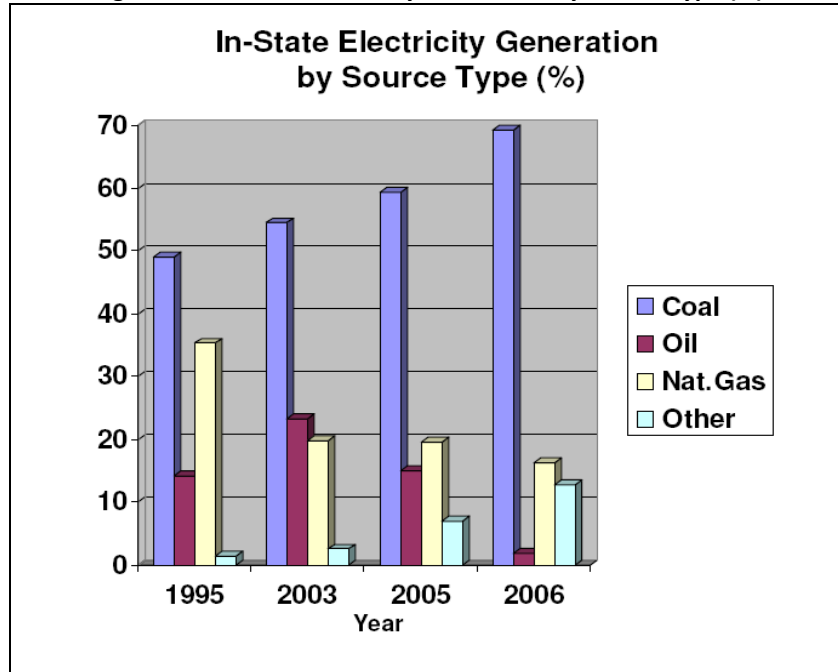


the region. The recommendations developed by the work group are based, in part, on a review of the following information.

### Electricity Generation and Consumption in Delaware

Electricity is generated within Delaware mainly by burning coal, although there are also generation units fueled by natural gas and oil. Generation from renewable and landfill gas (shown as “Other” in Figure 10) represents a small but growing percentage of Delaware’s in-state generation.

**Figure 10: In-State Electricity Generation by Source Type (%)**



Figures 11 and 12 focus on fuels used for electricity generation. They show the percentage of each fuel used nationally and in the PJM region<sup>23</sup>, which supplies electricity to Delaware, the District of Columbia, and twelve other states. Both charts show heavy reliance on coal for electricity generation, followed by nuclear and natural gas. In PJM, there is a much heavier dependence on nuclear-generated electricity and less on natural gas than nationally. The PJM region also uses relatively less oil, hydroelectric and renewables in the mix of fuels.

**Figure 11: Electricity Generation by Fuel Type, US 2006**

<sup>23</sup> PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

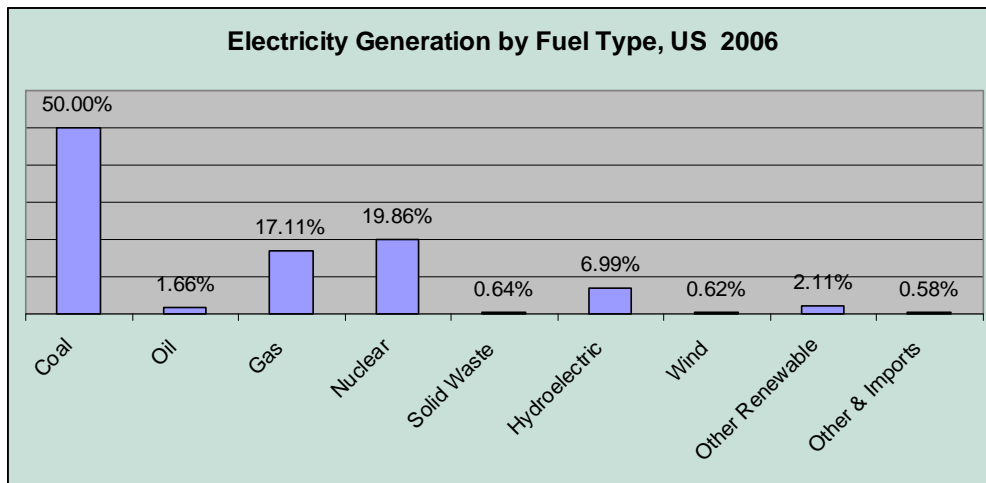
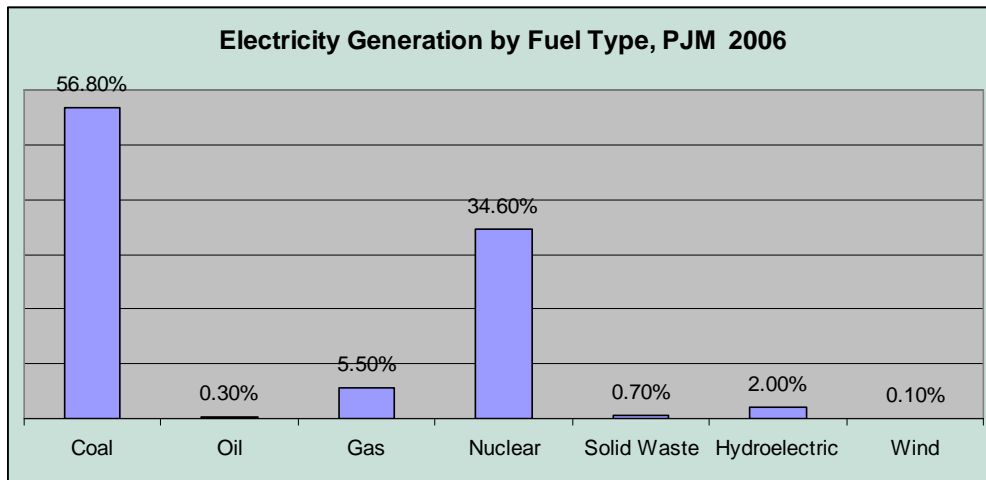


Figure 12: Electricity Generation by Fuel Type, PJM 2006



Electricity is generated in Delaware at facilities shown in Table 2.<sup>24</sup> The main and secondary fuels for each facility are shown. Two landfill gas to energy operations in Kent and Sussex counties became operational in 2007, with combined generation of 7 MW (Kent: 4 MW, Sussex: 3 MW).

<sup>24</sup> Source: Delaware Department of Natural Resources & Environmental Control, Air Quality Management Section. Analysis of 2002 Emissions from Delaware Electricity Generating Units (EGUs). Email from David Fees, 2/15/2008

**Table 2: Electricity Generation Facilities in Delaware, 2006<sup>25</sup>**

Plant Name	Main Fuel	Other Fuels	Nameplate Capacity (MW)
City of Dover			
McKee Run	Residual Oil	Natural Gas	151.2
Van Sant	Natural Gas	Distillate Oil	45.1
City of Lewes <sup>26</sup>	Distillate Oil		1
City of Seaford <sup>27</sup>	Distillate Oil		1.43
Conectiv			
Christiana	Distillate Oil		45
Delaware City	Distillate Oil		14
Edge Moor	Coal	LFG, WWTP Gas, Natural Gas, Distillate Oil	251.8
Edge Moor	Residual Oil	Natural Gas, Distillate Oil	446
Edge Moor	Distillate Oil		12.5
Hay Road	Natural Gas	Distillate Oil	705
Hay Road	Waste Heat		237
Madison Street	Distillate Oil		14
West Substation	Distillate Oil		14
Invista <sup>28</sup>	Coal	Residual Oil, Natural Gas	30
NRG			
Energy Center Dover	Coal	Natural Gas	18
Energy Center Dover	Natural Gas	Distillate Oil	100
Indian River	Coal	Distillate Oil	782.4
Indian River	Distillate Oil		17
Premcor <sup>29</sup>			
Refinery	Refinery Gas		119
Refinery	Refinery Gas	Syngas	63
Refinery	Syngas	Distillate Oil, Natural Gas	180
Warren F. Sam Beasley Station	Natural Gas	Distillate Oil	45
Ameresco	Landfill Gas		7
TOTAL			3299.43 MW

It is important to note the distinctions between Delaware's electricity generation and consumption vs. the PJM region. Since there are no nuclear power plants in Delaware, that component is absent from the in-state generation portfolio. As a result, power plants in Delaware are proportionately more dependent on coal than the PJM region average. According to the US Energy Information Agency, in 2006 nearly 70% of the electricity generated in Delaware was from burning coal.<sup>30</sup> As shown below, this also increases relative to emissions from electricity generation units (EGUs) compared to PJM region averages.

The overall production of electricity in Delaware is less than the amount of electricity consumed within the state. In 2006, net electricity generation within the state was 7,182,179 MWh; while total retail electricity sales were 11,554,627 MWh.<sup>31</sup> Thus net electricity generation in Delaware represents only 62% of electricity

<sup>25</sup> Source: DNREC Air Emissions Inventory

<sup>26</sup> Peak power generation only

<sup>27</sup> Ibid

<sup>28</sup> Internal power generation only

<sup>29</sup> Ibid

<sup>30</sup> Source: [http://www.eia.doe.gov/cneaf/electricity/st\\_profiles/delaware.html](http://www.eia.doe.gov/cneaf/electricity/st_profiles/delaware.html)

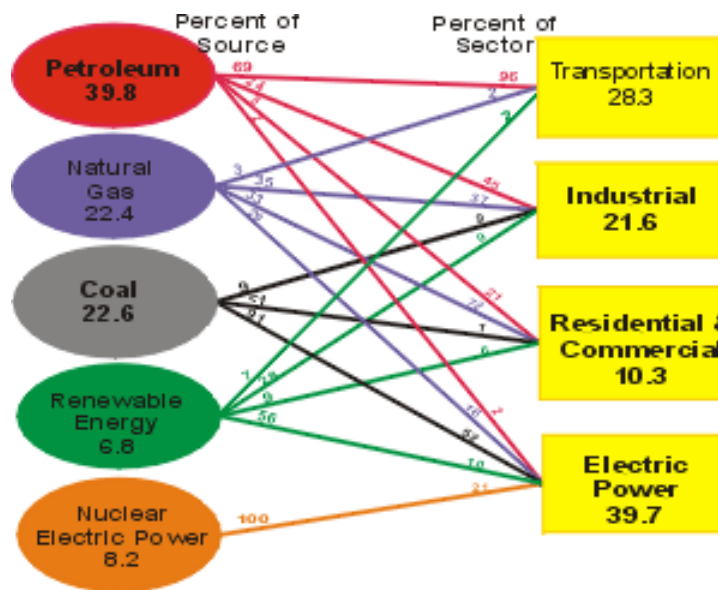
<sup>31</sup> Source: [http://www.eia.doe.gov/cneaf/electricity/st\\_profiles/e\\_profiles\\_sum.html](http://www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html)

consumption in Delaware. Since this imbalance is not likely to shift in the near future, it indicates that strategies to reduce the environmental footprint of Delaware’s energy use need to consider the environmental footprint of electricity supplied from out of state, as well as that of EGUs within the state.

### Air Pollution Emissions from Electricity Generation in Delaware

Figure 13 shows US primary energy consumption by source and sector in 2006 (quadrillion BTUs).<sup>32</sup> The lines represent the percentages of fuel sent to each sector and percentage of the sector’s fuel that comes from that source. With the exception of nuclear power, which is only used for electricity generation, all fuels are used in multiple sectors, although petroleum use for electricity generation is quite small.

**Figure 13: US Primary Energy Consumption by Source & Sector, 2006**



Carbon dioxide (CO<sub>2</sub>) emissions are closely related to energy use. Figure 14 shows the 2005 emissions (in tons) in Delaware broken down by type of source. On-road and off-road represent emissions from transportation sources; point sources include emissions from utilities and other power generation systems, covering the commercial, industrial and residential sectors. The emissions related to the commercial and residential sectors are mainly building-related emissions; industrial emissions include both building and processing related emissions.<sup>33</sup>

The majority of CO<sub>2</sub> emissions in Delaware are from point sources including electric generation which accounts for 35% of our CO<sub>2</sub> emissions. Coal-fired generation units as shown in Figure 15, represent about 2/3 of this sector, contributing 23% of our 2005 inventory. This reflects both the difference in emissions levels based on fuel source and the much higher percentage of the base load in-state electricity generation that is fueled by coal. Coal produces about twice as much CO<sub>2</sub> per kWh of electricity generated as does natural gas.

**Figure 14: 2005 Emissions of CO<sub>2</sub> Equivalents, Delaware**

<sup>32</sup> Source: <http://www.eia.doe.gov/basics/energybasics101.html>

<sup>33</sup> Source: Delaware DNREC, Air Quality Management Section, 2005 GHG Inventory Summary 9-15-08

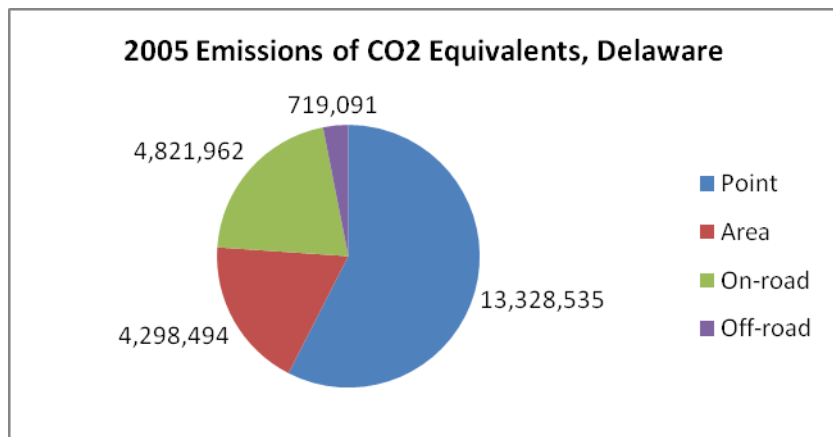
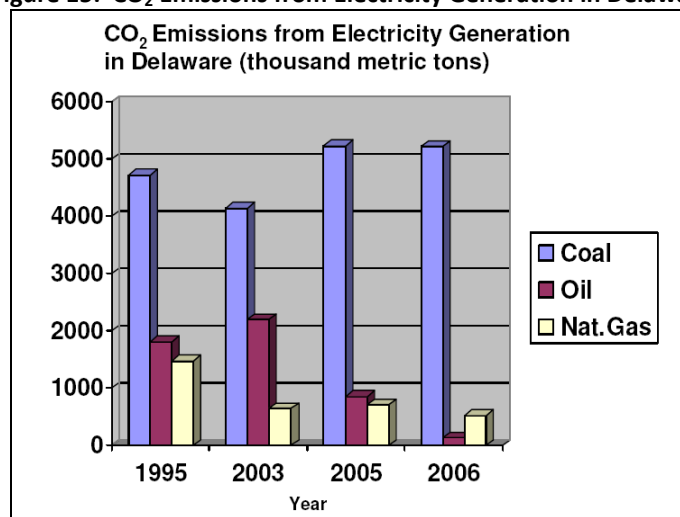


Figure 15: CO<sub>2</sub> Emissions from Electricity Generation in Delaware



The 2006 air emissions from each electricity generation plant in Delaware are shown in Table 3.<sup>34</sup> The emissions are combined for all units at each site. Mercury data are not included in this chart.

Table 3: Electricity Generation Facilities in Delaware, Air Emissions, 2006

Plant Name	CO <sub>2</sub> (TPY)	SO <sub>2</sub> (TPY)	NO <sub>x</sub> (TPY)	PM <sub>2.5</sub> (TPY)	VOC (TPY)
City of Dover McKee Run	19,959	55	47	3	1
City of Dover Van Sant	2,538	0	2	0	0
Conectiv Christiana	1,257	2	5	0	0
Conectiv Delaware City	724	1	2	0	0
Conectiv Edge Moor	1,657,418	7,982	1,665	416	24
Conectiv Hay Road	564,024	3	269	30	9
Conectiv West Substation	474	0	1	0	0
Invista	270,946	4,143	1053	249	3
NRG Energy Center Dover	127,498	1,531	382	95	2
NRG Indian River	3,573,125	20,706	6,373	2,346	33

<sup>34</sup> Source: Delaware Department of Natural Resources & Environmental Control, Air Quality Management Section. Analysis of 2002 Emissions from Delaware Electricity Generating Units (EGUs). Email from David Fees, 2/15/2008

Premcor Refinery	1,665,563	496	779	21	4
Warren F. Sam Beasley Station	9,360	0	2	1	0
Total	7,892,886	34,919	10,580	3,161	76

Air pollution emissions from electricity generating units as a percentage of all sources of emissions were evaluated for 2002. The results are shown in Table 4.<sup>35</sup>

**Table 4: Percentage Contribution of Electricity Generation Facilities to Air Pollution Emissions, 2002.**

% Contribution of Electricity Generating Units to:	NOx	SO2	PM2.5	Hg
All point sources	73%	87%	65%	27%
All point and mobile sources	22%	78%	45%	27%
All sources	21%	76%	29%	24%

Since 2002, pollution controls have been installed and new regulations have been promulgated in Delaware. An overview of current regulations regarding Greenhouse Gases (GHG) and other pollutants is included in Appendix D.

## Air Pollution Emissions from Transportation in Delaware

In 2002, air pollution emissions from on-road sources (cars and trucks) were:

**Table 5: Air Pollution Emissions from On-Road Sources<sup>36</sup>**

	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>2.5</sub>
Tons per Year	21,341	584	415
Percent of Total Emissions	37.4%	0.7%	5.8%

The DNREC Air Quality Management Section estimates the annual mobile emissions per household (based on projected car trips) for new developments:

- 153.5 lbs of Volatile Organic Compounds (VOC)
- 127.1 lbs of NO<sub>x</sub>
- 93.8 lbs of SO<sub>2</sub>
- 8.3 lbs of Fine Particulate Matter (PM<sub>2.5</sub>)
- 12,839.2 lbs of CO<sub>2</sub>

The location of the development affects the estimated vehicle emissions; emissions are higher for developments located in areas of the state designated as level 4 (the areas where growth is not desired, typically farther from towns and other communities). For example, a typical development of 100 units located 10 miles outside the growth zone will produce an additional 59 tons (not pounds) per year of VOC emissions, 77 tons per

<sup>35</sup> Source: Ibid. Data reflects reduced SO<sub>2</sub> emissions from Premcor's non-EGU units.

<sup>36</sup> Source: Delaware Department of Natural Resources & Environmental Control, Air Quality Management Section. Analysis of 2002 Emissions from Delaware Electricity Generating Units (EGUs). Email from David Fees, 2/19/2008.

year of NOx emissions and 1 ton per year of PM emissions, compared to the exact same development built within the growth zone.

## **Recommendations to the Governor**

The Council's Recommendations to the Governor are presented in groups organized to represent subject, or policy, areas. Each of the policy areas is of equal importance. Within each policy area, the order, or number, of the recommendation is arbitrary and does not represent any priority ranking.

The Council initially had grouped the recommendations based mainly on the timing for implementation , determined by the impact of the recommendation on reducing energy use and the anticipated financial impacts of the recommendations, both for cost to the government of implementation and potential costs or savings to residents and/or businesses. During the public input sessions, this caused confusion, and upon further review the Council decided to delete the groupings since even recommendations that would not be implemented for several years, may need planning and groundwork laid in the early years of the plan. As we move forward in implementation, the relationships between the recommendations need to be studied, developed and advanced in a framework that will enable the full potential of these recommendations to be realized. There also needs to be a well thought out process for engaging community leaders and residents in a way that gains their understanding and active participation in implementing the recommendations.



# Energy Planning Governance Recommendation

## Recommendation G-1: Energy Planning Governance

*Energy Policy should be elevated to the Governor's office by creating a Governor's Executive Office for Energy Policy that would provide for coordinated development and implementation of Delaware Energy Policy, including a review and evaluation of the governance structure regarding energy issues among executive bodies including but not limited to: Department of Natural Resources and Environmental Control, State Energy Office, Public Service Commission, Public Advocate, Department of Transportation, Governor's Energy Advisory Council and Governor's Office.*

Energy policy impacts nearly every facet of life in Delaware. It impacts the cost of energy and thus the profitability of Delaware's businesses, and state, local, and household budgets. Energy policy impacts economic security by the extent to which it insulates Delawareans from volatile fuel prices. Energy policy impacts air quality and the health of our citizens. And, energy policy impacts the cost of doing business, whether existing businesses remain competitive and whether new businesses choose to locate in Delaware as well as whether Delaware draws new business development in "green" industries.

While the Delaware Code establishes responsibility for development of an energy plan, it does not appear to clearly establish responsibility for looking at the whole picture of energy in Delaware and developing policy.<sup>37</sup> An integrated perspective from a body that looks at all the players and sets a consistent policy could strengthen Delaware Energy Policy. Currently many parties and agencies in Delaware have responsibility for and impact on Delaware Energy Policy, including the Governor's Office, the General Assembly, Department of Natural Resources and Environmental Control (DNREC (including the State Energy Office), Public Service Commission, Division of the Public Advocate, Governor's Energy Advisory Council, municipalities, utilities, generators, the regional electric grid operator, PJM, the Federal Energy Regulatory Commission, and a number of non-governmental organizations (NGOs). Examples of the diffuse nature of energy policy planning include:

**Governor's Office:** The Governor's Office issued the original energy plan in 2003, *Bright Ideas*, and in response to the significant increase in electricity prices in 2006, issued Executive Order 82 that resulted in the 2006 report: *Ensuring Delaware's Energy Future*. The Governor's Office makes major energy policy decisions, such as the State's participation in the Regional Greenhouse Gas Initiative.

**Governor's Energy Advisory Council:** The Governor's Energy Advisory Council has, among other things, responsibility to monitor Delaware's Energy system and identify and propose actions to enhance the system, and to spearhead the updating of the Energy Plan.<sup>38</sup>

**State Energy Office:** From within DNREC, the State Energy Office operates the State Energy Program under the US Department of Energy, serves as a focal point for energy efficiency and renewable energy assistance to citizens, government agencies and private sector interests, coordinates the activities of the new Sustainable Energy Utility, staffs the Energy Advisory Council and assists in the development of the five year energy plan.

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<sup>37</sup> See, for example, Title 29 of the Delaware Code, Chapter 80, Subchapter I, § 8003 (16), and Subchapter II, § 8051 (b) (5 and 6) which address responsibilities of the Energy Office but do not specify development of a comprehensive energy policy. Similarly, Subchapter II, § 8055 addresses responsibilities of the Governor's Energy Advisory Council but also does not specify development of a comprehensive policy. [http://delcode.delaware.gov/title29/c080/index.shtml#P-1\\_0](http://delcode.delaware.gov/title29/c080/index.shtml#P-1_0)

<sup>38</sup> Title 29 of the Delaware Code, Chapter 80, Subchapter II, § 8055.

**DNREC:** Houses the State Energy Office, but also has regulatory responsibilities concerning energy facilities and their impacts on public health and the environment. DNREC is also represented on the Governor's Energy Advisory Council, the Energy Cabinet Committee, the Sustainable Energy Utility (SEU) Board and other bodies impacting energy policy.

**General Assembly:** The General Assembly can set energy policy through legislative actions. Recent examples include: HB6, which resulted in the Power Purchase Agreement between Delmarva Power and Bluewater Wind; formation of the SEU; funding levels and program design for the Green Energy Fund; and establishment and enhancement of Delaware's Renewable Energy Portfolio Standards.

**Public Service Commission:** The Public Service Commission (PSC) has regulatory oversight of energy utilities, including Delmarva Power and Chesapeake Utilities, and as such, impacts and determines energy policy impacting rates, and development of demand response, Automated Metering Infrastructure and Smart Grid programs. The PSC does not have regulatory authority over the Delaware Electric Cooperative or the Delaware Municipal Electric Corporation. The PSC can have oversight over energy policy such as establishing mechanisms to achieve long term funding for generation development in Delaware.

**Division of the Public Advocate:** The Public Advocate intervenes on the behalf of Delaware ratepayers in issues before the PSC and participates on PJM committees.

**Department of Transportation:** The Department makes road and transit planning decisions that relate to and impact vehicle miles traveled. As such, the Department plays a key role in developing and implementing energy policy objectives concerning reducing vehicle miles traveled and encouraging development of mass transit and alternative transportation.

**Utilities:** Utilities are involved in energy policy as they develop demand response programs and work with the SEU to design energy efficiency programs. Delmarva is required to submit an Integrated Resource Plan to the Public Service Commission estimating how much electric power it will need in coming years and how it will meet the demand. Utilities participate on the Governor's Energy Advisory Council and in PJM policy decisions.

**Generators:** Generators decide how much and, with regulation by DNREC, what kind of generation they will build and maintain, and how much energy they will produce. They also participate in PJM policy decisions.

**Delaware Economic Development Office:** The Economic Development Office (DEDO) has not been involved in many of the regulatory and legislative initiatives; it needs to become a significant part of the process.

A Governor's Executive Office for Energy Policy could evaluate all the energy programs in place in Delaware and recommend any programmatic or structural changes or additions necessary to fulfill Delaware's energy and climate goals. An issue for consideration is to what extent this office should address climate change. Although climate change policy reaches beyond energy to include other sources of greenhouse gases (such as agricultural sources) as well as adaption and mitigation policies, energy use is the key driver of climate change.

**Cost Issues:** The cost to implement this recommendation would depend on whether new personnel are needed, or whether current employees are reassigned to fill the new functions.

# Recommendations to Reduce Energy Use through Energy Efficiency and Conservation

## Recommendation EE-1. Energy Reduction Goal & Vision

*The Governor should adopt the following goal and vision for reducing Delaware’s energy use:*

*Goal: Halt the growth in Delaware’s energy use, and begin to reduce Delaware’s energy consumption through energy efficiency, conservation, and distributed renewable energy resources. Achieve energy self-sufficiency and carbon neutrality<sup>39</sup> in Delaware’s built environment by 2030.*

*Vision: Sustained actions, starting immediately and pursued consistently over the next 20-30 years to achieve this goal will help create an ecologically viable and economically strong Delaware in which:*

- *Residential and commercial buildings are energy and carbon neutral, from their construction through their useful lifespan;*
- *Delawareans practice conservation and utilize energy efficient equipment, appliances and techniques as standard practice;*
- *Commercial and industrial buildings are as efficient as feasible;*
- *Industrial and commercial processes are state of the art in energy efficiency;*
- *State government demonstrates leadership in energy conservation and efficiency.*

Reducing the amount of energy Delawareans use through increased energy efficiency is the single most cost-effective strategy for reducing Delaware’s greenhouse gas emissions while meeting the state’s future energy needs. As shown in Figure 16, energy efficiency improvements in building systems such as insulation, lighting, air conditioning and water heating, are among the greenhouse gas abatement actions with the highest returns on investment.

The importance of energy efficiency in mitigating climate change establishes its priority for State policy beyond that of simply managing energy supply. Projections by the Inter Governmental Panel on Climate Change (Figure 17) indicate that energy efficiency has the potential to reduce CO<sub>2</sub> emissions by 51% in the coming years. This finding is based on several factors, energy efficiency and conservation: 1) are the lowest cost means of reducing CO<sub>2</sub>; 2) require the shortest lead time to implement of any low/no carbon alternative; 3) significantly lower energy cost and, thereby, improve competitiveness; and 4) are available for use in all sectors, across all fuels, and without geographic constraints.

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<sup>39</sup> Carbon neutrality, as used by the American Institute of Architects in their 2030 Challenge, is that a carbon neutral building uses no fossil fuel energy.

Figure 16: Global Cost Curve of GHG Abatement Opportunities

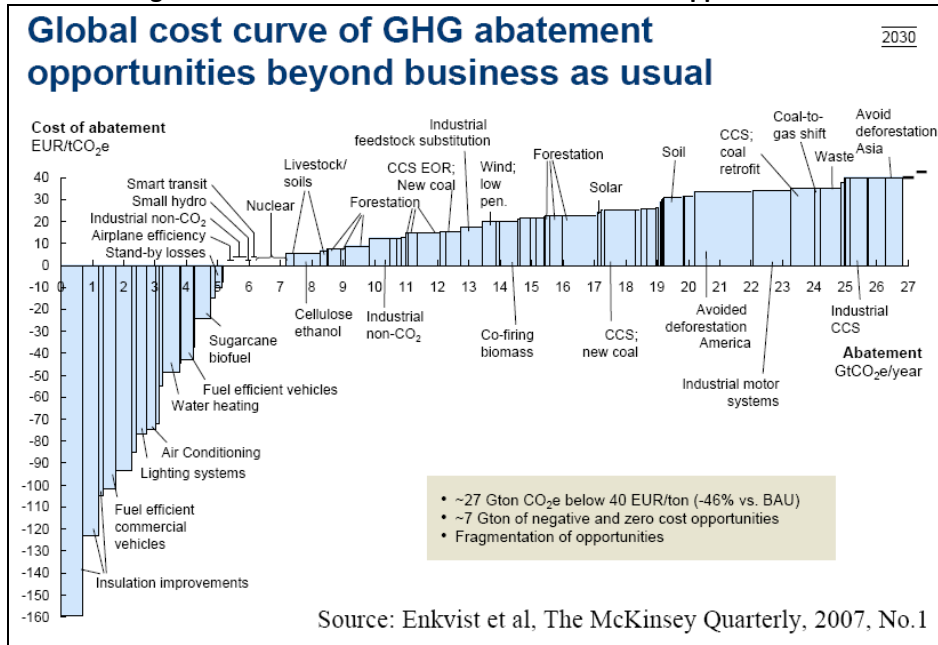
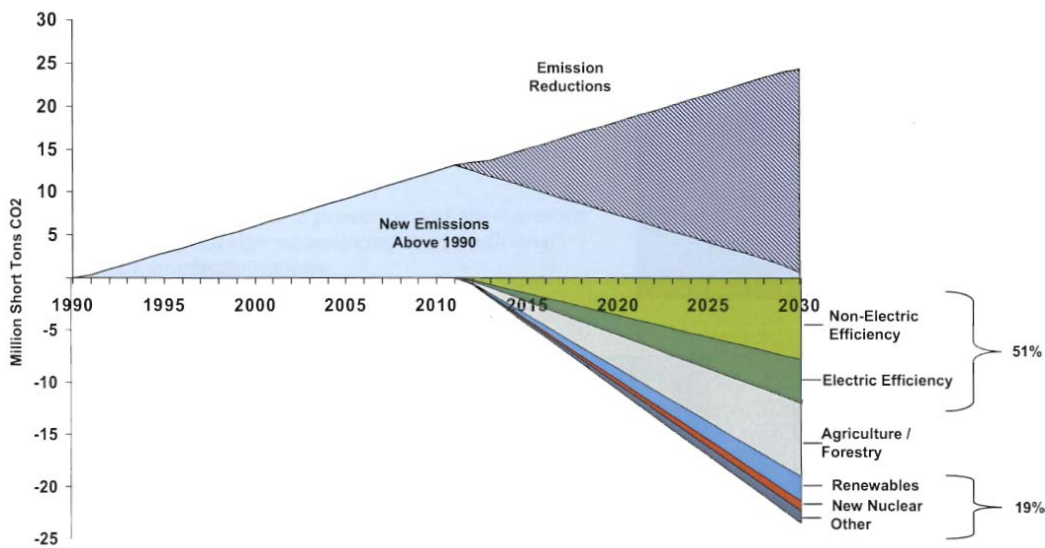


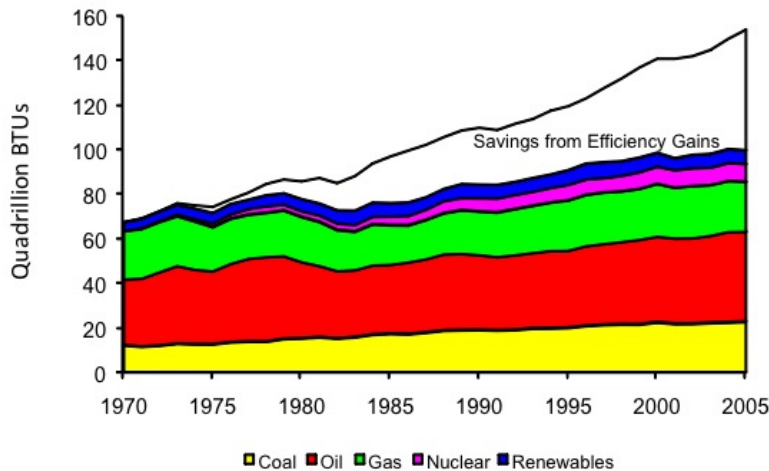
Figure 17: Projection of CO<sub>2</sub> Emission Reductions from Several Sources<sup>40</sup>



US experience has shown that economic development does not require increased energy demand. Between 1970 and 2005 US energy consumption grew by 48% (shown in Figure 18); during that same time period, the Gross Domestic Product grew by 195%.

<sup>40</sup> Source: IPCC, 2007. Mitigation of Climate Change. Data compiled from the IPCC report by staff of the Center for Energy and Environmental Policy, University of Delaware.

**Figure 18: Energy Efficiency Gains Since 1970<sup>41</sup>**



## Building Codes for Energy Efficiency

### Recommendation EE-2: Residential Energy Code

*Delaware's Residential Building Energy Code should be updated to reflect the adoption of the most current edition of the International Energy Conservation Code (IECC). Additionally, the Delaware Energy Office should be given the authority through legislation to administratively require an update of the State Building Energy Code to most current IECC every three years based on current code promulgation cycles. Training needs to be provided to all building code officials upon adoption of each update to the code.*

Energy Codes are a subset of a broader group of codes known as building codes. Building codes are written legal requirements governing the design and construction of buildings. Most of the codes adopted by state and local governments set minimum standards for safe occupancy and to protect individuals from substandard living and working conditions. All building codes generally reflect a consensus of current design and construction practice. They are intended to lock in safe current practice as a minimum standard for design and construction of residential and commercial structures.

Energy codes cover areas of construction such as wall and ceiling insulation, window and door specifications, Heating, Ventilation, and Air-Conditioning (HVAC) equipment efficiency, as well as lighting fixtures and controls. In some sense, energy codes are different compared to other building codes. They do not exist to protect the immediate health and safety of the building occupants in the same way as other codes. However, energy codes offer other substantial benefits to the individual and society. Most notably, implementing energy codes results in a reduced demand for energy. This in turn leads to a reduction in pollution associated with the burning of fossil fuels in the home or in power plants. An increase in national energy security, reductions in utility bills, and increased utility system reliability are also important benefits from the adoption of energy codes.

The International Energy Conservation Code (IECC) is the benchmark residential energy code by which the US Department of Energy makes its determinations for the purposes of fulfilling the mandate set forth in federal law. Many states reference these standards in their state building or energy conservation codes, although a number of states have also developed their own energy codes. States that reference the code frequently

<sup>41</sup> Source: Center for Energy and Environmental Policy, University of Delaware

introduce amendments to adapt the codes to their specific climate and political environment. The IECC is generally promulgated once every three years, with amendments and supplements made available in between editions.

The 2003 Energy Plan recommended that the State adopt updated building energy codes in both the residential and commercial sectors. As a result, Senate Bill 306 was introduced and passed in 2004 updating the State's Energy Code to the IECC 2000 edition on the residential side and ASHRAE Standard 90.1 -1999 on the commercial side. Attempts in 2007 and 2008 to update these codes to the most current editions failed in the General Assembly. All three surrounding states (Maryland, Pennsylvania and New Jersey) are currently utilizing the 2006 IECC. The 2009 edition is expected in the Spring.

Research shows that modern energy codes could save about 330 Trillion BTU by 2030, almost 2% of total current residential energy consumption. There would also be comparable savings in consumer energy bills, air pollution, and greenhouse gas emissions.

Energy codes capture what would otherwise be lost opportunities. Current energy standards provide energy efficiency provisions that are relatively easy and inexpensive to address in new construction, and that are far more expensive, or even impossible, after the fact. Building energy codes are one of the easiest and most cost efficient ways for states and local jurisdictions to implement energy management policies.

When an energy code is adopted statewide, it results in lower barriers to builders marketing themselves across the state, and even regionally or nationally. The consistency in standards opens up the market, providing incentives for manufacturers to offer and develop more building products, which can also lead to lower supply prices for builders. Additionally, the demand created for new services relevant to the new code can expand or open up new markets for builders. A uniform code also enables localities to pool limited resources and combine personnel to form county wide or regional enforcement programs.

Aside from the environmental benefits, energy codes, as part of broader energy efficiency policies, have potential economic benefits. The American Center for an Energy Efficient Economy (ACEEE) released a study in 2005 which found that the implementation of statewide energy efficiency programs (including building energy codes) in the Midwest would result in significant job creation. The region was expected to produce 30,220 jobs resulting in compensation of \$750 million by 2010, and 66,620 jobs resulting in compensation of \$1,770 million by 2020. Since the Midwest imports most of its natural gas, a reduction in demand means less money flowing out of the region, and more savings. These savings in turn work through economic multipliers to increase regional investment and growth.<sup>42</sup>

### **Recommendation EE-3: Commercial Energy and Ventilation Codes**

*EE-3A: Adopt the most recent edition of ASHRAE Standard 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" as our State energy code.*

*EE-3B: Adopt the most recent edition of ASHRAE Standard 62 – "Ventilation for Acceptable Indoor Air Quality" as our State ventilation code.*

*EE-3C: The Delaware Energy Office should be given the authority through legislation to administratively require an update of the State Commercial Building Energy Code to most current ASHRAE Standard 90.1 every three years based on current code promulgation cycles. Training needs to be provided to all building code officials upon adoption of each update to the code.*

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<sup>42</sup> <http://www.aceee.org/buildings/codes.htm>

Delaware's current commercial energy code is the American Society of Heating and Refrigeration Engineers (ASHRAE) Standard 90.1 – 1999. There have been three revisions to this standard since 1999 issued in 2001, 2004 and the current standard is ASHRAE Standard 90.1 – 2007. The standard provides for minimum energy-efficient requirements for the design and construction of new buildings and their systems, new portions of buildings and their systems, new systems and equipment in existing buildings.

Approximately 96 addenda have been incorporated into the Standard since 1999 many of which call for increased energy efficiency. Use of the most current standard will result in more energy efficient buildings.

The original ASHRAE Standard 90 was published in 1975 and revised editions were published in 1980, 1989, and 1999. As technology and energy cost began changing more rapidly, the ASHRAE board voted in 1999 to place the standard on continuous maintenance. Starting with the 2001 edition, the standard is now published in the fall of every third year.

**Ventilation Code:** The current ventilation (outside air) criteria in the International Mechanical Code used throughout Delaware is based on ASHRAE Standard 62-1989. After 20 years of Indoor Air Quality research and experience with ventilation system design, ASHRAE introduced an improved version of the standard in 2004 that was updated in 2007. The new standard greatly reduces the outside air requirements for many types of occupancies resulting in significant energy and cost savings. If adopted, a campaign to inform existing building owners of the change should be conducted as part of an educational program to reduce excess outside air introduction into their buildings and maximize the potential energy savings.

The original ASHRAE Standard 62.1 was published in 1973 and revised editions were published in 1981, 1989, 1999, 2001 and 2004. In its 1989 edition, and in response to a growing number of buildings with apparent indoor air quality problems, the standard increased minimum outdoor airflow rates significantly and introduced a requirement for finding outdoor air intake flow requirements for multiple-zone, recirculation systems. The 1999 and 2001 editions made several minor changes and clarifications that did not impact the minimum required outdoor airflow rates. In its 2004 edition, it modified the Ventilation Rate Procedure, changing both the minimum outdoor airflow rates and the procedures for calculating both zone-level and system-level outdoor airflow rates. The 2007 edition of the standard updates, revises, and improves it in several ways, without changing minimum outdoor airflow rates.

**Cost Issues:** Adopting the current addition of ASHRAE Standard 90.1 may increase construction cost slightly but will reduce energy consumption and operating cost. Copies of the standard are available from ASHRAE for \$119.00 each. Adopting the current addition of ASHRAE Standard 62.1 will reduce construction cost, energy consumption and operating cost in many new buildings. If implemented it would also reduce energy consumption and operating cost in many existing buildings. Copies of the standard are available from ASHRAE for \$65.00 each.

## **Residential Energy Use Reduction**

### **Recommendation EE-4: Enhanced Energy Efficient Construction of New Homes**

*The State should supplement the Federal tax credit by extending a homebuilder a tax credit for building a home that uses 50% less energy than the most recent IECC code.*

It is easier to incorporate energy efficiency measures into a home under construction than it is to change these items later. To that end, builders of new homes must be encouraged to build to a higher standard.

The Federal Government allows the builder (not owner) of a new home to take a \$2,000 tax credit if the home uses 50% less energy than the most recent IECC code allows for heating and cooling. A complementary incentive would be for the State government to extend to homebuilders an additional state tax credit for building to the 50% less energy than the IECC code standard.

Cost Issues: If the State were to match the Federal tax credit, it would require additional state funding of \$2,000 per home, plus administration. A cap could be placed on the number of homes eligible for the tax credit per year.

### **Recommendation EE-5: Expand the Weatherization Assistance Program**

*Significantly increase the budget of the Weatherization Assistance Program to enable the program to provide substantially more weatherization services to low-income owner-occupied and rental households as rapidly as possible.*

Delaware has an effective low-income weatherization program; Delaware households that receive weatherization save on average 16%- 18% of their annual household energy usage, or \$227 annually. These benefits accrue for years after the initial efficiency improvements. Delaware's Weatherization Assistance Program (WAP) benefits not only low-income households, but the entire State, achieving a societal benefit-cost ratio of 3.4.<sup>43</sup> Even so, Delaware has not significantly invested in low-income weatherization programs. Delaware currently augments federal funding for its Weatherization Assistance Program by a weatherization surcharge on electricity rates of Delmarva Power customers of \$0.000095 per kWh (about \$800,000 annually); and some of those funds can be used for emergency energy assistance rather than weatherization.

Current combined federal and state funding allows the Delaware Office of Community Services to weatherize 500 low-income households per year. Although 500 households are weatherized each year, 750 households at up to 80% of the state median income are added to the WAP waiting list each year. No households at 80% of the state median income are currently served by the program, and no households in rental units are served, though many other states have demonstrated techniques to successfully leverage landlord contributions for weatherization assistance. The Sustainable Energy Utility (SEU) Task Force Affordable Energy Working Group recommended that the SEU become involved in weatherization and expand cost-effective, weatherization services to income tiers up to 80% of the state median income, and to both single and multi-family rental units.

With a doubling of weatherization funding, the State Weatherization Program and the SEU will be able to partner to provide services to between 800 and 1,000 households per year and shorten the present wait-time for services. The role of the SEU would be to cover, at no initial charge to participants, the full incremental cost of high-efficiency versus standard efficiency equipment and measures. This includes the difference in price between qualifying Energy Star and standard appliance and equipment models. After the shared-savings period the participant will keep the entire savings accruing from the energy-efficiency measures. These added measures will not only save more money per month than their cost per month, but they will increase the value of the residential property at re-sale time.

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<sup>43</sup> Y-D. Wang, J. Byrne, J. Kulkarni, A. Banerjee, et al. "Energy, Economic, and Environmental Impacts of the Delaware Low-Income Weatherization Assistance Program." Newark, DE: Center for Energy and Environmental Policy. (2006).



In addition to the benefit to households, the US Department of Energy has found that 52 direct jobs are created for every million dollars invested in weatherization programs.

Cost Issues: The cost will vary depending upon the level of increase in state funding. For example, a doubling of the WAP budget would raise it to \$5 million per year. It should be noted that where the funding comes from can impact the eligibility of potential recipients, i.e. if the increased funding comes from an increase in the surcharge, potential recipients would be limited to Delmarva Power customers.

#### **Recommendation EE-6: Geothermal in New Home Construction<sup>44</sup>**

*Delaware, through regulatory adoption or state legislation, should require a percentage, the specific amount to be determined, of all new homes constructed in Delaware to utilize ground water source heat pumps as their primary HVAC source, where spatially and geologically feasible. The State Energy Office should conduct the necessary research to determine the appropriate percentage and should increase its marketing efforts for geothermal heat pump systems in the existing home market.*

The geothermal heat pump, also known as the ground source heat pump, is a highly efficient renewable energy technology that is gaining wide acceptance for both residential and commercial buildings. Geothermal heat pumps are used for space heating and cooling, as well as water heating. Its great advantage is that it works by concentrating naturally existing heat, rather than by producing heat through combustion of fossil fuels.

The technology relies on the fact that the Earth (beneath the surface) remains at a relatively constant temperature throughout the year, warmer than the air above it during the winter and cooler in the summer. The geothermal heat pump (GHP) takes advantage of this by transferring heat stored in the Earth or in ground water into a building during the winter, and transferring it out of the building and back into the ground during the summer. The ground, in other words, acts as a heat source in winter and a heat sink in summer. According to the EPA, geothermal heat pumps can reduce energy consumption—and corresponding emissions—up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance heating with standard air-conditioning equipment. GHPs also improve humidity control by maintaining about 50% relative indoor humidity, making GHPs very effective in humid areas. GHP's also can replace the need for fossil fuels, making them a carbon friendly and less expensive energy source.

Subject to availability of funds, the Delaware Green Energy Program (GEP) offers grants for geothermal heat pump systems installed by qualified contractors for Delmarva Power customers. The Delaware Electric Cooperative (DEC) and the nine municipal electric utilities represented by Delaware Municipal Electric Corporation (DEMEC) run similar programs. Under the GEP, residential customers are provided \$600 per ton not exceeding \$3,000 per residential dwelling for systems installed with an Energy Efficiency Ratio (EER) of 15.0 and Coefficient of Performance (COP) of 3.4 or greater or 50% of the installed cost, whichever is lower. Since the inception of the Green Energy Program in 2002 through the end of 2007, the GEP had awarded almost \$460,000 to 183 geothermal systems. In 2008 alone, the GEP saw 76 such systems installed and gave almost \$200,000 in grants, proving the viability and advantages of this technology.

Not only is the technology an efficient one, but it can result in a significant reduction in greenhouse gas emissions by displacing the combustion of fossil fuels for heating. Reliance on this technology also insulates homeowners from the variability and volatility of oil, natural gas and propane. The Environmental footprint work group rated these systems 'very positive' in effectiveness in meeting carbon reduction target, 'neutral' in

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<sup>44</sup> This recommendation was not proposed by a work group; it was developed by the Council.

affordable current costs, 'positive' for affordable cost outlook in near future, 'positive' on reliability, and 'very positive' for feasibility in Delaware.

Cost Issues: The costs for these systems can be slightly higher than traditional home furnaces, however, if built into the cost structure for the new home, and considering the long term savings and the advantages of incorporating costs into the mortgage, these systems are very affordable.

## State Government Energy Use Reduction

### Recommendation EE-7: State Energy Efficiency Policy

*The Office of Management and Budget should create and implement a State Energy Efficiency Policy which would establish a standard for the design, construction, renovation, and operation of all State funded facilities, including schools, to optimize energy efficiency and minimize overall energy consumption.*

State funded buildings include state government buildings and facilities, schools, libraries, etc. The new energy standard would have to supersede any locally enforced building code requirements; therefore it would need to be implemented and enforced statewide by the executive branch of the State government.

The proposed State Energy Efficiency Policy would be a multi-faceted approach incorporating the following action items:

- A. Enact legislation to establish a 'State' Energy Standard for Design and Construction of State Funded Buildings, which meets or exceeds the latest energy standards set forth in the most recent addition of ASHRAE Standard 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" thereby setting a uniform energy efficiency standard for all State buildings.
- B. Design and construct all new State funded buildings incorporating standards from the latest US Green Building Council Leadership in Energy and Environmental Design (LEED) Green Building Rating System for New Construction (LEED-NC); and operate, maintain, and renovate all existing State owned and operated buildings incorporating standards from LEED-EB (Existing Building) standards to maximize the operational efficiency of the facilities while minimizing their environmental impact. LEED for fit-outs should be utilized where the State rents, rather than owns, buildings. For all the above, LEED silver should be the minimum rating targeted. This recommendation does not address the issue of official LEED certification, but rather the standards to which buildings are designed and built.
- C. While the LEED initiative is not solely directed toward energy efficiency, building to the LEED rating system provides a good standard of design that improves the overall building operating efficiency (hence energy efficiency), as well as the added benefit of improved indoor environmental quality, sustainability, and carbon footprint reduction.
- D. Utilize the existing Energy Performance Contracting Act (Delaware Code, Title 29, Chapter 69, Subchapter V) to conduct energy audits and implement energy conservation measures in all existing State buildings and schools to improve the overall building operating efficiency while minimizing energy consumption and maximizing energy savings. Delaware already has the means to successfully implement "guaranteed energy savings performance contracts" for all existing State buildings and only needs to develop a program to realize the benefits statewide.

- E. Mandate the use of Life Cycle Cost Analysis (Delaware Code, Title 29, Chapter 69, Subchapter 1, Section 6909A) to justify funding for all State building construction and renovation projects. Use of Life Cycle Cost criteria would preclude the low-bid, initial cost design criteria that do not address areas such as operating efficiency, maintenance and replacement costs, and total energy costs over the ‘useful life’ of the facility.
- F. Centrally manage the energy usage in State owned and operated facilities to benchmark, track, and optimize overall building energy efficiency in an effort to minimize the State’s overall energy costs and consumption. Centralized management of energy usage allows the State to collect and trend energy data, map consumption and establish energy reduction strategies, improve and maintain building operating efficiencies, and take advantage of such energy cost savings incentives as aggregate energy procurement and demand response programs.<sup>45</sup>
- G. Commission all new State building construction, and retro-commission all existing State buildings, including schools, to ensure that building systems meet their design intent, operate and interact optimally, and function in a manner to maximize overall operating and energy efficiencies. Most of the State owned and operated buildings have never been commissioned and those that were most likely no longer operate in the most operationally or energy efficient manner.

Cost Issues: The overall cost to implement the action items identified for the proposed State Energy Efficiency Policy should be negligible. There would be a nominal increase in new construction and design costs with the inclusion of the added LEED initiative and commissioning requirements; however, these initial costs should be negated by the energy and operating efficiency savings derived over the life of the facility. The incorporation of energy efficiency measures in state funded construction, including schools, can be funded through the bond offerings managed by the SEU. The State only needs to realize a statewide Energy Performance Contracting Program to retro-commission all existing State buildings at no additional capital cost.

**Recommendation EE-8: Public Buildings and Facilities Renewable Energy Policy**

*The Office of Management and Budget should develop and implement a policy that sets standards and requires cost effective renewable energy systems to be incorporated in new construction and renovations of public facilities.*

The purpose of this initiative is to provide a reduction in building use energy and carbon intensity, provide energy funding for building owners, provide educational opportunities for school children that will give them hands on experience and reinforce environmental awareness, and have the government lead by example. Applicable buildings include any building owned or funded by a local or state government agency such as schools, maintenance buildings, office buildings, hospitals, libraries, prisons, etc.

Although several states have statutes or executive orders mandating the use of environmentally sustainable standards in the design, construction and operation of public facilities, there are only few states that mandate the use of renewable energy systems in those facilities. Each of these programs weighs the investment in alternative energy on a cost/benefit basis. Examples include:

Texas: requires state government departments to compare the cost of providing energy alternatives for new and reconstructed state government buildings and for certain construction or repair to energy systems and equipment. A review committee determines economic feasibility for each function by comparing the estimated

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<sup>45</sup> The ability to aggregate energy procurement for State facilities is limited for facilities located in municipalities that do not allow customers to seek alternative energy suppliers.

cost of providing energy for the function using conventional design practices and energy systems with the estimated cost of providing energy for the function using alternative energy devices during the economic life of the building. If the use of alternative energy devices for a particular function (including space heating and cooling, water heating, electrical loads, and interior lighting) are economically feasible, then the use of alternative energy devices must be included in construction plans.

Minnesota: state facility designs must consider the impacts of supplying a portion of the building's total energy use with on-site or off-site renewable or cleaner distributed generation systems. Separate portions of Minnesota law added at different times require that certain state building designs specifically evaluate the possibility of using active and passive solar systems; earth-sheltered construction; meeting 2% of building energy use with on-site solar or wind (Minn. Stat. 16B.32); and using geothermal and solar thermal applications for heating and cooling (Minn. Stat. 16B.326).

Vermont: statutes contain an incentive funding structure for locating renewable energy systems in school buildings. The amount of an award for the incremental costs associated with the installation of a space heating, water heating, cooling, or refrigeration system that uses biomass, a geothermal/ground source, wind, or solar energy as the primary heating or cooling source is 75 percent of the approved cost of those elements of the project specifically related to the renewable fuel source being used (as compared to 30 percent for other costs).

In Delaware, specific standards should be adopted to fit into the existing structure. A detailed review of these programs to include their experience (good and bad) to date should be initiated. A Delaware program should be initiated in three categories:

Educational Facilities – Any new school, school renovation (within a certain cost threshold) must be designed using “green code” or LEED principles. Cost/benefit analyses using the standards set in the policy should be completed for the incorporation of renewable energy systems into new construction. The components of any program would require a learning tool where students can participate in the operation of the project and where the technology basics can be in a science class curriculum. Curriculum would be developed on a school by school basis, depending on the technologies installed and aligned with existing climate change/renewable energy curriculums already in place.

New Construction – Any publicly funded building must be designed using “green code” or LEED principles. Further, the facility should be encouraged to be a research laboratory for new technologies. Cost/benefit analyses using the standards set in the policy should be completed for the incorporation of renewable energy systems into new construction.

Renovation – Any public funded building must use “green technology” where feasible and within certain cost parameters. Cost/benefit analyses using the standards set in the policy should be conducted for the incorporation of renewables into the renovation.

Cost Issues: Along with the mandates and code revisions, incentive funding resources would be needed to make these building design options cost effective and to provide incentives. Funding incentives for state capital projects could take the following forms: Grant funding for incremental costs associated with renewable energy systems (similar to previous Stripper Well program); Funding to be divided among qualifying projects based on cost, payback and environmental benefit; Incremental cost per square foot for renewable energy systems for school projects; or Revolving loan fund whereby the loan is paid back through energy savings, possibly through a partnership with the Sustainable Energy Utility.

## **Recommendation EE-9: Demonstration Project – Schools**

*Conduct a demonstration project, under the direction of the Department of Education, in which a school is designed, built and operated to LEED silver or gold standards.*

The ability to compare the construction costs as well as the on-going operating costs from a LEED certified school building to the benchmark of typical school buildings will provide decision makers with quantitative data regarding the relationship between costs and benefits associated with LEED programs. In evaluating options for the school, emphasis should be placed on options that will achieve the highest EPA Energy Star rating for the school. It is expected that a LEED certified building will cost more to construct, and possibly more to maintain since preventive maintenance cannot be deferred without negatively impacting the efficiency performance of the school. However, it is expected that the State will realize reduced operating costs from such a properly constructed and maintained structure.

Cost Issues: Approximately \$1,000,000 for construction of the school. The additional costs due to LEED certification are part of what would be determined during the demonstration project. The incorporation of energy efficiency measures into the project can be funded through the bond offerings managed by the Sustainable Energy Utility (SEU). The SEU may be a source of funding for the energy efficiency and renewable energy portions of the project.

## **Industrial Energy Use Reduction**

### **Recommendation EE-10: Combined Heat and Power**

*EE-10A. DNREC should develop Combined Heat and Power regulations for boilers/power plants on an energy output basis.*

*EE-10B. DNREC should study, and if appropriate, develop a set-aside of allowance allocations for energy efficiency and renewable energy in Delaware's NO<sub>x</sub> and CO<sub>2</sub> trading programs.*

Combined Heat and Power (CHP) is the generation of electricity and heat sequentially from the same heat input. Use of CHP increases the system's overall efficiency by providing electric and thermal service with higher efficiency and lower emissions than conventional separate systems. CHP can provide a way to reduce emission rate without strict reliance on the application of emission controls; however, multiple outputs of power and heat must be accounted for. Therefore, output based standards are key to recognizing efficiency benefits of CHP. (Example: LB/MWh output instead of LB/MMBTU input.)

Air quality regulations have traditionally established standards on the basis of mass of pollutants allowed per unit of thermal heat input. Attempts in the past to establish standards on an output basis or otherwise referred to as fuel-neutral regulations have faced opposition by various industries such as coal and oil producers. Most regulations today establish fuel specific standards on a heat input basis. Regulations do not specifically discourage CHP but they do not provide any specific incentives either.

US EPA states the following "Output-based regulations (OBR) encourage efficiency and renewable energy as air pollution control measures. OBR levels the playing field by establishing performance criteria and allowing efficiency and renewable energy to compete on equal footing with other methods of reducing emissions, such as combustion controls and add-on controls.

Traditionally, boilers and power generators have been regulated on an input basis. That is, emission limits have been established on a unit of pollutant emitted per unit of fuel input basis (e.g., pounds per million British

thermal units [lb/MMBTU]). This approach relies on the application of pollution control devices to reduce emissions and does not explicitly recognize the efficiency of the process in converting fuel input into a useful output.

Significant opportunities exist to reduce pollution upstream in the energy generation process by encouraging efficiency improvements through CHP. Establishing emission limits for CHP units on an output basis—units of pollutant per unit of useful output (e.g., pounds per megawatt-hour [lb/MWh])—recognizes efficiency improvements as pollution prevention.”

In Delaware, only Regulation 1144, “Control of Stationary Generator Emissions” addresses CHP and it defines CHP as follows:

**“Combined heat and power”** and **“CHP”** means a generator that sequentially produces both electric power and thermal energy from a single source, where the thermal energy is wholly or partly used for either industrial processes or other heating or cooling purposes.

This regulation establishes allowable emission rate in terms of LB/MWh output but it has limited scope because it only applies to internal combustion engines. It does not cover boilers or other forms of power plants.

Calculating emissions from CHP can be done using two approaches:

1. Add thermal output to electric output to reduce effective emission rate. (CA & TX DG Regs.)
2. Calculate credit for avoided thermal generator (boiler). (DE Reg.)

The first approach is simpler but second option more directly reflects actual emission benefits.

There may also be opportunities under allowance trading programs to provide incentives under a set-aside program. For instance, in Delaware’s NO<sub>x</sub> and CO<sub>2</sub> trading programs, Delaware could allocate specific tons of NO<sub>x</sub> or CO<sub>2</sub> allowances as set-aside each year for projects that reduce the consumption of electricity or energy other than electricity, or generate electricity using renewable energy.

Cost Issues: The only costs are those related to regulation development.

## Recommendations under the purview of the Sustainable Energy Utility

The following are the recommendations to reduce energy use for which the Sustainable Energy Utility (SEU) is envisioned as the primary vehicle for delivery of the services detailed in the recommendations. The Governor and the Council should closely monitor progress on the recommendations and, if necessary, assess how best to move forward on achieving the objectives of the recommendations, should alternative approaches be required.

### Recommendation SEU-1: Distributed Renewable Energy

*The SEU should defray the cost of installing customer-sited renewable energy as a mechanism to reduce electric transmission and distribution energy losses, dependence on the electricity grid, peak electric demand, and Delaware's carbon footprint.*

As mechanisms for reducing energy use (and thereby reducing carbon emissions) in the State, the importance of customer-sited renewable energy technologies<sup>46</sup> and demand side energy efficiency measures has been consistently recognized.<sup>47</sup> Customer-sited renewable energy generators can be powered by solar, wind, geothermal, biomass and small-hydro sources. This assortment of customer-sited renewable energy options has several unique benefits. Because they “are located at the point of energy use, they can greatly reduce transmission and distribution line congestion that results from transporting electricity over long distances. Customer-sited distributed energy improves electricity reliability and voltage stability with the positive effects of reducing the potential for power outages and improving electricity quality. By generating electricity at the customer’s point of use during times of high peak system demand, customer-sited renewables, solar in particular, can reduce peak demand, relieve local congestion, and overall demand for conventional primary energy sources, thereby driving down the retail energy costs, offering protection against price spikes, and creating an immediate and tangible reduction in CO<sub>2</sub> emissions.”<sup>48</sup>

Among the various sources of renewable energy, “the most ubiquitous renewable resource in the state is solar energy.”<sup>49</sup> It was noted in the 2003 Governor’s Energy Task Force report that the amount of solar energy falling on Delaware was 130 times the annual energy consumption of the state, including transportation fuels and electricity system losses, and constitutes the largest source of renewable energy for the State. The potential reduction in grid-based energy use reduction from this source is significant. For instance, the SEU distributed PV target alone is expected to displace grid electricity by an amount comparable to 35% of the estimated MWh savings for residential sector electricity from energy efficiency.<sup>50</sup>

The SEU has analyzed the Delaware market and has concluded the following: “The SEU will assist Delaware households and business in installing at least 300 MW of customer-sited renewable energy by 2019 through the use of incentives and other policy measures.”<sup>51</sup>

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<sup>46</sup> Also often prefixed as “user-sited” or “distributed”

<sup>47</sup> Delaware Climate Change Action Plan (2000), Center for Energy and Environmental Policy, University of Delaware. Available online at:

[http://ceep.udel.edu/publications/energy/reports/energy\\_delaware\\_climate\\_change\\_action\\_plan/deccap.htm](http://ceep.udel.edu/publications/energy/reports/energy_delaware_climate_change_action_plan/deccap.htm). Also see: SEU Task Force Report (2007). Available online at: <http://www.seu-de.org/>

<sup>48</sup> SEU Task Force Report, pp. 28.

<sup>49</sup> Delaware Energy Task Force, Final Report, September 2003, pp. 65

<sup>50</sup> Compare pp. 37 and 39 of the SEU Task Force Report (2007).

<sup>51</sup> SEU Task Force Report, p. 6.

Development of distributed energy should be expedited through incentives to individual residence and business owners, not only for environmentally friendly clean energy production but to encourage siting in Delaware of related manufacturing businesses.

Cost Issues: The SEU's customer-sited renewable energy financing mechanism incorporates a number of sources of funding such as: Tax Free Municipal Bonds; Green Energy Fund; sale of Renewable Energy Certificates (as well as special Solar Renewable Energy Certificates); and Shared-Savings; for realizing the target of at least 300 MW by 2019.

### **Recommendation SEU-2: Retrofitting of Existing Homes for Energy Efficiency**

*The SEU should defray energy efficiency investments of existing homes, both rental units and owner-occupied.*

Homes in existence today will continue to be the majority of our housing stock for a long time to come and these homes are all in need of some level of energy efficiency improvement. It has been traditionally very difficult to get owners of these homes (or owners of rental units) to see the long-term benefits of improving energy efficiency when most of these measures are not visible after they are installed. The SEU law incorporates nationwide best practices, which show that homeowners respond favorably to incentives for energy improvements.

A cost-effective level of retrofitting (averaging approximately \$2,500-\$3,000) – insulation, air sealing, and replacement equipment – can result in an average savings of 25-30% on the heating and cooling portion of the bill. A lighting package taking advantage of Compact Fluorescent or Solid State LED lights and an appliance package to offer incentives for replacement of refrigerators and washing machines with Energy Star rated models will save on base load usage at a similar percentage.

The SEU should require performance monitoring and make provisions to finance pre-and post retrofit audits in addition to the improvements themselves. The audit must be standardized and administered through a network of certified auditors. Similar programs throughout the Northeast offer levels of incentive from free audits, worth about \$500, to 50% of the retrofit cost, with program outlay per existing home capped at \$3,000.

Cost Issues: Cost to the SEU of approximately \$1 million/year, including administration costs. For example, at \$2,500/home, this would enable retrofitting 400 homes/year.

### **Recommendation SEU-3: Energy Efficiency Financing of New and Existing Homes**

*The Energy Office should explore, in coordination with the SEU, new energy efficiency financing models of new and existing homes.*

Energy Efficiency Financing would enable builders selling in to the new home market and buyers of an existing home to enter into shared-savings agreements with the SEU. Under these arrangements, builders and buyers could receive financing from the SEU to defray the incremental investment required for energy efficiency upgrades. The financing could be arranged so that these upgrades will save more money per month through reduced energy bills than the monthly cost of repayment to the SEU. The measures will also increase the value of the home.



Yet another approach is the Energy Efficiency Mortgage, (EEM). The instrument has been in existence for more than 15 years but it has not been widely utilized due to buyers financing through their builders rather than going to separate banking institutions for their mortgages. The work group speculates that the downturn in the housing market might enhance the effectiveness of EEMs. By using lending agencies that participate in the program, there is the opportunity to boost sales of energy efficient homes and also assist in funding energy efficiency upgrades in existing homes.

Cost Issues: The cost will be minimal for the exploration and evaluation of financing models. Cost for implementation will be identified during that process.

#### **Recommendation SEU-4: Enhanced Energy Efficient Construction of New Homes**

*The SEU should defray the incremental investments required for meeting the EPA Energy Star Program requirements.*

It is easier to incorporate energy efficiency measures into a home under construction than it is to change these items later. To that end, builders of new homes must be encouraged to build to a higher standard. The SEU Task Force identified what it deemed the logical level of efficiency over the current Delaware code as being the Federal EPA Energy Star Program. This program uses third party verification to certify that a home uses 15% less energy for heating, cooling and water heating than the 2006 code allows (note – the 2006 code requires higher efficiency than the codes in place in Delaware today).

The SEU could finance the incremental investments required for meeting the Energy Star Home requirements. A shared-savings agreement that incorporates the SEU, homebuilder and eventual owner would need to be worked out. This arrangement would not lead to any initial increase in cost to the homebuilder or the eventual homeowner. After the shared-savings period, the homeowner captures the energy savings for the life of the home. As in retrofitting of existing homes, a lighting package taking advantage of compact fluorescent or solid state LED lights and an appliance package to offer incentives for Energy Star refrigerators and washing machines can offer saving on base load usage.

Cost Issues: The cost would be part of the program operations of the SEU, and should require no additional State funding.

#### **Recommendation SEU-5: Alternative Fuel/Fuel Efficient Vehicles**

*SEU-5A. The SEU should provide economic incentives to encourage public and private fleet owners to purchase fleet vehicles that meet the State standards (to be developed under Recommendation TE-9).*

*SEU-5B. The SEU should provide economic incentives for home infrastructure options to encourage greater use of alternative fuel vehicles such as electric, compressed natural gas and Vehicle-to-Grid.*

The main approach to reducing the energy used per mile of travel is to improve the technology of the vehicle used, either by increasing fuel efficiency or switching to a cleaner burning, low or no carbon fuel. The technologies for such vehicles are improving constantly, from hybrid engines to hydrogen fuel cells, electric vehicles, and vehicles with vehicle-to-grid (V2G) capabilities.

Adoption of new technologies often begins with fleet purchases. These purchases increase the demand for these new vehicles, allowing more to be built, driving down the costs of production. Transportation energy use

reduction is included in the charge of the SEU; therefore, providing incentives for purchase of these lower energy using vehicles or for home infrastructure to service them is well within its purview.

Cost Issues: The incentive programs would be operated by the SEU, within its planned budget, not requiring additional funding from the State.

## Energy Education & Outreach

### Recommendation EO-1: Energy Education and Outreach Program

*The Sustainable Energy Utility, in coordination with the Energy Office, should develop and implement a comprehensive education program to inform Delawareans on energy efficiency that includes:*

#### Greenhouse Gas Information

- *Informing citizens about public policies (such as the Renewable Energy Portfolio Standards and Regional Greenhouse Gas Initiative) and the incentives available from the State, the Sustainable Energy Utility and the Federal government.*
- *Educating citizens about the importance and benefits of reducing the state's greenhouse gas emissions—including the economic benefits, new jobs and improved public health, and the potential costs of not doing so.*
- *Educating citizens on how to determine their personal GHG footprint and actions they can take to reduce it.*
- *Information about the scope and potential of distributed renewable energy in the State.*

#### Energy Efficiency Information

- *Energy efficiency steps targeted to different sectors of the economy that would include information that these groups could use to increase their energy efficiency, including easily achievable, cost effective actions;*
- *Behavioral aspects of maximizing energy efficiency and conservation;*
- *Information about the Sustainable Energy Utility as a comprehensive source of support for efficiency, conservation and renewable;*
- *Information on additional programs available from other sources, such as tax credits, deduction or rebates;*

#### Program Evaluation

- *Criteria by which the educational plan is evaluated objectively on a regular basis.*

Education on energy, climate change, and the health impacts of fossil fuel use will be critical in gaining widespread public participation in support of Delaware's goals to reduce energy use and mitigate climate change. While public policy leaders and elected officials must provide leadership, any plan to reduce Delaware's energy use and its greenhouse gas (GHG) footprint will require the enthusiastic support and participation of its citizens, if it is to succeed.

Current Department of Natural Resources & Environmental Control (DNREC) efforts include publications available at the Delaware Energy Office and a Climate Change website.<sup>52</sup> The Delaware State Curriculum Standards for public education K-12<sup>53</sup> include a number of concepts and achievement objectives in science and math that relate to energy<sup>54</sup> and climate change.<sup>55</sup> The standards need to be updated to include some

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<sup>52</sup> <http://www.dnrec.delaware.gov/ClimateChange/Pages/Climate%20change%20and%20Delaware.aspx>

<sup>53</sup> Delaware Department of Education, *Curriculum Standards*. <http://www.doe.k12.de.us/infosuites/staff/ci/default.shtml>

<sup>54</sup> Delaware Department of Education, *Science Standard 3, Energy and Its Effects, Grade Level Expectations*.

[http://www.doe.k12.de.us/ddoe/files/pdf/science\\_standard3.pdf](http://www.doe.k12.de.us/ddoe/files/pdf/science_standard3.pdf)

<sup>55</sup> Delaware Department of Education, *Science Standard 3, Earth's Dynamic Systems, Grade Level Expectations*.

[http://www.doe.k12.de.us/ddoe/files/pdf/science\\_standard5.pdf](http://www.doe.k12.de.us/ddoe/files/pdf/science_standard5.pdf)

important additional topics, such as energy efficiency, as well as new developments in science, science education, and public policy.

These efforts can serve as the initial base to be built upon as Delaware moves forward with a comprehensive energy and climate education and outreach program. The Sustainable Energy Utility (SEU) Contract Administrator will be developing educational programs. As described in the Request for Proposal for the SEU Contract Administrator (CA): “The CA shall develop and implement a public and consumer information strategy to: (1) promote customer participation in and market awareness of SEU services; (2) increase consumer awareness and understanding of the benefits of energy efficiency and renewable energy both for participants and non-participants; and (3) increase consumer demand for SEU services; and (4) affect consumer decision-making in consumer-driven energy efficiency choices. When appropriate, the CA will develop and implement energy education and technical training services and initiatives in cooperation with Delaware educational institutions.”<sup>56</sup>

Educational programs should target various segments of energy users in Delaware including residential, commercial, industrial, and motorists. Within these groups, there could be programs tailored for various categories of users, including, for example, schools, churches, and hotels. In addition, efforts should be undertaken to educate builders and contractors on energy efficiency.

Education will help Delawareans understand 1) the benefits and importance of energy efficiency and renewable energy, 2) the potential for significant reductions in energy use through efficiency, and 3) the programs and other incentives available to support energy efficiency and renewable energy. The education would include the importance of reducing energy use and implementation of renewable energy.

Cost Issues: The education program described above would be integrated with the SEU’s educational program, which has a target funding level of \$850,000 per year. There would be no additional cost to the State for the education program.

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<sup>56</sup> Delaware Energy Office, Delaware Sustainable Energy Utility, Contract Administrator, Request for Proposals, August 1, 2008, Paragraph 3.4, page 16.

## Recommendations to Reduce Delaware’s Transportation Energy Use

Delaware’s transportation system includes 5,317 miles of roadways maintained by the Delaware Department of Transportation (DelDOT) (including 41 miles of interstate highway), 925 miles of other roadways, a state-wide bus system, 271 miles of commercial rail lines (mainly freight lines), including passenger service to Philadelphia which is contracted from SEPTA and subsidized by the Delaware Transit Corporation (DTC).<sup>57</sup>

Transportation system planning is done by DelDOT, with oversight by the Wilmington Area Planning Council (WILMAPCO) and the Dover/Kent County Metropolitan Planning Council. The bus system is operated by DART First State, the Delaware Transit Corporation. DART also provides a service, RideShare Delaware, to assist commuters with finding and using alternative modes of transportation. The goal of the program is to reduce the number of single occupant vehicles (SOVs) traveling on Delaware's roadways, thus improving our air quality. Initiated in 1997, RideShare Delaware is funded with a combination of Federal Congestion, Mitigation & Air Quality (CMAQ) and State dollars.

### **Rail**

Subsidized rail transit is provided from Newark, Churchman’s Crossing, Wilmington and Claymont to Philadelphia on the SEPTA R2 line. SEPTA R2 ridership, as measured by passenger trips, has increased 42%, from 723 thousand in FY03 to 1 million in FY07. The Delaware Transit Corporation (DTC) is in the final engineering phase of the Commuter Rail Improvement Project (CRIP). The CRIP improvements are projected to double daily ridership from 3,000 to 6,000 passengers per day.

The CRIP consists of adding approximately 1.5 miles of new track (3<sup>rd</sup> Track) around the vicinity of Banning Park in New Castle County. The additional track will accommodate increased frequencies on the Delaware SEPTA R2 service terminating in Newark. Currently, only two tracks are available which create a choke point on this section of Amtrak’s Northeast Corridor and limits the amount of train movements, especially during peak periods. As part of the CRIP, a new Newark Train Station will be built at the current site of Newark Concrete. The new station will accommodate two SEPTA trains at one time. The new location will eliminate existing conflicts with freight traffic at the current Newark Station. The new station will have more parking and the location is better situated for eventual downstate commuter rail to Middletown and Dover. DTC, as part of the CRIP, has also signed an agreement with SEPTA to purchase four commuter rail cars that will be used as part of the additional service once the CRIP is completed.

Rail service to more distant locations is provided by Amtrak from Newark and Wilmington where there are approximately 2 and 80 trains per day respectively. These services provide an additional estimated 800,000 trips per year.

### **Bus**

Bus transit operated by DART First State includes both fixed route bus service and demand response service statewide. Between FY03 and FY07, fixed route ridership grew 11%, from 7.5 million passenger trips to 8.3 million. Over the same period, demand response trips grew 43%, from 569 thousand to 812 thousand.

### **Air Service**

Currently there is no commercial air service provided within Delaware. Residents frequently travel to Baltimore/Washington International Airport, the Philadelphia International Airport or to Salisbury, MD to access commercial air services.

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<sup>57</sup> Road miles – calculated in one direction for each road.

## Reducing Vehicle Miles Travelled

### Recommendation TE-1: Goal to Reduce Vehicle Miles Travelled

*The Governor should adopt a goal that by 2030, the total vehicle miles travelled in Delaware will not exceed the levels in 2009.*

Vehicle miles travelled (VMT) is one of three core factors in transportation energy use. National trend data indicates that not only has VMT grown substantially (outpacing population growth and vehicle registration), growth will continue, regardless of new federal proposed standards.<sup>58</sup> Indeed, the Department of Energy projects that by 2030, the number of VMT will be two times the 1990 level.<sup>59</sup>

CO<sub>2</sub> emissions have risen, and will continue to rise, concomitantly.<sup>60</sup> Any effort to reduce the energy associated with transportation use must therefore include controlling VMT while also leveraging the use of new vehicle and fuel technologies to reduce transportation-related energy use. For that reason, the above goal is recommended, in harmony with policies that move the vehicle fleet towards more efficient fuels and technologies.

The objective of the goal is to serve as an inspiration and benchmark for policies, programs and activities to reduce transportation energy use (i.e. land use policy, vehicle standards, etc.). The expected benefit is better land use and related decisions that will result in fewer vehicle miles travelled, and reduced associated energy use and emissions.

Cost Issues: None.

### Recommendation TE-2: Employer Trip Reduction Programs

*The Governor, through the Secretaries of Natural Resources & Environmental Control and Transportation should convene a committee, including representatives of Delaware employers such as the State Chamber of Commerce, to develop standards and incentives for employer participation in commute alternatives programs.*

The Goal of this recommendation is to encourage greater trip reduction efforts among employers statewide. Employer-sponsored commute benefits have long been documented to have a significant impact on reducing vehicle miles traveled. Since the end of the Employee Commute Option (ECO) mandates of the early nineties, efforts have been in place throughout the state to engage business partners in the voluntary act of employee commute program administration. Many employers currently offer varying degrees of demand management programs ranging from minimal to aggressive efforts, the latter primarily as a result of a legally binding Traffic Mitigation Agreement. However, there remain a significant number of employers throughout the state who do not offer any level of benefit to their employees. Programs and support systems are presently in place that could easily support employers in program implementation.

The committee would engage business stakeholders in:

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<sup>58</sup> Federal Highway Administration (FHWA). "Vehicle Registrations, Fuel Consumption, and Vehicle Miles of Travel and Indices," Highway Statistics 2005. Washington, D.C.: U.S. Department of Transportation, 2006, <http://www.fhwa.dot.gov/policy/ohim/hs05/htm/mvfvfm.htm>.

<sup>59</sup> S. Winkelman (Center for Clean Air Policy) calculations based on EIA's Annual Energy Outlook 2008 (Early Release) and the Energy Independence and Security Act of 2007.

<sup>60</sup> Ibid.

- Identifying minimum standards for employer trip reduction participation;
- Identifying the available and needed resources to support administration;
- Identifying existing and new tax incentives and administration processes to encourage their participation;
- Developing a recognition package to spotlight successes via local, regional and national venues;
- Develop incentives to encourage employer and employee telecommuting options.

The primary expected benefit of increasing the number of businesses participating in trip reduction efforts would be an increased reduction in vehicle miles traveled throughout the State, thus helping to achieve our energy reduction goals. Secondary, and equally important, goals are cost savings; expanded commuter choice options, aiding employer recruitment and retention efforts; and improved air quality.

Cost Issues: To the State: It is likely that this discussion would lead to a requested increase of the existing Travelink credit cap and/or the addition of a new one with an amount to be determined. The total amount of eligible credits allowed is \$100,000 in any State fiscal year. Additional costs could also potentially be needed to support expanded level of service to the business community.

To employers: Many initiatives would be at no- or low-cost. For those that are higher, costs could be offset by tax credits.

### **Recommendation TE-3: Bus Transportation System Improvement**

*TE-3A. Where possible, DART and other bus service systems should combine services in overlapping areas.*

*TE-3B. Add additional small bus/van routes to connect to longer distance, express oriented transit routes.*

In addition to DART, there are other bus services throughout the state that operate on a daily basis. DART could achieve significant savings if these resources were better integrated. One example of opportunity is in Newark with the University of Delaware's transit services, the Unicity service, and DART's fixed route services. The bus systems are complementary to one another, serving areas both in common and distinct. The separate services could be coordinated with one another to achieve optimal efficiency for both the systems and the riders. In addition, connectivity is offered with SEPTA and Maryland's MTA; however, these services could be better coordinated to provide more seamless travel patterns.

DART currently operates or contracts for several smaller cutaway vehicles and vans on short routes that connect to longer distance, express oriented transit routes. Ridership productivity on these connective routes often coincides with the heavily traveled runs of the "parent" transit route. With current land use patterns in the state, using the smaller vehicles to collect riders and bring them to the commuter route is one way to "increase" population densities and grow transit ridership.

Cost Issues: The costs of coordinating services are minimal. The costs of increasing the number of smaller buses/vans would include the capital costs for purchase of additional vehicles and operating costs (which are estimated by DART at approximately \$50/hour).

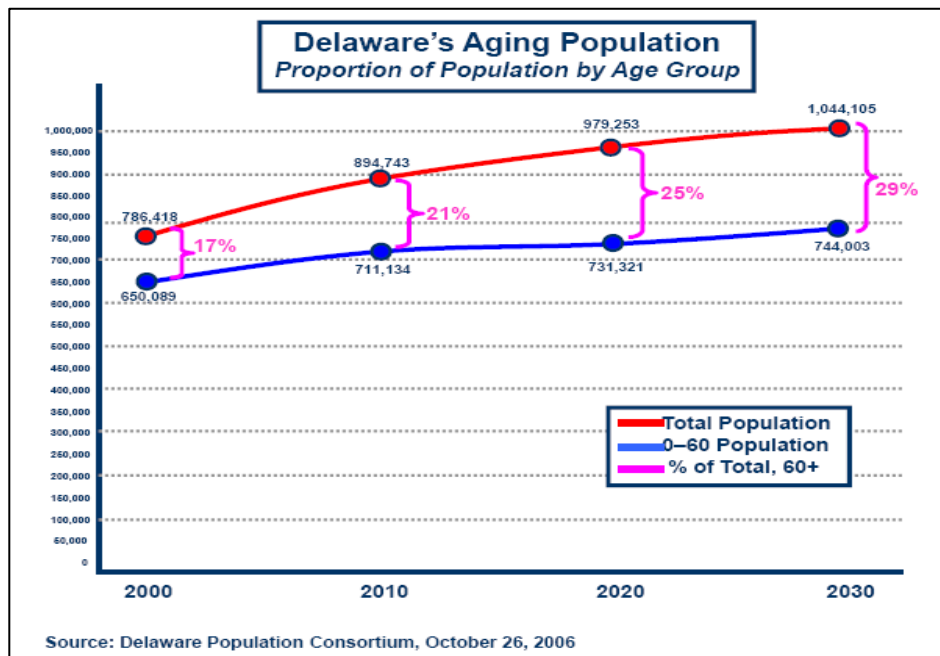
### **Recommendation TE-4: Non-ADA Para transit Service**

*The Governor, through the Secretaries of Transportation and Health and Social Services, should convene an ad hoc panel to evaluate and recommend options to improve energy-efficiency and cost-effective implementation of the State's policies regarding non-ADA Para transit service.*

An ongoing demographic shift, coupled with Delaware's liberal acceptance standards have resulted in booming paratransit ridership throughout the State. In addition to an aging population, disabled citizens often chose to move to Delaware in part for the extensive paratransit service. As shown in Figure 19, Delaware's population is aging, with an increasing proportion of the population being over 60 years old, reaching almost 30% in 2030. As disability rates increase dramatically with age, we can also expect to see more persons with disabilities. One outcome of this demographic shift is greater demand for paratransit services. Statewide, non-ADA trips were found to account for nearly 40% of all paratransit trips in a test month (December 2006).

The average paratransit trip requires over six times the subsidy of a fixed-route trip. In fiscal year 2008, the average Delaware paratransit trip cost over \$48.00, while a fixed-route bus trip was roughly \$5.20 and rail \$6.80. For the same period, revenue per trip was \$2.32, \$0.67 and \$2.80, respectively. Thus, the State subsidizes 95% of paratransit trip costs, 87% of fixed route bus trip costs and 59% of rail trip costs. Given the cost of operating the current paratransit service, an increasing proportion of the DART budget is being shifted from the fixed route system to paratransit service. In addition, according to the 2008 Transportation Energy Data Book, the average paratransit trip consumes over four times the amount of energy (BTU per passenger mile) as an average car trip.

**Figure 19: Delaware's Aging Population**



The panel would include representatives of The Elderly and Disabled Transit Advisory Committee (EDTAC), paratransit service users, DART, and other transportation service providers and would be charged with identifying various alternative approaches to providing non-ADA paratransit service consistent with State policies but at greater energy and economic efficiency.

Cost Issues: Cost for the committee would be minimal. Cost savings would be anticipated from the recommendations of the committee.



## **Recommendation TE-5: Transit Investment**

*DelDOT should raise fixed-route transit capital spending to at least 20% of total transportation spending in the region and create a dedicated funding stream for the system.*

Reducing VMT will require an increased public investment in transit. The US Census estimates that 11,000 Delaware workers (2.7% of the State transportation mode split) utilized transit as their primary means of travel to work in 2007—making it the third most popular mode choice behind driving alone and carpooling. Transit is most utilized in the State’s urban north (New Castle County), home to most of the routes, accounting for 10,000 (3.8% of county mode split) of the estimated 11,000 dedicated transit users in the State.

Transit use has increased during the last decade, while funding for system improvements has not kept pace. According to DART, fixed-route ridership has increased by 25% between 1996 and 2007. Ridership on SEPTA’s R2 rail service from Newark to Philadelphia has increased by 116% during the same period. Capital spending on transit in the Wilmington metro region, home to the State’s most extensive transit network, consistently has programmed about 10% of funding for transit in its Transportation Improvement Program (TIP) during the past decade. Funding for transit reached its high as a percentage of total funding in the FY 2006 TIP, when it reached 11.2% of total transportation spending; its lowest level was 6.5% in FY 2003.

To successfully reduce VMT statewide, Delaware’s fixed-route transit system requires improvements in frequency, connectivity, accessibility and expansion of service. A recent WILMAPCO survey of low-income and minority communities found that 44% said the transportation system does not meet their needs. Many pointed specifically to transit as ineffective. For example, increased weekend service is necessary to provide better connectivity for low-income workers to their jobs—many of which require service at off-peak times. Increasing the frequency of weekday service to key employment centers is also necessary for building ridership. Further, ensuring the general accessibility of existing bus stops is crucial to encouraging ridership. A quarter of respondents in WILMAPCO’s survey pointed specifically to dangerous crossings and broken sidewalks as deterring them from using the bus more often.

Raising fixed-route transit capital spending to 20% of total transportation spending in the region and creating a dedicated funding stream for the system, will allow for the improvements to the system which are anticipated to encourage greater overall usage and reduce VMT.

Most of DART's operating budget is funded from the State’s Transportation Trust Fund, which relies on revenues collected from the Motor Fuel Tax. If efforts to reduce VMT and/or increase fuel efficiency are successful, less funding will be made available to the Fund, and for transit, due to the resultant falling volume of fuel sales. In addition, the funding percentage for transit is currently argued year-by-year against road funding. A dedicated addition to the fuel tax could be utilized to help fund transit expansion.

Cost Issues: This recommendation involves the redistribution of transportation funds and possible creation of a new funding source.

## **Recommendation TE-6: Bus Rapid Transit Feasibility**

*The Delaware Department of Transportation should explore the feasibility of creating a phased bus rapid transit system throughout the Mid-Atlantic Area (Delaware, Maryland, Pennsylvania, New Jersey).*

The objective of a bus rapid transit system (BRT) would be to incrementally link communities, centers of commerce, and established systems of transportation. This would provide the following benefits: a more efficient land-use pattern, reduced traffic congestion, increase economic competitiveness of the region in today's global marketplace, and provide an environmental friendly solution to traffic management. Potential partners would include representatives from both the public and private sectors from Delaware, Pennsylvania, Maryland, New Jersey, and Federal agencies.

According to a November 2008 presentation at the University of Delaware's Institute for Public Administration, a typical heavy rail system in the US can cost \$200 million or more per mile to construct, and a typical light rail system can cost \$70 million per mile or more. By contrast, the most expensive BRTs cost around \$25 million per mile. Some very competitive systems have been built for significantly less.

There are efforts currently underway in Delaware regarding bus rapid transit. These have included identification of potential stakeholders; contact/communication of project concepts (through one-on-one meetings); and information meetings and workshops.

The following steps would be taken to implement the recommendation:

- Establishing a steering/exploratory committee representing the variety of stakeholders and regulators who would have interest in this issue
- Developing a draft agreement among a public/private partnership; including commitment to fund development of a business plan that includes the institutional arrangement, proposal for phased development including recommendations for pilot areas, and a 5 and 25 year plan for implementation
- Engaging all stakeholders in refining the draft agreement and supporting any necessary legislation/regulation

Cost Issues: A feasibility study should cost between \$150-200,000.

## **Recommendation TE-7: Bicycle and Pedestrian Transportation**

*TE-7A. DeIDOT and other state agencies and cooperators should encourage bicycling and walking as alternative transportation.*

*TE-7B. The Governor or the Legislature should implement a "Complete Streets" requirement statewide by statute or Executive Order.*

*TE-7C. DeIDOT and other appropriate agencies should increase funding for pedestrian and bicycle transportation.*

The US Census estimates that about 11,000 Delaware workers (2.7% of State mode split) utilized walking as their primary means of travel to work in 2007—making it the fourth most popular mode choice just behind transit. Walking is most utilized in the State's urban north with its greater density; nearly 8,100 (3.1% of county mode split) of the estimated 11,000 dedicated walkers in the State are in New Castle County. According to the Census, less people bike to work. In 2000, the latest available year, less than 900 residents (0.2% of the State mode split) used the bicycle as a primary means to get to work. About half lived in New Castle County. Additional people walk and bike every day, not captured by these data. They include school students or trips made by workers after or during work.

Increased use of bicycles and walking for transportation will reduce VMT. Delaware can take a number of steps to encourage more Delawareans to walk, including an increased focus on Safe Routes to Schools. The steps to encourage increased travel by bicycle include, among others, making roads safer for bicycles and enhancing education of riders and drivers on their respective responsibilities.

The recently developed Wilmington Bike Plan<sup>61</sup> provides a framework for comprehensive bicycle planning in the City. The Wilmington Bike Plan should be studied for the possibility of adopting elements of the plan into the State's planning efforts. While some of the Plan's proposals are applicable only to an urban environment, there are ideas in the Plan that are applicable to the whole State. State planning should include groups currently involved in bicycling issues, such as the Delaware Bicycle Council, WILMAPCO, county and local governments.

**Complete Streets Policy:** A complete street is a road that is designed to be safe for drivers, bicyclists, transit vehicles and users, and pedestrians of all ages and abilities. "Complete streets' focuses more on road users and is about making multimodal accommodation routine so that multimodal roads do not require extra funds or extra time to achieve. The intent is to change the everyday practice of transportation agencies so that every mode should be part of every stage of the design process in just about every road project-whether a minor traffic signal rehabilitation or a major road widening. The ultimate aim is to create a complete and safe transportation network for all modes."<sup>62</sup>

Current DeIDOT policy provides for planning to integrate bicycling into the development and management of the transportation system.<sup>63</sup> The policy should be evaluated and revised, as necessary, to implement the concept of Complete Streets as cost effectively as possible.

There are a number of steps that Delaware can take that would encourage more citizens to travel by bicycle. Key examples of these include:

*Bicycle route planning and bike path building:*

- Connect and incorporate greenways with bike paths and connect bike paths to regional paths. There are a number of pathway projects currently underway.
- Develop a direct bicycle route between Wilmington and Newark and a safe bicycle crossing for the C&D canal;
- Consider how to turn existing streets into Complete Streets on a case by case basis, as determined by need.

*Improve safety for bicycle travel:*

- Ensure that road shoulders are free of debris and that multi-use paths have regularly scheduled maintenance.
- Mark shared roads with the 'shared use marking' and bicycle lanes with bike lane symbols and directional arrows, with symbol repainting, as necessary, to maintain clear visibility.
- Ensure that bike lanes are not blocked with traffic islands.
- Provide for cyclist detection at demand-actuated traffic signals. Without this sensing, bicycles are sometimes unable to trip lights at intersections and thus cannot get a green light;
- Provide bicycle lanes at intersections to help cyclists and motorists position themselves correctly to increase safety.

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<sup>61</sup> <http://www.wilmapco.org/BikeWilmington/index.htm>

<sup>62</sup> Complete Streets: We Can Get There from Here, Institute of Transportation Engineers. ITE Journal, May 2008 by Laplante, John, McCann, Barbara, [http://findarticles.com/p/articles/mi\\_qa3734/is\\_200805/ai\\_n25501805](http://findarticles.com/p/articles/mi_qa3734/is_200805/ai_n25501805)

<sup>63</sup> DeIDOT Bicycle Policy, P.I. Number: D-06. Available at:

[http://www.deldot.gov/information/community\\_programs\\_and\\_services/bike/biking\\_in\\_delaware/deldot\\_policy.shtml](http://www.deldot.gov/information/community_programs_and_services/bike/biking_in_delaware/deldot_policy.shtml)

Facilitate bicycle commuting:

- Provide more bicycle parking in the form of racks and lockers. A number of sites in Delaware already provide lockers, such as the train stations at Newark and Churchmans Crossing.
- Foster bicycle commuter training programs that teach safe cycling in traffic.
- Provide incentives for bicycling commuters per the Bicycle Commuter Act.

Publicity and education:

- Educate all citizens about laws and responsibilities of drivers and riders and about bicycle safety. This education could be part of standard drivers' education.
- Use publicity to remind drivers and cyclists of the importance of cooperating with each other.
- Publicize and enforce the State law that requires motorists to remain five feet away from bicyclists.
- Publicize the benefits of bicycling including the health benefits, the cost savings, the reduction in personal contribution to climate change, and increasing the number of well-publicized, fun "Bike to Work" days.

Cost Issues: The cost of implementing a Complete Streets policy will vary depending upon existing conditions. While the primary mode of travel to work for about 3% of residents in the Wilmington region is non-motorized, non-motorized spending typically does not exceed 1% of transportation spending in the region's Transportation Improvement Program. Increasing the non-motorized share to 2-3% of total transportation spending in the Wilmington region, and indeed throughout the State, will encourage greater overall usage of the pedestrian and bicycle system and reduce VMT. This portion of the recommendation would be a redistribution of existing transportation funding, not additional funding.

## **Increasing Vehicle Efficiency/Reducing Energy Use per Mile**

### **Recommendation TE-8: Vehicle Fees &/or Fuel Taxes**

*The Delaware Department of Transportation should develop and propose vehicle-related fees and/or fuel taxes which encourage increased fuel efficiency and decrease miles travelled.*

This recommendation is intended to encourage the purchase of efficient vehicles for primary transportation by private vehicle owners in Delaware. Vehicle miles traveled is included to distinguish, for example, a person who drives a truck for his or her daily commute from a person who owns a truck but only uses it occasionally to move large items. The person who uses the truck daily has a much greater energy footprint than the person who uses a more efficient vehicle for the majority of his or her driving and should pay accordingly.

The registration fee would reflect the cost to society (in the form of pollution, fossil fuel depletion, greenhouse gas emissions, etc.) of the service the vehicle provides. There are a variety of approaches that can be taken to determining the fees. Whatever approach is developed will need to be easily understandable by the public in order to be most effective.

A registration fee system based on energy consumption per miles driven has the same effect as raising the fuel tax; both represent an increase in cost to operate a vehicle that is proportional to the total energy consumed. The registration fee approach is preferable for several reasons, one being that vehicle registration fees have a psychological impact on people out of proportion to their actual value, as seen in the recent reaction to increased Division of Motor Vehicles (DMV) fees across the board. A more significant reason is that fuel taxes have a higher disproportionate impact on low income car owners. A fuel tax increase of \$0.50/gallon (which might not be sufficient to cause much change in vehicle purchase behavior) would increase fuel cost for a 25 mpg gasoline vehicle driven for 10,000 miles by \$200. Vehicle registration fees are currently relatively low, \$40

annually for a passenger vehicle, and the incremental difference for a 25 mp vehicle is unlikely to come near to approaching that level.

Cost Issues: There would be minimal cost in development of the program. Implementation costs would include modification of the DMV's procedures and outreach on the system.

### **Recommendation TE-9: Alternative Fuel/Fuel Efficient Vehicles**

*TE-9A. The Office of Management and Budget should establish high standards<sup>64</sup> for fuel efficiency and environmental impacts for new fleet purchases by the State.*

*TE-9B. As new alternative fuel vehicle technologies become commercialized, the State Energy Office should conduct studies of options for making the support infrastructure available and convenient to the public in an economically feasible and environmentally safe manner.*

The main approach to reducing the energy used per mile of travel is to improve the technology of the vehicle used, either by increasing fuel efficiency or switching to a cleaner burning, low or no carbon fuel. The technologies for such vehicles are improving constantly, from hybrid engines to hydrogen fuel cells, electric vehicles, and vehicles with V2G capabilities. Adoption of new technologies often begins with fleet purchases. These purchases increase the demand for these new vehicles, allowing more to be built, driving down the costs of production.

Broad adoption of new technology vehicles by the general public is dependent upon the availability of the infrastructure to provide the fuel or charge for the vehicle and, for V2G vehicles, the ability to interact with the utility grid when the vehicles are not in use. To assist in this, the State Energy Office should, as new technologies are nearing full commercialization, conduct feasibility studies of the various options available for providing the necessary infrastructure to facilitate widespread adoption and success of the new technology. These studies should be done in conjunction with the DNREC's relevant regulatory programs, the Delaware Economic Development Office and Office of State Planning.

Cost Issues: Vehicle purchase costs will likely increase, at least initially, based on the higher standards, but the increased purchase cost may be offset, all or in-part, by decreased fuel expenses. Costs of the studies will vary and may be eligible for grant funding.

### **Recommendation TE-10: HOV (High Occupancy Vehicle) Lanes**

*As new roadways or expansions are planned, DelDOT should evaluate and incorporate HOV lanes into those plans as appropriate.*

Highway congestion has increased dramatically over the past two decades. At its most fundamental level, highway congestion is caused by the lack of a mechanism to efficiently manage use of existing capacity. The objective of HOV lanes is to reduce the level of single-occupancy-vehicle (SOV) usage and encourage multiple occupancy vehicles (carpools/vanpools/transit) on Delaware highways during peak periods of travel demand thus reducing congestion and energy use per mile travelled.

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<sup>64</sup> One such high standard that Delaware could adopt would be the California Low Emission Vehicle II standard.

There are various HOV lane configurations in use today. Some types of HOV lanes, called concurrent flow lanes, are adjacent to, and operate in the same direction as, the general-purpose lanes. Other types, called contra-flow lanes, operate in the opposite direction of the adjacent general-purpose lanes effectively enabling HOV users to drive on the "wrong" side of the roadway with barriers separating them from oncoming traffic. HOV lanes are delineated by a variety of methods, including barriers, buffer areas, and pavement markings.

The success or failure of HOV lanes in managing travel flow is highly correlated with a roadway's operational density. An insufficiently congested roadway will not encourage the use of HOV lanes given the restrictions imposed on operators of SOVs.

A note raised by the work group was that new road constructions and expansions increase impervious surface area, creating negative environmental impacts. Those impacts should be taken into consideration when determining the need for new roads or roadway expansions.

Cost Issues: The cost of incorporating HOV lanes into new roads and expansion projects will vary depending upon the HOV system utilized and the road configuration of the project. Incorporating HOV lanes into construction of new projects will be less costly than retrofitting current roadways.

# Reducing the Impact of Land Use on Energy Use

## Recommendation LU-1: Smart Growth

*The Governor, through the Office of State Planning, should strengthen Delaware's efforts to effectively direct growth into growth zones and require Smart Growth.*

Fundamentally reversing trends in sprawling land use is the linchpin for achieving reductions in VMT. Greater density enables a more effective and efficient public transit system and non-motorized transportation network<sup>65</sup>. Single-occupancy vehicle trips will drop as density increases. Smart Growth is characterized by interconnectivity; compact development; a mix of housing, commercial and retail; walkable neighborhoods; and a variety of transportation choices.

With Smart Growth, more residents will live closer to their workplaces and other destinations. A two-thirds reduction in vehicle miles travelled (VMT) per person has been shown in compact neighborhoods, versus areas in which housing is at 1-2 dwelling units/acre. Conversely, the number of transit + walking + biking trips per household climbs steeply as nearness to jobs increases. Nearness to transit is also important. Research suggests a 42% reduction in VMT for households within ½ mile of transit and a 21% reduction in VMT for households between ½ and 1 mile.<sup>66</sup>

An extensive review of the literature has led to the conclusion that “one of the best ways to reduce vehicle travel is to build places where people can accomplish more with less driving.” New technology in either automobiles or with cleaner fuels won't get us to the kind of reductions in carbon dioxide that we will need in order to curb global climate change. With a nationwide projected 23% increase in population and a 48% increase in VMT by 2030, taking into consideration new technology in automobiles and cleaner fuels, we will still be 30% over 1990 levels by 2030, unless we develop more dense and compact communities.<sup>67</sup> Delaware's projected 2030 population will experience a 21% increase, fairly close to the national increase.<sup>68</sup> In compact urban neighborhoods where there are transportation options beside cars, people drive a third fewer miles than in automobile-centric neighborhoods.<sup>69</sup>

Delaware has been pursuing Smart Growth approaches through Livable Delaware. Although there has been considerable progress made (i.e. the designation of growth zones, requiring comprehensive plans with implementation of future growth plans through zoning code modifications at the County and local levels, incentives and processes to encourage Smart Growth, state approval processes for annexations, and improved coordination within and among levels of government), the overall effort has not been as successful as it needs to be to truly be effective in reducing transportation energy use.

According to data from a University of Minnesota study, “aggressive” Smart Growth policies will result in a 5.3% reduction in VMT for that state, while what they call “comprehensive” policies will reduce VMT by 3.4%; their

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<sup>65</sup> The minimum density usually considered necessary to support frequent public transit service is about 12 dwelling units per acre.

<sup>66</sup> Walters, Jerry, “Measuring the Effects of Land Use on Travel Behavior and Climate Change,” address at Haagen-Smit Symposium, April, 2008.

<sup>67</sup> Ewing, Reid, and Keith Bartholomew, Steve Winkelman, Jerry Walters, Don Chen, “Growing Cooler: The Evidence on Urban Development and Climate Change,” Urban Land Institute. 2008

<sup>68</sup> State of Delaware Office of State Planning Coordination-Delaware Population Consortium, “Annual Projections,” June 1, 2008 [http://stateplanning.delaware.gov/information/dpc\\_projections.shtml](http://stateplanning.delaware.gov/information/dpc_projections.shtml)

<sup>69</sup> Ewing, et al. op.cit. p.4.

study suggests that even “limited” Smart Growth policies will take down the VMT by 1.5%.<sup>70</sup> The 2007 New Castle County Comprehensive Development Plan Update showed that under current land use trends, there would be 78,100 transit riders/day and a daily VMT of 15.5 million/day by 2030. However, if growth were steered into a centralized core south of the C&D Canal and into a redevelopment corridor in the northern section of the county, the analysis shows about 80,000 transit riders/day and a daily VMT of 14.5-15 million. Under the more restrictive development patterns, the analysis also showed better traffic flow, a reduction in volatile organic compound (VOC) emissions, a greater percentage of the population living near a bus stop, and far fewer acres consumed by development when compared to the current trend scenario.<sup>71</sup>

Contrary to the ideal and despite Delaware’s efforts to date, population growth continues to rise outside of traditional centers. WILMAPCO has also shown that a decreasing percentage of New Castle County residents are within walking distance of bus stops as low-density developments continue to spring up outside DART’s service area. These trends can be reversed. A plan to do this will require sound technical analysis, tough zoning-restrictions and a healthy dose of political will. New centers can be created within existing sprawl. The following are examples of successful Smart Growth approaches and techniques that could be utilized<sup>72</sup>:

- Making well-planned Smart Growth a requirement.<sup>73</sup>
- Consistent enforcement by State and County governments of restrictions on growth outside designated growth zones.
- Charging carbon impact fees on new development that create automobile-dependent neighborhoods.<sup>74</sup>
- Prioritizing public funding for improvements to facilities within identified growth zones.<sup>75</sup>
- Requiring that all city, county and state government buildings be built in growth zones.<sup>76</sup>
- Requiring that new schools be built within growth zones,<sup>77</sup> and as infill, where possible.
- Limiting transportation investments outside identified growth zones.
- Actively encouraging local governments to grant density bonuses and reduce or waive fees for building infill, for redeveloping in blighted areas, and for workforce housing which embodies Smart Growth characteristics, making certain that it is within designated growth zones and near transit.
- Utilizing Transfer of Development Rights (TDRs) regularly and effectively to save open space and provide for higher density in growth zones.
- Educating local governments on how they can utilize State Tax Increment Financing enabling legislation in growth zones, and particularly in redevelopment areas.<sup>78</sup>
- Developing better methods of assessing the traffic impacts (including Level of Service) of mixed-use developments and the accurate capture of the benefits of this development type.<sup>79</sup>

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<sup>70</sup> University of Minnesota Center for Transportation Studies, “Reducing Greenhouse Gas Emissions From Transportation Sources in Minnesota,” June, 2008. <http://tzd.state.mn.us/Publications/ResearchReports/pdfdownload.pl?id=938>

<sup>71</sup> New Castle County, Delaware. 2007 Comprehensive Development Plan Update, Section II, “Future Land Use.” Pp17, 18.

<sup>72</sup> Delaware’s existing statutes will need to be reviewed and potentially revised for authority to implement selected approaches.

<sup>73</sup> Farr, Douglas, *Sustainable Urbanism: Urban Design with Nature*, p.149. Hoboken: John Wiley and Sons. 2007.

<sup>74</sup> Ewing, et al, op.cit., p.15.

<sup>75</sup> Wheeler, Stephen M., *Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities*, p.15, New York: Routledge, 2004.

<sup>76</sup> Duany, Andres, and Elizabeth Plater-Zyberk, Jeff Speck, *Suburban Nation: The Rise of Sprawl*, p.227. New York: North Point Press. 2000.

<sup>77</sup> Duany, et al, op.cit., p.233.

<sup>78</sup> With tax increment financing, money raised from a bond sale is given to a developer as reimbursement for infrastructure costs on a project. The additional property tax generated as the value of the site increases goes to pay off the bond.

<sup>79</sup> WILMAPCO, through an initiative started by DelDOT, has a committee working to develop such methods.



Cost Issues: There is minimal or no direct government cost for implementation of policies; costs may be incurred in development of specific policy approaches.

## **Recommendation LU-2: Transit-Oriented Development**

*The Office of State Planning should work with local governments to promote Transit-Oriented Development as an innovative strategy and design tool to create livable healthy communities that are integrated with public transit, linked to a network of walkable, bikeable streets.*

Transit-Oriented Development (TOD) is a Smart Growth approach based around multi-modal transportation. The approach is designed to create communities that contain a rich mix of living, working, and commercial uses. With TOD, new residents have places to eat, shop, work, and play near where they live and have an alternative to the conventional suburban sprawl environment.

TOD includes complete streets, streets that are designed to be accessible for everyone: younger or older, walker or biker, and regardless of disability, facilitating people moving around without a car and thus keeping healthier by being able to bike and walk places. This leads to saving money on transportation and medical costs and allows people to live in a community with open space and a sense of place.

TOD can help redevelop in built-out and congested areas, leverage public-sector investment, and capture potential future value. Properties within a 5 to 10 minute walk of a train stop sell for 20-25% more than comparable properties further away as people often prefer higher densities when they see what it can look like.<sup>80</sup> In turn the government saves money on road infrastructure and by providing resources that are less costly. Likewise, the private sector has the opportunity to leverage public sector investment, capture potential future value of the community, and to develop in built-out and congested areas. Wilmington's waterfront redevelopment around the train station is a TOD-type redevelopment, as is the proposed Claymont Renaissance and Fairplay at the Churchmans Crossing Rail Station.

Some strategies to maximize the effectiveness of TOD projects are for government to acquire land prior to TOD construction when land value is lower, then lease to others as land value increases. Other public-private partnerships unlock the value from undervalued and underutilized assets, such as having public ownership of land by the TOD site for the first decade to eliminate holding costs during the sometimes lengthy design and approval process.

While not applicable in every situation, there is a general rule of thumb regarding TOD districts or zones. The Gateway Zone is closest to the transit platform and contains open space and the highest density and building height. The Midway Zone has less intense development and has a more varied land use pattern. The Transition Zone is located at the periphery of the TOD district, where development transitions into the surrounding area.

TOD was a 2008 "Best Bet," according to Emerging Trends in Real Estate®, the real estate industry's most respected annual forecast<sup>81</sup>. Every \$1 million invested in public transportation leads to \$3 million in increased business sales, for both highway and transit users, and generates over \$6 million in local economic activity.<sup>82 83</sup> Further, TOD can help save money on resource and infrastructure costs that go along with sprawl development.

Cost Issues: Costs are project specific.

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<sup>80</sup> [http://www.publictransportation.org/reports/asp/land\\_use.asp](http://www.publictransportation.org/reports/asp/land_use.asp) Accessed 11/05/08

<sup>81</sup> A joint publication by PricewaterhouseCoopers and the Urban Land Institute.

<sup>82</sup> [http://www.apta.com/research/info/online/ben\\_overview.cfm](http://www.apta.com/research/info/online/ben_overview.cfm) Accessed 11/05/08

<sup>83</sup> <http://www.publictransportation.org/facts/> Accessed 11/05/08

### **Recommendation LU-3: Emissions Standards for Development**

*The Department of Natural Resources and Environmental Control, Air Quality Management Section should establish an "Emissions Standard and Mitigation Regulation" for land use development.*

The DNREC Air Quality Management Section conducts analyses of the annual pounds per household of mobile emissions (cars) that are projected for new developments (discussed on p. 28 of this report). A regulation should be developed to establish emissions standards for development that occurs outside the State's designated growth zone<sup>84</sup> and require mitigations to meet or exceed the standard for any development plan whose pre-development analysis of emissions exceeds the cap.

When viewed in total, the evidence on land use and driving shows that compact development will reduce the need to drive between 20 and 40%, as compared with development at the outer suburban edge with isolated homes, workplaces, and other destinations.<sup>85</sup> To reduce transportation energy use, sprawl development must be controlled, and development that does occur must be more energy efficient.

The recommendation of an emissions mitigation regulation aims to provide a strong disincentive to development outside the growth zones. First, it recommends that a standard be set for new development. Development that exceeds the benchmark will be met with significant on-site mitigation requirements that would prevent exceeding the standard. Examples of mitigation measures include, but are not limited to, minimizing the need for external trips by including services/facilities within the project; maximizing energy conservation and improving the thermal integrity of buildings; providing adequate ingress and egress at entrances to public facilities to minimize vehicle idling at curbside, etc.

For development plans that exceed the emissions standards, developers will be required to submit, and have approved, a mitigation plan. Projects that cannot implement sufficient on-site measures to reduce project impacts on-site may be allowed to do off-site mitigation.

This may impact development decision-making, leading to substantial changes in such things as site design, location and building practice, that would not now currently be considered and/or to a net decrease in emissions from sprawl development. The expected benefit is better land development that uses less energy, both in and of itself and through associated transportation.

The policy would require a change in the memorandum of understanding (MOU) between New Castle County and the State, to require that land development plans in New Castle County be subject to the same emissions analyses to which projects in Kent and Sussex Counties will be. The recommendation will require the identification of meaningful and measurable mitigation measures.

Cost Issues: The only cost to the state is that associated with policy development and the staff time involved for the additional reviews of New Castle County projects.

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<sup>84</sup> Delaware's growth zone includes Levels 1 and 2 of the State Strategies for Policy and Spending.

<http://stateplanning.delaware.gov/strategies/strategies.shtml>

<sup>85</sup> R. Ewing, R. Pendall, and D.Chen. Measuring Sprawl and Its Impact. Washington, D.C.: Smart Growth America/U.S. EPA, 2002, p.18.

# Reducing the Environmental Footprint of Delaware's Energy Use

## Recommendations

### The Need to Address Climate Change

#### **Recommendation FP-1: Climate Change Commission**

*The Governor should establish a greenhouse gas reduction goal and a Climate Change Commission to develop a detailed Climate Change Action Plan for Delaware, including a trajectory for the reduction in greenhouse gas emissions and an adaptation plan, incorporating periodic review and evaluation of the plan.*

It is important that both the state government and Delawareans understand the potential impacts of climate change on the state and the range of options available both to mitigate and adapt to those changes. It is also important for Delaware to prepare to meet federal greenhouse gas emission reduction requirements that Congress and President Obama are sure to establish in the next year or so. Developing this knowledge and implementing new federal mandates will require the dedicated study and input from experts in a number of fields including, but not limited to, the scientific community, law and policy experts, industry, technology experts, agriculture, state agencies, educators, architects, environmental groups, public health advocates, legislators, and general public.

Delaware developed its first Climate Change Action Plan in 2000. That plan, the next 5 year state energy plan, and the recent plans developed by neighboring states, such as Maryland, can serve as resources to inform the new Commission.

To be most effective, the plan should include a long-range greenhouse gas reduction target and intermediate targets by which progress can periodically be assessed. A process should also be established for the periodic review of the action plan and progress towards achieving goals. In addition, local governments will have a major role to play in both mitigating and adapting to climate change and should be involved both in developing the State's plan and encouraged to develop their own climate change action plans. State policies and programs to support the local governments' efforts should be included in the State's climate change action plan.

Cost Issues: Costs could range from a low of about \$50,000 to several hundred thousand for consultants, contractors and studies, taking into account the cost of state employee time devoted to the Commission's work. Most of the Commission and working group members will be volunteers, participating as part of their regular jobs.

### Increasing Renewable Energy Use

#### **Progress Toward Increasing Renewables in Delaware**

Over the past 5 years, the two fastest growing sources of renewable energy in the US have been biofuels and wind, as shown in Table 6. It is sobering however, to realize that, in spite of the two to three-fold growth of these sources over that period, renewables, including conventional hydroelectric, contribute less than 7% of the nation's energy needs.

**Table 6: US Energy Consumption from Renewable Energy Sources, 2003-2007<sup>86</sup>**

<b>(Quadrillion BTU)</b> <b>Energy Source</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
Renewable	6.150	6.261	6.444	6.922	6.830
Biomass <sup>a</sup>	2.817	3.023	3.154	3.374	3.615
Biofuels	0.414	0.513	0.595	0.795	1.018
Waste	0.401	0.389	0.403	0.407	0.431
Wood Derived Fuels	2.002	2.121	2.156	2.172	2.165
Geothermal	0.331	0.341	0.343	0.343	0.353
Hydroelectric Conventional	2.825	2.690	2.703	2.869	2.463
Solar/PV	0.064	0.065	0.066	0.072	0.080
Wind	0.115	0.142	0.178	0.264	0.319

<sup>a</sup> Biomass includes: biofuels, waste (landfill gas, MSW biogenic, and other biomass), wood and wood-derived fuels.  
MSW=Municipal Solid Waste.

The Delaware Green Energy Program has helped to increase the deployment of renewable energy in Delaware. This program has provided grants for the installment of 118 photovoltaic systems, 162 geothermal systems, 6 solar water heating systems, and 2 wind systems throughout the state. The total capacities of the installed systems are shown in Table 7.<sup>87</sup>

<b>Table 7: Green Energy Program Installed Capacity</b>		
<b>Technology</b>	<b>Installed Capacity</b>	<b>Units</b>
<b>Nonresidential Installed Capacity</b>		
Photovoltaic	879.89	Kilowatts
Geothermal	94.50	Tons <sup>a</sup>
Solar Water Heating	0	Square Feet
Wind Turbines	1.8	Kilowatts
<b>Residential Installed Capacity</b>		
Photovoltaic	413.82	Kilowatts
Geothermal	779.50	Tons <sup>a</sup>
Solar Water Heating	490.0	Square Feet
Wind Turbines	2.4	Kilowatts

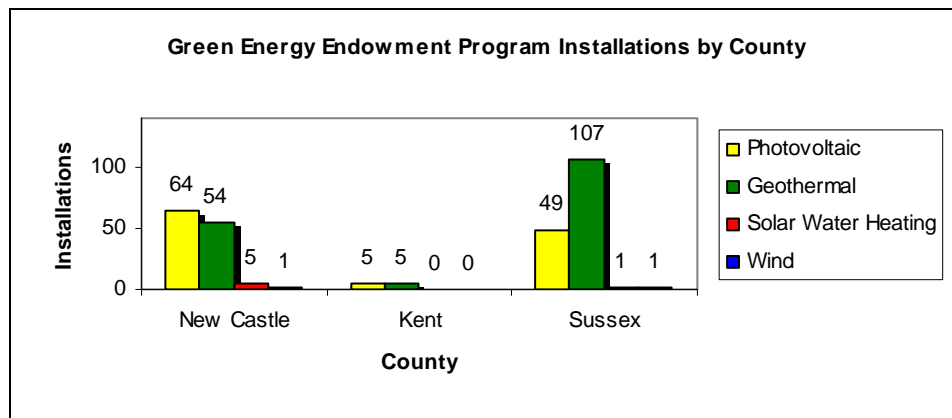
<sup>a</sup> One ton of heating/cooling capacity = 3.5172 kilowatts

Numbers of installations of the various technologies by county are shown in the chart in Figure 20. As of mid-2008, PV and geothermal systems have had the greatest numbers of installations through the fund.

**Figure 20: Green Energy Program Installations, by County**

<sup>86</sup> Source: [http://www.eia.doe.gov/cneaf/alternate/page/renew\\_energy\\_consump/table1.html](http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.html).

<sup>87</sup> Source: Delaware Department of Natural Resources & Environmental Control, Energy Office. Green Energy Program: Fiscal Year 2008 Status Report.



In addition to the Green Energy Fund for Delmarva Power customers, Delaware Electric Cooperative (DEC), and the nine municipal electric utilities represented by the Delaware Municipal Electric Corporation (DEMEC), have also established Green Energy Fund programs for their electric customers to provide grants and incentives for renewable generation projects. The DEC’s Renewable Resource Fund has provided grants to member-owners for renewable generation projects such as solar and wind. To date 16 solar and 3 wind projects have been completed or are under construction, representing over 80 kW of member-owned renewable capacity. DEMEC customers have installed a total capacity of 48 tons of geothermal (= 170 kW) and 30 kW solar photovoltaic.

**Recommendation FP-2: Green Energy Program**

*The Green Energy Program should be examined and aligned to complement other state and federal programs, including the Sustainable Energy Utility and federal tax credits, to help achieve Delaware’s renewable energy goals and solar carve-out.*

The State’s Green Energy Program offers a 50% rebate of installed system costs for qualifying systems, subject to maximum rebate levels. Currently, the funds are exhausted, and reservations for rebates are extending out to 2011 for residential systems. The State’s Green Energy Fund grows at approximately \$2.6MM per year, and is funded by a fee of 0.36 \$/MWh of usage for Delmarva (0.18 \$/MWh for Munis and Coops). This can be compared to the fund operated by New Jersey, which collects 0.86 \$/MWh. Germany funds its Green Energy Fund with a charge of 5.40 Euros/MWh, and further commits to payments for a 20 year period. This aggressive policy covers all renewables and has made Germany the center of the PV manufacturing world, with over 225,000 jobs and 3% of its overall energy demand met by solar. Delaware is far sunnier than Germany, with 50% more electricity generated on the same PV equipment.

Present policy will fund the installation of 1.0 MW<sub>peak</sub> of new PV each year; slightly more as PV equipment prices fall. An installed Base of 100-200 MW<sup>88</sup> is needed to meet the solar portion of the State’s Renewable Portfolio Standard (RPS) requirement. Although not required to be the sole source of funding to meet the requirement, the Green Energy Fund, as presently designed, will support only 14 MW<sub>peak</sub> over that time frame, not even close to the level of the requirement.

The solar carve-out in the RPS was designed to provide incentives for much more photovoltaics than the Green Energy Program is able to help fund. As noted above, the current Public Benefit Charge (PBC) is 0.000356 cents/kWh for Delmarva Power customers and a 0.000178 cents/kWh charge used to create the related funds for the Delaware Electric Cooperative and the DEMEC municipal electric utilities. Ideally, with a PBC or RPS, the

<sup>88</sup> The range is based on calculation by the Delaware Energy Office and Delmarva Power.

policy is trying to provide enough of an incentive to make the installation of renewable energy a rational economic choice. It needs to be enough of an incentive so that people don't perceive the investment taking forever to pay off. But it should only provide just enough of an incentive so that there is not excessive freeloading -- freeloaders are people who would have made the investment anyway but take advantage of an incentive that is more generous than it needs to be. Ideally, the incentive also provides for a steady and sustainable development of the industry so to avoid booms and busts.

A PBC can do this if it has sufficient funding and is continually crafted and adopted to changing economic conditions. However, New Jersey and California<sup>89</sup> are both moving away from the PBC because of the political difficulty of increasing PBCs. Both states are moving toward an approach of smaller customers receiving the up-front incentives and larger customers receiving incentives through Solar Renewable Energy Credits (SRECs).

The analysis in this recommendation is necessary since the Fund, as currently configured, will not incent sufficient solar installations to meet the carve-out, the backlog for rebates is increasing, and new entities, such as the Sustainable Energy Utility (SEU) have been created. With the establishment of the SEU, additional options for incentivizing renewable energy systems may be developed. Depending upon the programs offered by the SEU, a restructuring of the Green Energy Program should be evaluated. A key question is what type of program will be best to achieve the State's goals.

Cost Issues: Costs for the evaluation should be minimal.

### **Recommendation FP-3: Net Metering**

*Legislation should eliminate forfeiture provisions from the Net Metering Law*

In Delaware, as required by the Renewable Portfolio Standards (RPS), a certain percentage of electricity sold in the state must come from renewable generation sources, and a certain portion of that must be from solar photovoltaic generation, reaching 2% by 2019. Utilities may satisfy their solar requirements by purchasing Solar RECs from the owners of photovoltaic systems.

Delaware has a net metering law which allows electric customers to get a credit against their electricity bills for electricity they generate using renewable resources. This electricity generated creates Renewable Energy Credits (RECs). RECs are an attribute separate from the energy itself and are tradable commodities.

The Delaware Code provides that any excess generation in a billing period may be carried forward as a credit to the customer's bill until the end of a 12 month period. At that point, the excess credits are forfeited to the Green Energy Fund. The customer's credits are calculated at the retail rate. Forfeitures, however, are calculated at the wholesale supplier's cost. The customer may choose whether her/his 12 month period ends July 31 or December 31.

The idea behind allowing customers to choose their anniversary dates was to allow them to build up credits for use later in the year, and to pick the anniversary date that best matches their generation/usage pattern. The Delaware Energy Office, however, has received calls from customers expressing problems with both dates. December 31 is a problem because some customers use the summer to build up a credit to satisfy electric costs past December into February. July 31 is a problem for these same people because it forfeits 2/3 of their summer and previous month productions. It should also be noted that under current law, even a customer who generates exactly what he/she consumes may well have to make net payments for the year. This can occur

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<sup>89</sup> Current cent/kWh PBC's in NJ and CA are 0.000860 and 0.000790, respectively.

because credits are carried forward, but charges are not. Elimination of the forfeiture provision would eliminate this anniversary issue.

The Code further provides that SRECs associated with the forfeited energy costs are given to the electric supplier. Thus, if a customer has used less than he/she generated, SRECs associated with the excess are conveyed to the customer's electric supplier. It is arguable that the customer, who paid for the generating facility, should retain ownership of all his/her SRECs. This treatment would be comparable to the way other generators are treated.

Delaware law limits the net metering provisions to systems that are sized to meet the needs of the customer. Eliminating the forfeiture provisions and allowing a reasonable limitation for customer sizing which addresses cost and reliability issues would support increased installation of photovoltaic systems. The current forfeiture arrangement means that customers have a financial incentive to install less solar power than they think they will need in order to provide a cushion from forfeiture, whereas, as public policy, we want to encourage the installation of more solar power. There are additional anti-energy conservation and anti-efficiency consequences of the forfeitures provisions:

Solar owners who have installed enough solar power to meet or almost meet their power requirements have no financial incentive to reduce further their electric use because they will forfeit the value of their energy savings.

Solar owners who have generated more electricity than they have used will lose SRECs associated with the excess power. Currently SRECs are trading in excess of \$200/SREC. Thus, a customer with excess solar generation would lose greater than \$200 for each megawatt-hour of excess generation. This customer has a significant financial incentive to increase his power use to be sure he does not forfeit his SRECs.

Prior to the 2007 revision to the net metering law, if a customer produced more energy than she/he used, the customer could receive a check from the utility company for the excess.

Cost Issues: The Green Energy Fund would lose the value of forfeited excess generation. The amount of this loss is expected to be very small because of the very limited amount of excess generation installed, and because the forfeiture provision creates an incentive to increase electric use to prevent forfeiture of energy and associated SRECs. The utilities would lose the value of forfeited SRECs. Again, this value is expected to be very small.

#### **Recommendation FP-4: Solar/Renewable Energy Access**

*Solar and renewable energy rights should be available to the citizens of Delaware. Barriers, and methods to relieve those barriers, need to be identified and examined and addressed. The Governor and Legislature should enact legislation addressing deed restrictions and/or covenants that unduly prohibit the use of renewable energy sources.*

Presently, deed restrictions exist in many communities that do not allow solar hot water or solar electricity systems, creating a substantial roadblock to new business opportunities in solar energy conversion. The Delaware Energy Office has received complaints from citizens over the last three years that homeowner associations have prevented individuals from installing renewable energy systems. The reasons have varied from fear of the impact on home values to aesthetics.

In response to these calls the Energy Office conducted a study of the current solar covenant and easement laws around the country, and found that several states have enacted legislation to address similar issues. SB 238/SA

1 and HS 1 for HB 344, introduced during the 144th General Assembly, were developed based upon this review. The purpose of these bills was to enact legislation that would prohibit restrictive covenants on roof mount solar and wind turbine systems respectfully. SB 238 passed the Senate but was not acted upon in the House; HB 344 was not acted upon.

Cost Issues: No costs to the State.

### **Recommendation FP-5: Renewable Energy Portfolio Standards**

*The Governor should examine and, if necessary, propose revisions to the Renewable Energy Portfolio Standard (RPS) to achieve Delaware’s renewable energy goals and to determine whether or not to increase the RPS requirement to be greater than the current specification of 20% by 2019.*

Senate Bill 19 as amended by House Amendment 1, passed by the 144<sup>th</sup> Delaware General Assembly, called for an increasing percentage of electricity sold in the state to Delmarva customers to come from renewable energy sources. The percentage started at 2% in 2007 and increases each year to 20% in 2019. The legislation also created a “solar carve-out”, increasing to 2% per year in 2019.<sup>90</sup> This bill replaced the first RPS bill, which was passed by the 143<sup>rd</sup> General Assembly.<sup>91</sup> The new legislation both raised the percentage requirements from the initial bill and created the solar carve-out, which was not included initially.

Currently, twenty-four states and the District of Columbia have RPS policies in place; four others have nonbinding goals for adoption of renewable energy. The more aggressive requirements are California, which has a requirement of 20% by 2010, and Oregon and Illinois, which both have requirements of 25% by 2025.<sup>92</sup>

Electricity production in Delaware and the rest of the nation is a significant source of CO<sub>2</sub> and other pollutants with more direct and immediate health impacts such as fine particulates, SO<sub>x</sub>, NO<sub>x</sub> and mercury. While major reductions in Delaware’s greenhouse gas (GHG) emissions will already occur from the generation sector, additional reductions may be desired and suggest a further transition from energy sources for electricity from fossil fuels to renewable energy sources. Delaware has a potential supply of clean renewable energy in the form of off-shore wind and contract arrangements for out-of-state on-shore wind energy. Additional development of the off-shore wind resource (excluding shipping lanes, migratory bird flyways, etc.) to a depth of 50m could provide potential power of 6200 MW if fully developed – over 4 times the state’s total electrical power consumption (1300 MW by all users.)<sup>93</sup> While the off-shore wind generating resource potential is vast, the development of such resources will require considerable investment, transmission upgrades and a means of overcoming reliability concerns due to intermittency. In addition, the success of further development of off-shore wind will be dependent upon market forces and financial incentives.

Nationally, recommendations for reducing GHG emissions have included a reduction in global carbon dioxide emissions by 80% by 2050<sup>94</sup> and/or producing 100% of our electricity from carbon-free sources within 10

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<sup>90</sup> SB 19 as amended by HB 1, AN ACT TO AMEND THE DELAWARE CODE TO INCREASE THE RENEWABLE ENERGY PORTFOLIO STANDARD. <http://dep.sc.delaware.gov/electric/sb19ha1.pdf>

<sup>91</sup> SB 74 as amended by SA 1,2 and 3 and HA 1, AN ACT TO AMEND TITLE 26 OF THE DELAWARE CODE RELATING TO RENEWABLE ENERGY PORTFOLIO STANDARDS. <http://dep.sc.delaware.gov/electric/rpsact.pdf>

<sup>92</sup> US Department of Energy, Office of Energy Efficiency and Renewable Energy, *States with Renewable Portfolio Standards*, June 2007. [http://apps1.eere.energy.gov/states/maps/renewable\\_portfolio\\_states.cfm](http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm)

<sup>93</sup> Amardeep Dhanju, Phillip Whitaker and Willett Kempton, “Assessing offshore wind resources: An accessible methodology”, *Renewable Energy*, 2007. <http://www.ocean.udel.edu/windpower/docs/DhanjuWhitKemp-proof-RE07.pdf>

<sup>94</sup> placeholder for reference info



years<sup>95</sup>; increasing the percentage of electricity from renewable energy sources is integral to most climate change mitigation proposals.

In Delaware, a reason for potentially increasing the standard is that, should all its existing wind contracts come to fruition, Delmarva Power will exceed the 20% requirement before 2019.<sup>96</sup> Although not required to meet the RPS, DEMEC and DEC are required to meet the demands of their customers for renewable energy. Each has established a program through which customers can elect to pay more for renewable or “green” power. DEMEC has also entered into a contract to purchase power from the Bluewater Wind off-shore wind project. Given concerns expressed in the work groups regarding the question of whether or not all the current contracts will come to fruition, and what the impacts on cost and reliability will be as these projects are brought on line, it will be appropriate to evaluate the situation in 2010 to determine what, if any, changes are appropriate to the RPS requirement. The areas to be reviewed should include: applicability of the RPS to customer classes, electricity providers, percentage requirement and timeline, and whether a carve-out is appropriate for wind energy resources.

Cost Issues: Depending upon the approach used to review and evaluate the RPS, consultant or other costs may be involved.

### **Recommendation FP-6: Biomass Energy**

*FP-6A. The Energy Office should update the “Delaware Biomass Supply Assessment”, including current and potential biomass feed stocks and by-products from all agricultural & forestry activities in the urban and rural communities of the state.*

*FP-6B. Delaware Senate Bill 280, enacted during the 140<sup>th</sup> General Assembly, should be amended by the legislature to eliminate unconstructive impacts on Delaware’s biomass utilization and economic growth both in the urban and agricultural communities.*

Consuming biomass<sup>97</sup> for heating/cooling and transportation needs is not a new concept. Humans have utilized combustion of organic plant material for heating, cooking and transportation fuels for centuries. Current available technologies and others in various development stages have made combustion techniques environmentally feasible, capping emissions below restrictions imposed by federal & state laws. Combined heat and power (CHP) facilities, along with co-generation plants operated solely on herbaceous biomass are currently providing electricity (and steam) around the nation and world, including in our neighboring states.

Due to the limitations embedded in SB280, no biomass facility may legally be built in Delaware. This creates a significant economic loss; the National Arbor Day Foundation estimates a single 75 megawatt wood fuel plant will add 500 direct and indirect jobs to the local economy. The limitations prevent almost all biomass energy use in Delaware, regardless of environmental impacts (both positive and negative).

Legislation should be developed to encourage the use of renewable resources grown and utilized within our own state for bio-energy projects, based on ‘emission levels’ and not ‘feedstock material’. Biomass derived from

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<sup>95</sup> Al Gore, “The Climate for Change”, New York Times, Nov. 9, 2008, p. WK 10.

<http://www.nytimes.com/2008/11/09/opinion/09gore.html?hp>

<sup>96</sup> With an estimated 22% from on- and off-shore windpower. Glen Moore, Delmarva Power, Workgroup meeting, November 12, 2008.

<sup>97</sup> Based on the U.S. Department of Energy definition, Biomass is any organic matter which is available on a renewable basis including forest residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residue and aquatic plants.

woody & herbaceous plant material is currently available to support a feedstock for local consumers using combustion and gasification technologies. In 1994, the Delaware Forest Service released a study titled: “Delaware Waste Biomass Resource Survey”, in which harvested wood from silviculture activities and site conversion, along with primary/secondary industry mill residues, waste paper, corrugated cardboard, solid wood from used pallets/construction/demolition residues and poultry wood-residue material were evaluated. Although this report contains outdated numbers, it clearly showed that there was, at that time, sufficient feedstock for bio-energy facilities. This report did not generate results from urban wood residues. Moisture content and heating values of individual woods vary greatly between feedstock sources and need to be evaluated in feasibility studies for combustion and gasification technologies.

Currently, forests cover over 30% of Delaware, or 382,900 acres, including land in rural and urban communities. Private landowners hold 93% of this land with the other 7% in public ownership. Through continued sustainable management of our forestland, local bio-energy facilities could be supported, while developing a wood utilization market for our forest landowners.

In addition, there are significant acres of dedicated ‘open space’ required via sub-division regulations. This land could be developed into short-rotation woody biomass plantations instead of expansive unproductive mowed-grass fields. Establishing short-rotation plantations at these sites would not only eliminate the need for maintaining required grass heights using gas-powered machinery, but could also contribute to the creation of ‘carbon-sink’ areas, along with providing valuable habitat for neo-tropical birds and ground wildlife.

Cost Issues: Initial cost to prepare a current Delaware Biomass Supply Assessment would be approximately \$50,000, but would be an invaluable tool for further feasibility studies for specific biomass energy projects.

## Improving Existing Energy Facilities

### **Recommendation FP-7: Reducing Carbon Emissions from Existing Coal Facilities<sup>98</sup>**

*Delaware, through the appropriate state agencies, should support the development of carbon emission reduction technologies that could be deployed at existing coal plants in Delaware.*

Delaware’s energy planning naturally includes both demand and supply side objectives. On the supply side, a comprehensive approach includes aligning Delaware for next generation energy resources as well as how to use and sustain our current resources. Delaware is currently a net importer of energy and dependent upon local and PJM regional coal derived generation. As Delaware moves forward, the priorities are twofold: to establish new renewable resources and, as a bridge to the future, to maintain existing resources as cleanly as possible.

In Delaware (and within PJM) more than 50% of our energy comes from coal sources. Even the most aggressive renewable integration will not replace these resources expeditiously because of capital cost, time to develop, financing hurdles, and the reliability challenge of capacity gap from actual yield to as built. For the near future, as we phase in renewable sources we will continue to be dependent upon fossil generation while renewable technology and other energy supply options develop and are implemented in the field. Delaware has three coal fueled electric generating plants. Plants such as Indian River are in the process of installing pollution major control technology that exceed national and regional standards and will make these fossil fuel plants among the cleanest in the country. However, this current technology does not address CO2 emissions and therefore does not address Climate Change and/or the State’s carbon reduction objectives.

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<sup>98</sup> This recommendation did not originate in a work group; it was developed by the Council.

Technology options include approaches such as capture and sequestration as well as innovative carbon elimination technologies. The State should work with the coal facilities to explore options for implementing innovative carbon elimination technologies.

Cost Issue: Depending on the approach utilized, the cost to the State will vary.

# Clean Energy Economic Development Recommendations

## Recommendation CE-1: Clean Energy Business Development Initiative

*The Delaware Economic Development Office should develop, implement and fund a comprehensive Clean Energy Business Development Initiative.*

This is the primary economic development recommendation. All the rest of the recommendations in this section are either in support of or specific implementation pieces of this recommendation. To implement this, the Economic Development Office (DEDO) will need to establish the Clean Energy Business Cluster strategy as a high-level, high-priority strategy with appropriate leadership and resources. To be attractive both nationally and on a global basis, DEDO should conduct a review of programs being offered by other states and countries as part of their energy initiative, including: R&D support, grants for capital investment, tax relief, etc. Many states and countries have established programs and although incentives will not be the only deciding factor for business location decisions, they can heavily influence where R&D is completed, along with pilot scale facilities and major commercial supply manufacturing. The strategy should include metrics with regular monitoring and measurement to assess progress as the strategy is implemented. Specific elements of the strategy should include, but not be limited to:

- Providing grants and other forms of assistance to strengthen and support clean energy businesses currently located in Delaware.
- Developing opportunities and a suite of incentives to recruit clean energy business manufacturing operations and ancillary support businesses to Delaware.
- Providing seed money for clean energy business start-ups to drive new business development. New ideas will likely come from research at local academic centers, so university and state policies that encourage technology spin-off companies should be instituted.
- Identifying private/public demonstration projects of alternative energy and conservation concepts to position DE as a national model.
- Strengthening and expanding the Delaware Green Industries Program. The Green Industries Program, created in the mid-1990's, was designed to encourage use of recycled products and source reduction. The program provides financial incentives, in the form of tax credits and tax reductions, and technical assistance. The program has been underutilized. A review of the financial incentives should be conducted to improve the effectiveness of the program. In addition, the program should be reviewed for potential expansion to include clean energy businesses and businesses incorporating clean energy technologies.
- Coordinating the Initiative with the Comprehensive Energy Workforce Training Strategy.
- Developing a marketing plan of "Why Delaware" that is focused on targeted industries, companies and academia. This plan should specifically include both local education on how to utilize the clean technologies and external marketing of "Why Delaware" as a clean energy business location. The effort should target all stakeholders (public, state and federal government, targeted industries and companies, and academia).

Cost Issues: To successfully implement a Clean Energy Business Development Initiative will take significant funding from the State. Leveraging opportunities with Federal or private investments, including alignment with the Stimulus Package, should be evaluated and pursued, where appropriate.

## **Recommendation CE-2: Comprehensive Energy Workforce Training Strategy**

*The Governor, through the appropriate agencies, should develop and implement a comprehensive energy workforce training strategy. The strategy should include all aspects of the energy workforce, including programs in the vocational/technical schools, Delaware Technical and Community College, the University of Delaware and Delaware State University.*

A trained workforce is a critical component for a new clean energy business economy. The most immediate needs are for energy conservation and renewable energy installations and the assembly, installation, and maintenance of large and small renewable technologies such as those required to support an off-shore wind park and solar energy initiatives. Distributed renewable energy technologies and energy efficiency investments in residential and commercial establishments throughout Delaware will require a trained small business workforce to deploy across the state. In addition, Delaware Technical and Community College (DTCC) is establishing an Energy Management program which will include operation and maintenance of wind turbines.

There is a need, nationally, for additional wind technicians, and Delaware has the opportunity to become the premier training center serving regional and national training needs in addition to those in Delaware. The current "Facility Energy Management" certificate program offers an introduction to wind turbines and other renewable energy sources. Additional continuing education training in Green Building design and techniques, energy auditing and other sustainability-related professional and trades skills are being developed. DTCC is well suited to offer the programs that prepare the technicians who will produce, install and maintain new energy related technology, and undertake the massive job of retrofitting existing buildings and systems.

Cost Issues: State investments combined with grant awards will be necessary to fund the resources required to fully implement these vital learning programs.

## **Technology Specific Recommendations**

### **Recommendation CE-3: Wind and Solar Business Development**

*CE-3A. The Delaware Economic Development Office should be funded and tasked with the development of a favorable climate in Delaware for new primary wind industry and ancillary support businesses for the wind industry whether located in Delaware or elsewhere.*

*CE-3B. The Delaware Economic Development Office should be funded and tasked with the development of a favorable climate in Delaware to capitalize on the state's strong solar business sector.*

*Wind:* Delaware has an opportunity to develop a significant wind energy industry. The state has jumpstarted the US industry with its historic power purchase agreement (PPA) between Bluewater Wind and Delmarva Power, garnering national and international attention and stimulating other states to solicit projects. This happened because the state took an active role in requiring a new, in-state power plant with a long-term contract for stable-priced power. As a result, Delaware has already been emulated by New Jersey and Rhode Island, with others, including Maryland, considering RFPs for off-shore wind.

Delaware is well positioned to take advantage of this growing industry given its first mover status, its large wind resource (almost all off-shore), a long coastline with protected ports, one deepwater port, an underutilized manufacturing base, strong public support, and the nation's leading academic research group on off-shore wind power (at the University of Delaware (UD)). The power sector is also well positioned for wind expansion. Nearly 100% of our in-state generation is derived from fossil fuels, and we are currently importing a third of the

electricity consumed in the state. The expansion of wind generation makes sense for the electricity sector to stabilize prices and reduce our high carbon risk profile.

The current Bluewater Wind project is the size of a large power plant with 230 MW initially contracted, and the potential additions of other contracts could increase this to as much as 450 MW, with a maximum project size of 600 MW. Nevertheless, as potentially the first US facility to be built, it could be considered a pilot project. After this project is underway, it will be easier to design and plan the next off-shore wind farms. Additionally, this recommendation includes a focus on wind power support services such as turbine manufacturing, maintenance, etc. that would service farms located along the entire coastline.

Existing Wind Energy-Related Businesses & Research:

Bluewater Wind (Newark): During the project development phase, two permanent DE employees, approximately 50 consultants, analysts, public relations, etc and about \$10M spent, to develop the project and contract. During construction, 400 – 500 skilled and technical jobs ramping up over a three-year period during engineering and construction, then dropping to approximately 80 permanent employees for operations and maintenance of the facility over its 25 year project life.

Port of Wilmington (Wilmington): Offloading imported components from deepwater ships, loading onto barges to carry to assembly site.

Claymont steel (Claymont): Potential for manufacturing sub-surface piles. Would require equipment for bending steel plate into 15' diameter tube. Not currently contracted with Bluewater. Unknown employment impact.

Philadelphia Gear (New Castle): A manufacturer of large, high precision gearboxes such as those for wind turbines. The company has a new 44,000 sq. ft. facility with enhanced 1500 horsepower test stand capability and 25 ton crane capacity.

DelStar Technologies (Middletown): Produces a high performance fabric used in the manufacturing of wind turbine blades.

Automobile manufacturing: Trained manufacturing workforces from the Chrysler & GM plants with skills that could transfer to wind turbine assembly.

UD Center for Carbon-free Power Integration: UD is the lead university research group in the US on off-shore wind. Areas include planning, policy, and grid integration. The University currently employs eight people conducting research, analysis, and teaching on off-shore wind. UD's Center for Composite Materials is also considered world class in conducting research on materials and design of advanced wind turbine blades.

Potential for Industry Growth in Delaware over the Next 20-30 Years:

The current installed power generation capacity in Delaware is 3,400 MW and the state's total load is 11,600,000 MWh with about a third of the load required for Delaware generated from outside the state. The off-shore wind power potential for Delaware is over 19,000 MW of capacity or 65,000,000 MWh/year output. It is conceivable that Delaware could become totally energy sufficient and meet the 2% annual growth in electric demand by adding 2,100 MW of off-shore wind capacity over a 10 year period. That is the equivalent of 5 Bluewater wind sized projects (current economic assumptions are based on one 450 MW project). Correspondingly this would dramatically increase the job creation and sustainability of the work force.

In addition, White Pine Energy suggests that the use of new technology high efficiency flywheel storage devices could enhance the available capacity from wind and help stabilize the variability of wind systems.

Beyond the next 10 years, additional off-shore wind capacity could be added for the purpose of exporting power to neighboring inland states. This consideration would require the Mid-Atlantic Power Pathway (MAPP) project to be designed to include options for transmission interconnection and storage devices to accommodate the variability of wind power production.

Delaware has the potential to become the staging area for regional deployment of wind power infrastructure to coastal neighbors greatly increasing the size and duration of the workforce to be created by the Bluewater project.

*Solar:* Sunlight can be used for generating electricity, heating and cooling of buildings, domestic and process water heating, and pool heating. These approaches have been aggressively implemented in Europe over the past decade and, in many ways, the US is still a developing country with respect to solar energy. Delaware is in an excellent position to benefit from the expected growth in the solar energy field. It has several key players in research, manufacturing, and education, such as GE Energy, DuPont, the University of Delaware, and Delaware State University. In addition, the creation of the Sustainable Energy Utility (SEU) has the potential to significantly increase the deployment of solar technologies as distributed energy sources throughout Delaware.

#### Existing Businesses and Research Activity

Today approximately 300 people are employed in the solar industry in the state of Delaware. This is dominated by the 200 employees of GE Energy's manufacturing plant in Pencader Industrial Park in Glasgow. The other large employer is DuPont, with an estimated 40 employees. The remaining 60 jobs are in the area of solar installation, of which there are approximately 11 different installer groups operating in the state. All of the above jobs are in the area of PV solar, the direct conversion of sunlight to electricity. There is little activity in solar thermal for water or space heating, or solar pool heating which are both big opportunities for growth in Delaware.

At UD, the following Research Centers and Programs are directly involved in solar energy conversion research: Energy Institute, Institute of Energy Conversion (IEC), and the Center for Catalytic Science & Technology. The IEC is a nationally recognized center of excellence. On the educational side, a new energy minor for engineering undergraduate students was just created in the College of Engineering. The Solar Hydrogen Integrative Graduate Education and Research Traineeship Program (IGERT), funded by the National Science Foundation, is located at the University of Delaware and provides a path for graduate level education in solar cell technology research. A National Science Foundation funded Research Experience for Undergraduate program also currently brings in 10 domestic students every summer to UD.

#### Potential for Industry Growth in Delaware over the Next 20-30 Years

The manufacturing base established by GE Energy and DuPont is likely to continue, as the industry has been growing at >40% per year for the past 8 years. Most recently, the industry is undergoing some difficult times as ramifications of the financial crisis are being felt, and prices are generally falling for PV equipment. Although this is good news for the consumers and installers, it may cause some consolidation of the manufacturing industry in the short term.

Growth of Delaware's installation businesses will depend largely on the Green Energy Fund and perhaps even more on the effectiveness of the SEU and its ability to incentivize solar installations.

Cost Issues: To successfully implement Wind and Solar Energy components to Clean Energy Business Development Initiative will take significant funding from the State. Leveraging opportunities with Federal or private investments should be evaluated and pursued, where appropriate.

## **Recommendation CE-4: Clean Energy Research**

*The Governor, through the appropriate state agencies, should facilitate public and private sector funding for clean energy research at Delaware's universities*

Strong research programs will attract outstanding researchers to locate in Delaware, and will serve as a draw for clean energy businesses to locate in Delaware as well as the opportunity to grow new businesses based on the research. The State should build on the existing relationship with Delaware State University and the emerging UD Energy Institute and its related research centers. The Energy Institute will provide an excellent opportunity to coordinate necessary research efforts and to train the workforce in many aspects of alternative energy. In order to function well and be competitive with similar institutes in other states, it needs a very strong immediate commitment from the State of Delaware to make the State one of the leaders in this rapidly growing field.

Cost Issues: This includes helping the universities to obtain Federal funding for clean energy related research projects through provision of matching funds or supporting projects with the federal delegation.

## **Recommendation CE-5: Vehicle to Grid Development**

*The Governor, through his policy office, should convene an advisory group to determine the infrastructure, incentives and rules needed to facilitate Vehicle-to-Grid (V2G) development and implementation.*

Vehicle-to-grid (V2G) interconnects the automotive industry and the electric industry. The batteries in plug-in cars, whether all-electric or plug-in hybrid, are used for services of value to the electric system. These include balancing fluctuations in power (called "regulation") for the large grid operators - in our region, PJM Interconnect. As solar and wind power increase on the grid, electrical storage in batteries will also become valuable to smooth out mismatches between renewable power output and the need for electricity ('load'). The V2G technology was developed at UD, and UD is widely considered the leading R&D group developing it. UD has 16 researchers engaged in software development, prototype vehicle modifications, federal policy initiatives, marketing research, and policy and rate research, toward enabling V2G businesses. This is organized within UD's new Center for Carbon-free Power Integration.<sup>99</sup>

### Related Entities and Operations:

The Mid-Atlantic Grid-Interactive Cars Consortium (MAGICC): an industrial consortium furthering the preconditions for the business model for V2G. Delaware-related entities participating in the consortium include UD, Pepco Holdings, and PJM Interconnect.

Pepco Holdings, Inc.: Parent company of Delmarva Power, has invested \$250,000 in V2G research and development at UD. They could plausibly play a role in V2G businesses, although they have not committed to do so.

AutoPort (New Castle): has the capability to process 250,000 "light conversions" per year, or several thousand of the more extensive conversion of gasoline to electric vehicles.

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<sup>99</sup> Additional information on the research can be found at [www.udel.edu/V2G](http://www.udel.edu/V2G).



### Pilot Projects Underway

One pilot project at UD operates an electric car and the UD fuel cell bus as power plants, controlled by a signal from PJM. This pilot has garnered national attention within the electrical industry. A second project, underway and funded, will place about 6 vehicles in local fleets, all controlled by a server to respond to the PJM signal as a group.

Negotiations are underway for an assembly facility in Delaware to refit gasoline cars to be fully electric cars with built-in V2G capability. This would satisfy back orders for about 10 electric cars and would provide in-state capability to produce electric cars for experiments and niche markets—up to 1,000 per year. Due to low volumes, cost of the package would be \$70,000. In volume OEM production, with suppliers also in volume production, the cost would be approximately a \$5,000 premium over the comparable gasoline car.

### Potential for Industry Growth in Delaware over the Next 20-30 Years:

It is plausible that over next 20 years up to 50% of the automobiles in the state would be either fully electric or plug-in hybrid, and 70% of those, or 35% of the automobiles in the state on V2G contract. Implications of this include a thriving V2G business with gross revenues of \$1,000 per car providing regulation (100,000 cars \* \$1,000=\$100M) plus \$500 per car providing other V2G services (180,000\*\$500=\$90M). Based on these calculations, total potential gross revenue for V2G could reach \$190M. If Delaware maintains its current lead on this technology, there could be additional licensing, training, franchising businesses outside Delaware.

Short-term business in years 1 through 10 could include production at rates of 100 to 5,000 vehicles per year that are customized for V2G. As cars become more electrified but still lack V2G capability, this could be accomplished at higher volumes and lower cost. Low volume capability also enables conversion of custom vehicles (e.g. mail trucks, bucket trucks) even after OEMs pick up plug-in cars.

Possible production in Delaware of OEM electric vehicles in existing plants: The two major auto assembly plants in DE recently employed over 2,000 people (1,100 people at Chrysler Newark Assembly (shut at the end of 2008), and 920 employees at General Motor's (GM) Boxwood Road Assembly. These plants are less economic because their supply chain is long, with many parts coming from the Midwest. However, electric cars would have different suppliers, some starting anew. The Chrysler plant has high-volume but inflexible equipment, less suitable for a new model starting up. The GM plant is more flexible, with ability to run four or more models at the same time, which means production of 10,000/year can be economical. GM is currently running at less than one-half capacity.

Opportunities exist to develop suppliers to V2G assembly plants. There are a few manufacturers of auto parts in Delaware providing parts for our assembly plants, including plastics and many smaller shops providing smaller volumes to automobile refitters. There are plausible suppliers of power electronics for electric cars at low to medium volumes. However, at higher volumes Delaware currently has nothing that could compete with high-volume power electronics suppliers such as Delphi. Companies like DuPont and W.L. Gore could become suppliers for large-scale battery production. However, a V2G business in Delaware, or electric-car manufacturing in Delaware, does not guarantee battery production locally.

Cost Issues: Costs for the advisory committee should be minimal.

## **Recommendation CE-6: Biofuels - Expanded Research**

*The Delaware Economic Development Office should work in close alignment with Delaware-based companies and universities to encourage expanded research and business leadership in the State, including the attraction of partners.*

DuPont is a global leader in developing the value chain from agricultural carbohydrates to biofuels and biomaterials. A number of significant partnerships have been established to accomplish this with others anticipated in the future. Some of the current partners are Genencor, Tennessee, Iowa and BP.

It is unlikely Delaware will be the home for large-scale production of agricultural feedstocks. The critical research and business development leadership is located in Delaware and is a major factor in the corporate strategy of DuPont. Smaller companies such as AthenaBio and Fraunhofer CMB and research at UD and DSU can contribute specific improvements to steps in the value chain such as enhanced seeds and feedstock candidates, high temperature, continuous ethanol and biobutanol production with hyperthermophilic bacteria, and new enzymes for bioprocessing. There is a modest facility for soy diesel in Delaware.

Potential for Industry Growth in Delaware over the Next 20-30 Years:

The current fuel additive, ethanol derived from the edible part of corn, is not a sustainable answer to the oil supply and cost issue. More attractive solutions under development and demonstration are bioprocessing of the stover from the corn plant or use of non food source replenishable plants such as switch grass. One of the most promising fuel additives is biobutanol instead of ethanol. Biobutanol is less corrosive and has much more energy/environmental value than ethanol. This is the goal of DuPont and its partners over the next 20 years.

The potential world market for biofuels exceeds \$100 billion with an annual growth of 20%/yr. The Innovation Center at DuPont's Experimental Station in Wilmington is the hub for the biofuel leadership. It received a \$6 million grant from the State as a commitment of its support. Currently there are about 100 DuPont employees working to build one of the largest businesses in DuPont history.

Cost Issues: This includes helping the universities to obtain Federal funding for clean energy related research projects through provision of matching funds or supporting projects with the federal delegation.

### **Recommendation CE-7: Energy Storage**

*The Governor, through the appropriate state agencies, should establish a support effort for research and development, incentives for suppliers to locate in Delaware, and efforts to raise awareness of energy storage technologies and opportunities.*

Many of the sources of alternative energy have the common issue of variable power delivery (such as the sun or wind for electricity) or a limited power life without recharge (such as electric or hybrid vehicles or electronic devices). There are many regional companies active in the development of materials or components in the energy storage market. These products are electrolytes, separators, electrode binders, electrodes and flywheels. These comprise the system of battery and capacitor devices. The current companies in Delaware engaged in storage technology are DuPont, W.L. Gore, Air Products and small start-ups.

There are several key research projects on energy storage being conducted at UD. Research on energy storage in nanostructure carbon and other nano-materials is aimed at developing new energy storage devices, i.e. electrochemical supercapacitor, a new type of electrochemical energy storage system that utilizes the capacitance associated with charging and discharging of electrons in double-layer format. Development of high energy and high power devices has been one of the areas of top most importance in recent years; the

rechargeable batteries/capacitors and/or fuel cells are anticipated to be the primary sources of power for the future.

For the past nineteen years, the Magnetics Lab at the University of Delaware has been involved in the study and development of materials for high performance permanent magnets. These materials are currently being widely used in a vast number of commercial and military applications. These applications include advanced motors, generation and distribution of electrical power (windmills, hydroelectric turbines, etc), the automotive and aviation industry (hybrid electric vehicles, MagLev trains, more electric aircraft, etc.), the information storage industry, medical surgical and diagnostics equipment, bioengineering, and numerous military weapons, guidance and communications systems. The high strength of these magnets will allow lighter, more compact, lower cost and more energy efficient devices to be developed which will help us to reduce our dependency on fossil fuels and enable "more electric" product commercialization.

Pilot Projects, in place or under consideration, include research and development in separators, electrolytes, electrode materials, and battery packs.

Potential for Industry Growth in Delaware over the Next 20-30 Years:

The current world market is about \$60 billion/yr. and is expected to grow to over \$300 billion/yr. as alternative energy and longer life electronic devices are commercialized and adopted. Also the level of federal funding will continue to escalate from over \$100 million. Energy storage is a common denominator for many very large markets such as transportation, consumer electronics and electricity power back-up which can involve many companies.

Delaware, by having two major multi-national suppliers that are active in the market, along with many companies that could enter this market, and university support of alternative energy production methods, could become a leader in R&D of Energy Storage Materials (battery and capacitor). The newly formed UD Energy Institute and similar efforts at Delaware State could become the cornerstone to development and directed R&D in areas of interest to Delaware based companies. This could feed the potential growth to establish technology development programs and encourage suppliers to locate R&D and scale up activities in Delaware. These suppliers, with state support, could establish and grow pilot production and commercial facilities supporting materials supply to these developing and growing applications.

Most of the industry research programs for energy storage are staffed with 8-10 researchers; pilot production capability for energy storage could add another 15-20 highly skilled workers and production facilities can add significantly higher numbers. Delaware could potentially establish 10 different programs in Energy Storage in the next 20-30 years. Continued growth from the existing Delaware base could be greatly expanded by attraction of new companies into the State.

Cost Issues: This includes helping the universities to obtain Federal funding for clean energy related research projects through provision of matching funds or supporting projects with the federal delegation. Other costs for business recruitment and marketing would be included in the Clean Energy Business Development Initiative.

## **Emerging Technology Pilot Projects**

### **Recommendation CE-8: Vehicle-to-Grid large fleet demonstration project**

*The Governor, through the appropriate agency(ies), should conduct a pilot project using state government or other large fleets to evaluate the economics and technical feasibility of business models for vehicle to grid.*

Pilot projects underway include UD operation of an electric car and the UD fuel cell bus as power plants, controlled by a signal from PJM. This pilot has garnered national attention within the electrical industry. A second project, underway and funded, will place about 6 vehicles in local fleets, all controlled by a server to respond to the PJM signal as a group. Negotiations are underway for an assembly facility in Delaware to refit gasoline cars to be fully electric cars with built-in V2G capability. This would satisfy back orders for about 10 electric cars and would provide in-state capability to produce electric cars for experiments and niche markets—up to 1,000 per year. Due to low volumes, cost of the package would be \$70,000. In volume OEM production, with suppliers also in volume production, the cost would be approximately a \$5,000 premium over the comparable gasoline car.

Potential for Industry Growth in Delaware over the Next 20-30 Years:

It is plausible that over next 20 years up to 50% of the automobiles in the state would be either fully electric or plug-in hybrid, and 70% of those, or 35% of the automobiles in the state on V2G contract. Implications of this include a thriving V2G business with gross revenues of \$1,000 per car providing regulation (100,000 cars \* \$1,000=\$100M) plus \$500 per car providing other V2G services (180,000\*\$500=\$90M). Based on these calculations, total potential gross revenue for V2G could reach \$190M. If Delaware maintains its current lead on this technology, there could be additional licensing, training, franchising businesses outside Delaware.

Short-term business in years 1 through 10 could include production at rates of 100 to 5,000 vehicles per year that are customized for V2G. As cars become more electrified but still lack V2G capability, this could be accomplished at higher volumes and lower cost. Low volume capability also enables conversion of custom vehicles (e.g. mail trucks, bucket trucks) even after OEMs pick up plug-in cars.

Possible production in Delaware of OEM electric vehicles in existing plants: The two major auto assembly plants in DE recently employed over 2,000 people (1,100 people at Chrysler Newark Assembly (shut at the end of 2008), and 920 employees at General Motor's (GM) Boxwood Road Assembly. These plants are less economic because their supply chain is long, with many parts coming from the Midwest. However, electric cars would have different suppliers, some starting anew. The Chrysler plant has high-volume but inflexible equipment, less suitable for a new model starting up. The GM plant is more flexible, with ability to run four or more models at the same time, which means production of 10,000/year can be economical. GM is currently running at less than one-half capacity.

Opportunities exist to develop suppliers to V2G assembly plants. There are a few manufacturers of auto parts in Delaware providing parts for our assembly plants, including plastics and many smaller shops providing smaller volumes to automobile refitters. There are plausible suppliers of power electronics for electric cars at low to medium volumes. However, at higher volumes Delaware currently has nothing that could compete with high-volume power electronics suppliers such as Delphi. And, companies like DuPont and W.L. Gore could become suppliers for large-scale battery production. However, a V2G business in Delaware, or electric-car manufacturing in Delaware, does not guarantee battery production locally.

Cost Issues: Costs to implement this pilot project would need to be determined as project specifics are developed.

**Recommendation CE-9: Hydrogen/Fuel Cells –high visibility, high impact project.**

*DelDOT should create a public/private partnership to fund a fast fill hydrogen station at the I-95 rest area.*

The proposed project is to create a public/private partnership to fund a fast fill hydrogen station at the I-95 rest area. This station would leverage the state's network of hydrogen refueling stations and location on the New York to Washington DC "hydrogen highway". The project could help to attract a major automotive company to set up a fuel cell vehicle lease program here for cold-weather fuel cell vehicle testing.

Cost Issues: Cost for the fast fill station will be approximately \$1million.

### **Recommendation CE-10: Hydrogen/Fuel Cells - State fuel cell vehicle fleet pilot project**

*The Office of Management and Budget, in cooperation with the Energy Office and the University of Delaware, should establish a pilot project to help to create a functioning system of fuel pumps and vehicles located near where the research is being conducted.*

The fuel cell and hydrogen industry in Delaware is vibrant and active. Two major industry suppliers of fuel cell components, W. L. Gore and Associates, Inc. and E. I. Du Pont de Nemours, Inc. are headquartered in Delaware. These two companies together account for the majority of the membrane electrode assemblies (the heart of the polymer electrolyte fuel cell) provided for fuel cell systems made today. Additionally, Ion Power is a local small business that supplies materials for fuel cells. In the hydrogen production/distribution arena, Air Liquide houses its North American research facility in Newark and has a hydrogen facility filling station at their site.

Delaware also has a good regional location, with numerous major fuel cell industrial suppliers within ~100 miles: Air Products, Inc in Allentown, PA, (hydrogen), BASF in Iselin, NJ, (catalyst materials), and Johnson Matthey, Inc. in West Chester, PA. (catalysts and MEAs), Arkema, Inc. in Philadelphia, PA, (membrane materials), and Millennium Cell, Inc. in Eatontown, NJ (fuel cell systems). The total employment in fuel cell related businesses within these companies is currently many hundreds, with the potential to grow to many thousands within 10-15 years.

The academic expertise in fuel cells and hydrogen is equally rich and varied. At UD approximately 25 faculty are engaged in fuel cell research, and Delaware State University (DSU) is active in research on hydrogen storage materials. In 2008, a Center for Fuel Cell Research (CFCR) was founded at UD. The CFCR conducts fundamental research on fuel cell and hydrogen infrastructure science and technology to improve performance and durability of fuel cells using novel materials, architectures, and operating strategies, while enabling commercialization with technology transfer to industry. The Center will also conduct public outreach to educate the community about the benefits of fuel cells. Local industry has a history of partnering with the universities to fund research efforts.

Currently, the most visible pilot project in the state is the UD Fuel Cell Bus Program. The first bus (22-ft) has been in operation on UD campus since April 2007. A second bus (22-ft) will be added in spring 2009. Two additional, 30-ft buses will be added in 2010. One hydrogen refueling station is in operation at Air Liquide, and two more stations are planned for Wilmington and Dover. By 2010, we expect Delaware to have a fleet of at least four transit buses and a network of three hydrogen refueling stations. The project has \$10million in federal funding and has received \$400,000 in funding from DNREC and some smaller grants from DEDO, funding sufficient for the increased buses and fueling stations.

Potential for Industry Growth in Delaware Over the Next 20-30 Years:

Delaware has an excellent base of companies (e.g., DuPont, WL Gore, Ion Power, Air Liquide, and Air Products) and a superb university research environment at UD and DSU to support it. The region is already a hub for production of fuel cell components, and if properly leveraged, could become “the silicon valley of fuel cells”. By mid-century, the fuel cell industry will likely be a multi-billion dollar industry with products in automobiles, portable electronic products like laptops and cell phones, and stationary applications like backup generators and/or home power stations. With proper stewardship, Delaware could be the home to tens of thousands of high paying, manufacturing and fuel cell related jobs in the next 20-30 years.

Cost Issues: Costs to implement this pilot project would need to be determined as project specifics are developed.

# Transmission & Distribution System Recommendations

## Recommendation TD-1: Permitting, Siting & Right-of-Way Coordination

*The Governor, through the Executive Office of Energy Policy or other agency as determined by the Governor, should convene a stakeholder group to discuss and ascertain the best means of increasing coordination between all stakeholders to simplify the permitting, siting and right-of-way acquisition process for electric and natural gas transmission and distribution projects.*

Increasing electric transmission capacity in Delaware was identified by the Transmission & Distribution Work Group as a major issue, not just for serving existing and future load but also for transporting energy from new generation facilities, including renewable energy facilities that will be sited in the State. By the end of 2007, Delmarva Power (DP), currently Delaware's sole electric transmission owner, had a total transmission plant investment of approximately \$611 million, representing approximately 2,200 miles of transmission circuits. While DP has been successful in making use of its existing rights-of-way to add new transmission lines, those existing rights-of-way are quickly being utilized and soon it will be necessary to obtain additional corridors to continue expanding the transmission system to meet future load growth and accommodate new generation. Problems facing the increased need for transmission capacity include siting transmission facilities and right-of-way acquisition.

Siting of transmission facilities - There are sixty local governments in Delaware: three counties and fifty-seven municipalities. Land use decisions, for the most part, are made by the local governments; authority over land use has been granted to the counties through provisions in Title 9 of the Delaware Code, and to the municipalities through provisions in Title 22. Local governments control land use through the adoption and implementation of Comprehensive Plans, and enforcement of their associated ordinances, including zoning ordinances<sup>100</sup>. The counties treat public utilities as a conditional use: permitted but subject to additional conditions. Conditional uses are subject to public hearings by the planning boards/commissions of the respective counties and the county council<sup>101</sup> during which additional conditions can be placed on a project, including those relating to 'health, safety & welfare'.

Several state agencies are also involved in the siting of public utility generation, transmission, and/or distribution facilities. The Department of Natural Resources and Environmental Control (DNREC) issues permits relating to air emissions, wetlands or sub-aqueous lands. The Department of Transportation (DeDOT) has control over street rights-of-way, which has been discussed in terms of co-locating transmission and distribution facilities in existing rights-of-way. The Office of State Planning Coordination (OSPC) also has a role to play, albeit not a regulatory role. To date, the OSPC has been effective in addressing and coordinating land use issues and activities between state and local governments, as well as between state agencies.

With the large number of entities that must issue approvals for the siting of transmission lines, it is important that there be increased coordination between agencies to avoid delays and respond to issues before they arise.

Obtaining Right-of-Way - Obtaining right-of-way for new electric transmission facilities is becoming increasingly difficult. Right-of-way that can be permitted and is suitable for building transmission facilities is becoming more scarce and valuable, and there are aesthetic concerns from the general public around electrical transmission facilities. A utility can be successful in negotiations for a majority of a proposed route, but one or two landowners can stop the entire project by refusing to negotiate. It is possible for a landowner to delay

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<sup>100</sup> In New Castle County, these provisions are contained in the County's Unified Development Code.

<sup>101</sup> In Kent County the council is the Levy Court.

construction of transmission facilities for extended periods by virtue of withholding land rights. With the current rate of load growth, a delay or cancellation in a project can lead to supply and reliability concerns. There is also the concern for the “Not in My Back Yard” mentality which is almost always present at public hearings; a transmission line is may benefit the entire state or region, but nobody wants it in their backyard. These problems are anticipated to increase as population increases.

Delaware does not grant condemnation rights to electric utilities nor is there a state siting process that can ultimately resolve these issues. The possibility of a condemnation alternative can assist with negotiations and preclude one land owner from unreasonably withholding the granting of an easement or demanding unjust compensation for such easement. This right of condemnation is a critical issue for energy utilities: without it, projects, including capacity additions, can be delayed, canceled, or may experience significant cost increases. Because of these concerns, the federal government identified certain areas of the country as ‘national electric corridors’. In areas with this designation – which includes all three counties in Delaware – the federal government can exercise eminent domain authority if a state fails to provide siting within a one-year timeframe. The State should be aware that if they fail to act regarding siting, the federal government can take action itself.

Transmission line redesigns, made necessary by reluctant landowners, can also create other problems for utilities. Some rerouting leaves only wetlands or other environmentally sensitive areas as a plausible route, requiring careful planning, environmental permitting and mitigation efforts. There is also the potential for future costs when rights-of-way are limited or restricted.

In addition to electricity transmission, Delaware should consider fast-tracking the natural gas pipeline project permitting process at the state level for critical energy transmission infrastructure development. Where feasible and in the public interest, the state should endeavor to make public right-of-way available, even along “limited access” highways to facilitate expansion of critical energy infrastructure. In planning highway corridors or expansions, adequate right-of-way for proposed or future energy infrastructure should be considered. These could lead to transmission expansions, not only for the benefit of large natural gas consumers but also for the local distribution companies (DP and Chesapeake Utilities (CU)) to put them in a better position to provide natural gas to areas that are under-served today.

The issue of eminent domain authority is highly sensitive and politically charged. While the recommendation is not for the State consider the matter at this juncture, it is becoming increasingly apparent that it may have to be considered in the future, especially in light of the perceived federal power granted by the Energy Policy Act of 2005 and the designation of national electric corridors. Interpretation of the powers bestowed by that Act has been challenged by regional and national environmental organizations and several states, and currently an appeal is pending in the US Court of Appeals.

Cost Issues: Costs for the stakeholder group and process should be minimal.

## **Recommendation TD-2: Natural Gas Expansion**

*The State, through the Public Service Commission and the Energy Office, should consider policy and/or legislative changes to facilitate the expansion of the natural gas transmission and distribution systems, where economically feasible and without being unduly burdensome on existing ratepayers, for the purpose of increasing the availability of natural gas for its residents, industrial and commercial consumers, electricity generating facilities, and other businesses, especially those located in areas of the state where natural gas is not available.*



Expansion of the natural gas transmission system to serve electric generation is a problematic issue, best characterized as a “chicken and egg” problem. Eastern Shore Natural Gas (ESNG) has evaluated numerous projects during the past 10 years regarding the feasibility of providing firm natural gas service to electric generating stations located on the Delmarva Peninsula and has provided proposals to electric generation companies. With appropriate commitments from generation entities, capacity on the natural gas pipeline system could be increased to meet almost any incremental generation load over the next five to ten years. To provide additional year-round firm transportation services, ESNG must obtain Federal Energy Regulatory Commission (FERC) approval to construct the required additional facilities. In that process, the FERC will determine whether the proposed new natural gas transmission facilities are economically justified; i.e., can be constructed and operated without being subsidized by existing customers who do not need, or may not otherwise benefit from, the additional facilities. This will require long-term, firm commitments by the electricity generators. To date, the generators have been reluctant to enter into long term commitments with the natural gas pipeline without having a similar commitment for purchase of their generated electricity. Thus, the “chicken and egg”, without a binding commitment from a customer of the pipeline capacity resulting from the expansion, the natural gas infrastructure to deliver to the electric generator cannot be built.

The Delaware Public Service Commission (PSC) has opened a public procedure<sup>102</sup> to review the Integrated Resource Plan (IRP) filed by Delmarva Power. The IRP evaluates generation, transmission and demand side resource options during a ten-year planning period to ensure that sufficient and reliable resources to meet customer Standard Offer Service needs are acquired at a reasonable cost. Among the resource options that will be considered would be a natural gas generating plant. One viable site for such a plant could be at the existing Indian River electric generation station in Sussex County. Should the PSC determine that such a plant best serves the needs of Delmarva Power’s electric consumers without being unduly burdensome on its ratepayers; the “chicken and egg” conundrum would be solved.

While the PSC has no regulatory jurisdiction over ESNG’s natural gas transmission expansions, it continues to work closely with both CU and DP on developing guidelines and policies that will support economically feasible distribution expansions into areas where natural gas is not presently available as a fuel choice, primarily eastern and some western portions of Sussex County. These areas have been experiencing high residential and commercial growth; however, the forecasted load is not sufficient to support significant transmission expansion to reach those areas. This again is a “chicken and egg” problem; the infrastructure cannot be built out because the current growth does not justify the need for expansion and there is not a large anchor customer to justify the need for expansion; likewise, a large user is less likely to site in these areas because natural gas infrastructure is unavailable. Should a large user, such as an electric generator, not site in Sussex County and the State continues to be desirous of expanding natural gas into un-served or under-served areas, it may wish to consider alternative funding mechanisms to support such growth.

Regarding the expansion of natural gas distribution systems, the 2003 Energy Plan recommended that the State evaluate possible incentives for making natural gas available to all areas of Delaware, especially the fastest growing parts of Sussex County<sup>103</sup>. Natural gas has since been extended into areas of the State in which accessibility was limited in 2003; however, there continue to be areas that are under-served. The PSC is working with both CU and DP on developing guidelines and policies that will support economically feasible distribution expansions into areas where natural gas is not presently available while not placing the expense of such expansion on existing natural gas ratepayers.

Ultimately, the consumer must choose their energy source and provider. The consumer and the market are better served if there are multiple energy choices from which to select and that the customer selects the most appropriate energy choice for their respective situation. This includes residents, commercial businesses and

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<sup>102</sup> PSC Docket No. 07-20.

<sup>103</sup> Governor’s Energy Task Force. “Bright Ideas for Delaware’s Energy Future”. Strategy #5.

industrial plants. Today, propane, fuel oil and electricity are available to virtually all residents and businesses in Delaware; the same cannot be said for natural gas.

Resolving this issue will not only provide Delaware with alternate fuel options for electric generation, it can reduce the demand on other less efficient fuels for residential and commercial customers and overall, help lower emissions.

Cost Issues: The cost to the state can range from minimal to substantial depending upon the approach or approaches selected to address this issue.

## Ongoing Actions and Projects for Support

The following actions and projects are currently underway. At this point in time, the only specific actions that may be necessary by the Governor are general support statements and/or letters. Through these actions and projects, many important steps are being taken to reduce energy use, increase renewables, improve the efficiency of the transmission and distribution system and pursue clean energy economic development. These are important to achieving Delaware's energy goals and should be monitored for successful completion or implementation.

### **Advanced Energy Technologies for Demand Response in Electricity Transmission & Distribution Systems**

*Support deployment by all electric utilities of electric demand response, energy efficiency, Advanced Metering Infrastructure, and Smart Grid technologies, with dynamic pricing, by ensuring that this demand response effort continues through to completion in order to provide the opportunity for energy savings across the state.*

Demand for electricity is highly concentrated in a small number of hours per year. In the PJM region, the top 80 – 100 hours account for 16% of peak demand.<sup>104</sup> In order to meet demand for electricity at all times, there must be enough generating capacity to meet demand, even at its highest levels. As a result, there are generating plants that are used less than 100 hours a year.

Demand for electricity is growing, straining capacity and reliability. Over the next decade, demand is projected to grow by 19 percent. Over the same period, however, generating capacity is expected to grow just 6 percent.<sup>105</sup> Nationally, a 5 percent reduction in demand would eliminate the need for an estimated 625 peaking plants nationwide creating a \$35 billion savings over 20 years.<sup>106</sup>

Demand response is one of the most effective and efficient means of managing energy. Traditionally, it is a tool for shaving peak demand by enabling customers to reduce their use of electricity at times of peak demand. The overall concept of demand response includes demand response devices, Automated Metering Infrastructure (AMI), and Smart Grid. Demand response devices include air conditioners and other appliances that can respond directly to price signals from a utility or Curtailment Service Provider (CSP)<sup>107</sup>, and Smart thermostats that can communicate with a utility or CSP to receive price signals and reduce energy use when prices reach certain thresholds, at the election of the consumer. AMI devices record customer consumption at least hourly and provide for at least daily transmittal of measurements over a communication network to a central collection point.<sup>108</sup> Smart grid includes advanced sensors throughout the grid to facilitate improved reliability, enable the grid to reconfigure itself, and provide efficiency and security. AMI enables utility operational benefits that improve service and help offset the cost of advanced meters and networks. Operational benefits include automated meter reading, the ability to detect outages automatically and to ensure that all outages in an area are corrected while service trucks are still in the area, and to turn customer service on and off remotely.

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<sup>104</sup> The Brattle Group, Discussion Paper May 16, 2007.

<sup>105</sup> Ibid.

<sup>106</sup> The Brattle Group, The Power of Five Percent, How Dynamic Pricing Can Save \$35 Billion in Electricity Costs, May 16, 2007., p. 5. <http://www.brattle.com/Publications/ReportsPresentations.asp?PublicationID=754>

<sup>107</sup> CSPs are aggregators of demand response. They group together customers who want to participate in demand response and facilitate their demand response participation.

<sup>108</sup> <http://www.ferc.gov/industries/electric/indus-act/demand-response/dem-res-adv-metering.asp>

Demand response puts downward pressure on prices. While these savings may be temporary, they are expected to be significant. A five percent load reduction could create nationwide price reduction savings of \$5 billion to \$10 billion.<sup>109</sup>

Delmarva Power filed its Blueprint for the Future in February 2007. The Blueprint filing has three main components: deployment of advanced metering infrastructure, implementation of demand response and demand-side management programs, and a decoupling mechanism. In its order on September 16, 2008, the Delaware Public Service Commission (PSC) authorized Delmarva to work with the Commission and interested parties to determine the viability of implementing demand response programs in the near term, and authorized the diffusion of AMI into Delmarva's electric and natural gas distribution system networks. Delmarva Power is now collaborating with PSC, the Division of the Public Advocate and other stakeholders to implement AMI enabled demand response programs for both residential and non-residential customers using technologies such as smart thermostats and switches.

A number of jurisdictions in the United States, including some of Delaware's neighboring states, have demand response pilots and programs. In California pilot plans, customers reduced their demand during the top 60 summer hours by 13 percent up to 43 percent, depending on the technology employed.<sup>110</sup> In a Chicago pilot program, participants paid real-time prices for their electricity. They shifted use to off peak times, and also reduced their overall use by 3 to 4 percent. The Illinois legislature and Commerce Commission have now ordered that real-time prices be available statewide.<sup>111</sup> New Jersey's Energy Master Plan targets a reduction of 900 MW of peak load by 2020 from demand response programs. Maryland is aggressively seeking peak load reductions. In the District of Columbia, an organization known as SMPPI<sup>112</sup> is conducting an initiative, known as PowerCentsDC™, which will measure approximately 1,400 customers' reactions to critical peak pricing and hourly pricing options.

The impact of demand response on the environment has not been well studied, is situation specific, and complex.<sup>113</sup> It is likely to be positive, but could be mixed or negative in certain situations. Demand response is valued in Europe as a tool to lessen CO<sub>2</sub> and other pollution emissions. Generally demand response results in an overall reduction of energy use of several percent. It reduces the need for additional peaking plants and accompanying transmission and distribution facilities and thus eliminates the environmental damage that would be created by building and using these facilities. Importantly, it can facilitate an increased use of intermittent power generation such as wind power; it can be used to drop demand when the wind slows.

On the other hand, some demand response may be backed up by diesel generators. DNREC regulates these back-up generators; air permits allow only limited operation hours per year. Peak demand is sometimes met by natural gas fired generation. When peak demand is reduced, a portion of the reduction is made up at off peak

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<sup>109</sup> The Brattle Group, *The Power of Five Percent, How Dynamic Pricing Can Save \$35 Billion in Electricity Costs*, p. 6.

<sup>110</sup> *Ibid.*, p. 3.

<sup>111</sup> Nemtzow, David, Dan Delurey and Chris King, "The Green Effect", *Public Utilities Fortnightly*, March 2007.

[http://www.demandresponsecommittee.org/The\\_Green\\_Effect.pdf](http://www.demandresponsecommittee.org/The_Green_Effect.pdf)

<sup>112</sup> Under terms of the Pepco and Delmarva merger settlement agreement approved by the D.C. Commission, Pepco agreed to fund a smart meter pilot program for small customers. Representatives of PEPCO, the D.C. Commission, the D.C. Office of People's Counsel, the D.C. Consumer Utility Board, and the International Brotherhood of Electrical Workers Local 1900, formed a non-profit corporation called the Smart Meter Pilot Program, Inc. (SMPPI).

<sup>113</sup> Much of the following discussion is drawn from the article *The Green Effect*, written by David Nemtzow, Dan Delurey and Chris King, and published in *Public Utilities Fortnightly* in March 2007. Available at: [http://www.demandresponsecommittee.org/The\\_Green\\_Effect.pdf](http://www.demandresponsecommittee.org/The_Green_Effect.pdf)

times. At some times of the year and depending on many complex interacting factors, shifting the load to off peak times could mean that some load is shifted from natural gas to base load generation powered by coal.

Cost Issues: There will be a cost to the utilities to install demand response meters and AMI and Smart Grid infrastructure. However, a portion of this cost will be offset by utility operational savings.

### **Cost Decoupling Mechanism to Facilitate Demand Response and Pricing Structures to Support Energy Efficiency & Conservation**

*Support efforts, currently underway, by the electric and gas utilities, the Public Service Commission and other stakeholders to create a decoupling mechanism that will remove disincentives to the utilities to promote demand response, load management and energy efficiency. The impacts on low-income households need to be factored into the program specifics.*

Support the current efforts on evaluation and potential adoption of pricing structures and mechanisms that support the State's efforts in promoting energy efficiency and conservation measures which are economically feasible, do not unduly burden utility ratepayers, and which eliminate disincentives for the utilities' support of such measures.

The benefits of energy efficiency and demand response programs are widely recognized and should be encouraged. However, for both electric and natural gas distribution companies, revenues are dependent upon actual consumer usage; therefore, there are disincentives on the part of a utility to promote energy efficiency and demand response programs. By allowing distribution companies to recover their costs through fixed rates that are not dependent upon actual sales, those disincentives are greatly lessened or removed entirely.

The Staff of the PSC, natural gas and electric distribution utilities, and other interested parties have investigated the concept of 'decoupling' in a recent proceeding, and the result of that proceeding is that the PSC "approved the adoption of Staff's recommendations regarding the potential adoption of a modified fixed variable rate design whereby more of the fixed costs are recovered in the customer charge and initial rate blocks of the delivery portion of the customer bill for Delaware distribution utilities in the context of a rate case proceeding."<sup>114</sup> The specific details of any utility's particular rate design were not outlined in this proceeding; they are to be determined in the context of each individual rate case proceeding. As there are typically a number of years between rate case proceedings, the PSC also "maintained the flexibility to address the rate design changes outside of a base rate case if the situation is warranted." As additional conservation and efficiency programs are proposed or promulgated, further consideration should be given to modifying the utilities' rate mechanisms to help ensure the State's and the utilities' objectives are aligned. Further rate restructuring would provide utilities greater certainty in recovering the annual costs necessary to operate and maintain their distribution systems and also eliminate disincentives to support and promote energy efficiency measures being proposed and/or implemented.

In the area of electric demand response, implementation of AMI technologies will support new rate structures such as the "Critical Peak Rebate," "Critical Peak Pricing," and "Time of Use" rates being tested in other areas of the United States. Under such rate structures, energy users can access pricing information that is not available with conventional meters and then use that information to personally assess the tradeoff between energy costs and energy usage -- before energy is used. Today's utility billing methods only report the cost of usage weeks after the usage occurs, and the customer has no direct information as to the actual cost of energy at any point in time. Design and implementation of demand response rate structures will require continuing discussion

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<sup>114</sup> PSC Order No. 7420, Regulation Docket No. 59, signed 9/16/08

between the electric utilities, state regulators and interested parties to determine the approaches that best match the needs of Delaware.

In February of 2007 Delmarva Power filed with the PSC its Blueprint for the Future (the “Blueprint”). Delmarva Power’s Blueprint contained broad ranging programs, including, but not limited to, demand-side management, demand response, revenue decoupling, and advanced metering. After thorough review, the PSC issued an order which, among other things: (1) approved the potential adoption of a revenue decoupling mechanism, to be fully explored, developed and if appropriate, implemented through a subsequent base rate case proceeding, (2) approved the diffusion of advanced metering technology into the electric and natural gas distribution system networks, (3) approved consideration of Delmarva’s proposed energy efficiency/conservation programs, (4) directed Delmarva, the Public Advocate and PSC Staff to move forward with the development and implementation of reasonable demand-side management and or demand response programs for near term implementation and (5) directed Delmarva to move forward with the implementation of the demand response programs proposed in Delmarva Power’s Blueprint.

Cost Issues: The Public Service Commission will be addressing this issue, and the impact on customers, as it relates to Delmarva Power as part of an upcoming rate case.

### **Integrated Resource Planning**

*Support and encourage efforts by all electric distribution utilities in Delaware to implement an integrated resource planning process (“IRP”) and that the IRP process be coordinated with PJM’s Regional Planning Process. The IRP should include a resource portfolio approach reflecting a diverse mixture of the following: transmission, substantial levels of Energy Efficiency (EE) and Demand Side Management (DSM), and generation.*

It is generally accepted in the industry that integrated resource planning benefits electric consumers by requiring their service provider to consider all available supply options in securing safe, reliable, and cost effective energy to meet demands. Under integrated resource planning, supply options are not limited to traditional generation but also include demand-side management programs, purchased power agreements, and renewable energy sources.

Delmarva Power must file an Integrated Resource Plan (IRP) with the PSC that evaluates “all available supply options during a 10-year planning period in order to acquire sufficient, efficient and reliable resources over time to meet its customers' needs at a minimal cost.” The IRP must additionally present Delmarva’s “supply and demand forecast for the next 10-year period, and shall set forth the resource mix with which Delmarva Power proposes to meet its supply obligations for that 10-year period (i.e., demand-side management programs, long-term purchased power contracts, short-term purchased power contracts, self generation, procurement through wholesale market by RFP, spot market purchases, etc.)” Delaware Code also requires the Delaware Electric Cooperative to “annually prepare a 10-year plan detailing its energy supply requirements and planned procurement strategies to meet forecasted demand.”

Municipal electric providers are not required to conduct integrated resource planning; however, a number of these providers have elected to do so voluntarily. Electric distribution companies should be encouraged to work together in developing strategies that benefit not just their customers, but all of the State’s consumers. As an example, the nine municipal electric utilities represented by DEMEC have now contracted to purchase power from the proposed Bluewater Wind project which will promote generation diversity and result in long term economic and environmental benefits for the state residents. Finally, coordination of these IRP’s with the PJM Regional Planning Process will potentially provide the greatest benefit for customers.

Meeting the electric needs and expectations of Delaware’s electric customers requires a diversified approach that includes transmission, substantial levels of energy efficiency and demand side management, and generation resources. No one single approach can solve all of Delaware’s present and future energy needs; all three must be evaluated to determine the best mix for Delaware. Energy efficiency, conservation and demand response efforts represent what many consider the quickest, most cost-effective opportunities to reduce energy consumption and peak load. Energy savings through efficiency measures and demand response can impact or defer the need for new generation or increased transmission capabilities.

Cost Issues: The costs to the State to support and encourage such processes should be minimal; however, there will be costs to utility ratepayers.

### **Energy Efficiency in PJM Capacity Market**

*Support development of a program for meaningful participation of energy efficiency in PJM capacity markets. Once developed, encourage participation of Delaware energy efficiency providers in the capacity market.*

PJM, the grid operator for the fourteen-state region that includes Delaware, operates a capacity market in order to ensure adequate generating capability in the region. Electric generators participate in this market by offering generating capacity in turn for which they receive a capacity payment. Demand responders also participate in the market and are paid for their commitment to drop electric load when called upon by PJM.

Like electricity generation and demand response, energy efficiency reduces the need for additional generation. The Federal Energy Regulatory Commission (FERC) has required that PJM allow energy efficiency to participate in the capacity market. PJM stakeholders are discussing various proposals for how energy efficiency will participate in the market. Proposals range from those that would not support increased deployment of energy efficiency, to those that would support implementation of energy efficiency measures.

All stakeholders involved agree that rigorous measurement and verification protocols would be required in order for energy efficiency to participate in the capacity market; PJM would need to be able to count on promised energy efficiency actually delivering promised load reduction in order to ensure system reliability.

The benefit of participation of energy efficiency resources in the capacity market is that the energy efficiency resource providers would receive a stream of payments that would support and encourage adoption of energy efficiency measures. Large electricity users would be able to participate in the program directly. Small users, including residential customers, could participate through an aggregator.

Cost Issues: There will be no incremental cost for this program. The costs of the capacity payments are spread to all users; however, the participation of energy efficiency in the capacity market puts a downward pressure on prices that exceeds the capacity payments.

### **Mid-Atlantic Power Pathway**

*Continue support for the Mid-Atlantic Power Pathway Project (MAPP).*

The MAPP project, initially approved by PJM in October 2007, is a 230 mile 500 kV transmission project that originates at the Possum Point substation in northern Virginia runs through southern Maryland across the

Chesapeake Bay, up the Delmarva Peninsula and across the Delaware River, terminating at the Salem/Hope Creek substation in southern New Jersey. The transmission line will tie in along the route at various substations which will allow power to flow into the local transmission systems to serve load. The project will be the only transmission tie directly into the southern Delmarva Peninsula that does not rely on transmission lines running from the northern part of the peninsula. The project will allow any generation built on the Delmarva Peninsula, including renewable energy, to be used to both support local load and be sold into the wider regional energy market. The MAPP Project, when considered in conjunction with other approved large scale transmission projects, will enable the transmission needs of consumers within the PJM footprint to continue to be met in a reliable and economic manner. Therefore, MAPP will provide a key component of PJM's transmission "backbone" for the future. In addition to the increased reliability and transmission capabilities offered by MAPP, the project will also provide significant economic benefits to the state as it is built in terms of new jobs and increased demand for goods and services.

Concerns regarding the MAPP project have been raised regarding its facilitation of the transmission of power produced by electric generation facilities with relatively high air emissions. In this case, that relatively high emitting generation may be located in states upwind of Delaware. Delaware's air quality and ability to attain and/or maintain compliance with the national ambient air quality standards (NAAQS) is affected by emissions from upwind states. The flip-side of this issue is that while MAPP will increase the ability to import low-cost coal generated power, it will also allow Delaware access to energy from renewable sources generated outside of Delaware and potentially to sell renewable energy generated in Delaware. A recent study by the North American Electric Reliability Council concludes that increased electric transmission is essential to reliability of the transmission grid as more and more solar and wind projects are developed and come on-line.

During several Work Group meetings, there was discussion of increasing the size of MAPP, and other sizeable transmission projects, in order to accommodate future energy resources. From one 'straw' proposal: "It is also an opportunity for the state to stimulate the development of its renewable energy resources and export electric energy to large load centers in the Mid-Atlantic region. MAPP and similar future projects should be designed and sized so Delaware can make best use of the local utility scale renewable energy resources such as off-shore wind power." Here, it was generally agreed that PJM's fifteen year planning process was sufficient to address future transmission needs due to increases in actual generation.

The PSC should work with PJM, as necessary, to understand the impact on the transmission system of large amounts of renewable resources located in close geographic proximity. This could occur, for instance, if a large amount of off-shore wind capability and on-shore renewable energy projects are developed. Because of the speculative nature of these studies they would not be included as part of PJM's formal regional transmission project review, but may be instructive for the development of transmission projects in Delaware and the surrounding area.

### **Center of Excellence in Off-shore Wind at the University of Delaware**

*In coordination with the Federal Delegation, support graduate training and a Center of Excellence in off-shore wind at the University of Delaware's Center for Carbon-free Power Integration.*

With its newly created Center for Carbon-free Power Integration, The University of Delaware (UD) is the lead university research group in the US on off-shore wind. Areas of research include planning, policy, and grid integration. The University currently employs eight people conducting research, analysis, and teaching regarding off-shore wind.



The State should work with its Federal Delegation to support graduate training and a Center of Excellence in off-shore wind at UD's Center for Carbon-free Power Integration. Designation as a Center of Excellence or national center would lead to an approximate \$1M/year budget. Federal funding could be utilized for stipends for students and postdoctoral scholars, and a base funding level for the R&D program.

Cost Issues: No state costs would be involved in designation of the Center of Excellence.

### **Hydrogen/Fuel Cells Research and Deployment Coordination**

*Support the effort among the state government, local industry and universities for a coordinated, strong approach to fuel cell research and deployment.*

The fuel cell and hydrogen industry in Delaware is vibrant and active. Two major industry suppliers of fuel cell components, W. L. Gore and Associates, Inc. and E. I. Du Pont de Nemours, Inc. are headquartered in Delaware. These two companies together account for the majority of the membrane electrode assemblies (the heart of the polymer electrolyte fuel cell) provided for fuel cell systems made today. Additionally, Ion Power is a local small business that supplies materials for fuel cells. In the hydrogen production/distribution arena, Air Liquide houses its North American research facility in Newark and has a hydrogen facility filling station at their site.

Delaware also has a good regional location, with numerous major fuel cell industrial suppliers within ~100 miles: Air Products, Inc in Allentown, PA, (hydrogen), BASF in Iselin, NJ, (catalyst materials), and Johnson Matthey, Inc. in West Chester, PA. (catalysts and MEAs), Arkema, Inc. in Philadelphia, PA, (membrane materials), and Millennium Cell, Inc. in Eatontown, NJ (fuel cell systems). The total employment in fuel cell related businesses within these companies is currently many hundreds, with the potential to grow to many thousands within 10-15 years.

The academic expertise in fuel cells and hydrogen is equally rich and varied. At the University of Delaware (UD) approximately 25 faculty are engaged in fuel cell research, and Delaware State University (DSU) is active in research on hydrogen storage materials. In 2008, a Center for Fuel Cell Research (CFCR) was founded at UD. The CFRC conducts fundamental research on fuel cell and hydrogen infrastructure science and technology to improve performance and durability of fuel cells using novel materials, architectures, and operating strategies, while enabling commercialization with technology transfer to industry. The Center will also conduct public outreach to educate the community about the benefits of fuel cells. Local industry has a history of partnering with the universities to fund research efforts.

Cost Issues: Cost will be based on form of State involvement utilized.

### **Recycling**

*Delaware should promote statewide recycling programs to increase the percentage of wastes removed from the solid waste stream. Recycling saves energy and reduces greenhouse gas emissions, positively affecting climate change.*

Recycling is a nascent industry in Delaware which has finally established a secure foothold. More so than most industries reviewed by this workgroup, the recycling industry in Delaware is strongly influenced by and, in some sectors, tied to government policy. Recycling saves energy and as such is a relevant topic for this workgroup and the energy planning effort.

In practice, 'Recycling' typically includes recycling and reuse activities including, but not limited to: post-consumer recycling of residential and commercial cans, paper, cardboard, plastic, etc.; pre-consumer, industrial waste and byproduct recycling (such as wood shavings or chemical solvents); the collection, processing and remanufacture of these materials; and the reuse of materials such as tire re-treading and timber for building construction.

Due to the diversity of activities included in 'recycling' and different definitions of recycling, the data on many recycling activities is difficult to develop. Data on most industrial recycling activities are not reported or available, however some useful data is presented below.<sup>115</sup>

According to a recent draft report by the Northeast Recycling Council on recycling activities in Delaware in 2006<sup>116</sup>, using a broad definition of 'recycling':

142 businesses were engaged in recycling activities

1,555 jobs were directly involved in "recycling related economic activity"

\$47 million were spent on annual payroll for "recycling related economic activity"

\$250 million in estimated gross receipts were generated by "recycling related economic activity"

The major contributors to this economic activity were: iron and steel mills; re-used merchandise sales; recycled material wholesalers; compost and organic producers; and residential and commercial recycling collection.

#### Potential for Industry Growth in Delaware over the Next 20-30 years:

There are a number of trends that support the growth of recycling in Delaware. The most notable trends include: increasing energy costs; increasing virgin material costs (wood fibers, metals, plastics); increasing transportation costs; increasing integration of recycled materials into manufacturing processes; and a trend towards local self sufficiency. Given these trends, the global growth of the industry, and the current size and state of this industry in Delaware, Delaware is in a good position to benefit from this growth.

A recent report by the Recycling Public Advisory Council on Municipal Solid Waste recycling (a limited subset of recycling activities) in Delaware found that, in 2006<sup>117</sup>, employing the very limited EPA definition of 'recycling', 23% (250,000 tons) of the MSW disposed of in Delaware was recycled.

Another recent report on resource management in Delaware produced by the Institute for Local Self Reliance reached the following conclusions<sup>118</sup>, using a broad definition of 'recycling':

75% or more of Delaware's Municipal Solid waste could be recycled;

The estimated value this 75% in 2006 was \$60 million;

If the 75% of the MSW was recycled in 2006, 2,360 direct jobs would be generated, plus 1,000's of additional indirect jobs;

On a per-ton basis, sorting and processing recyclables alone sustain 11 times more jobs than land filling or incineration.

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<sup>115</sup> It should be noted that the data is from different sources, generated by different methods, and some caution should be exercised when combining and comparing the data.

<sup>116</sup> DSM Environmental Services Report for the Northeast Recycling Council. (2008) *2006 Recycling Economic Information Study - Draft Report*. (This report is not publicly available at this time, but should be published and available on this website by the end of 2008: <http://www.nerc.org/documents/index.html>)

<sup>117</sup> Recycling Public Advisory Council. (2008) *Addendum to the Recycling Public Advisory Council 2007 Annual Report*. <http://www.awm.delaware.gov/Info/Documents/Measurement%20and%20Methodology%20Report%20FINAL%20COMPILE%20MASTER%20-%20V20.pdf>

<sup>118</sup> Institute for Local Self Reliance. (2007) *A Scenario for Resource Management for the State of Delaware*. <http://www.awm.delaware.gov/SiteCollectionDocuments/AWM%20Gallery/AWM-DelawareILSR060407.pdf>

Based upon the reports above and information from the EPA<sup>119</sup>, it is estimated that at a MSW recycling rate of 75%, nearly 14 Billion BTU's of energy would be saved and 386,000 metric tons of carbon equivalent green house gasses would be avoided annually.

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<sup>119</sup> "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" (EPA530-R-06-004).

## APPENDIX A: ACRONYMS AND ABBREVIATIONS

AC:	Alternating current
ADA:	Americans with Disabilities Act of 1990
AMI:	Advanced Metering Infrastructure
BTU:	British Thermal Unit, the amount of energy required to heat a pound of water 1°F
CAES:	Compressed Air Energy Storage, a method of storing energy by compressing air, then using it to run an electrical turbine.
CCS:	Carbon Capture and Storage, a method to reduce CO <sub>2</sub> emissions from power plants by capturing and compressing the gas, and storing it deep underground
CF:	Capacity Factor, the fraction of maximum power that a power source produces on average on an annual basis. Typical values are 0.85 for coal plants, 0.40 for off-shore wind, and 0.16 for solar PV in Delaware.
CHP:	Combined Heat and Power, a technology in which the waste energy from electric power generation is used for heating
CO <sub>2</sub> :	Carbon Dioxide
DC:	Direct current
DEC:	Delaware Electric Cooperative
DG:	Distributed generation
DEMEC:	Delaware Municipal Electric Corporation
DMV:	Delaware Division of Motor Vehicles
DNREC:	Delaware Department of Natural Resources and Environmental Control
DP&L:	Delmarva Power & Light Company
DPPA:	Delmarva Peninsula Planning Association, organization to which all electric utilities on the Delmarva Peninsula belong
DSM:	Demand side management
EE:	Energy efficiency
EIA:	US Department of Energy, Energy Information Administration
ESNG:	Eastern Shore Natural Gas Company
EURCSA:	Electric Utility Retail Customer Supply Act of 2006
FERC:	Federal Energy Regulatory Commission, responsible for regulating the interstate transmission of electricity, natural gas, and oil
GHG:	Greenhouse gas (e.g., CO <sub>2</sub> , methane, nitrous oxide, ozone)
Gt:	Gigatons = billions of metric tons CO <sub>2</sub> e: The effective concentration (or mass) of CO <sub>2</sub> equivalent to both the CO <sub>2</sub> and other greenhouse gases and aerosols
Hg:	Mercury
IGCC:	Integrated Gasification Combined Cycle, a coal plant technology in which coal is gasified with steam and oxygen and the gas mixture (syngas) then used to drive a turbine to generate electricity
IRP:	Integrated Resource Plan
kW:	Kilowatt, a measure of power equal to 1000 watts
kWa:	The average power measured in kW, for example from a solar PV panel
kWh:	Kilowatt-hour, the amount of energy consumed by an appliance using one kW of power for one hour. 1 kWh= 3412 BTU
LEED:	Leadership in Energy and Environmental Design, energy efficiency standards program of the US Green Building Council
LNG:	Liquified natural gas
LMP:	Locational Marginal Price

MAPP:	Middle-Atlantic Power Pathway
NIETC:	National Interest Electric Transmission Corridor
PBC:	Public Benefits Charge, a charge added to a utility bill based on the amount of electrical energy used
PHMSA:	US Dept. of Transportation, Pipeline and Hazardous Materials Safety Administration
PM2.5:	Particulate matter with particles of diameter 2.5 micrometers or less
PPA:	Power Purchase Agreement, a legal document in which a power generator agrees to supply power to a distributor for an agreed price
PSC:	Delaware Public Service Commission
Quad:	Quadrillion BTUs, or a billion million ( $10^{15}$ ) BTUs. The US consumes about 100 Quads per year.
MW:	Megawatt, a unit of power equal to 1000 kW
NOx:	Oxides of Nitrogen, (e.g. NO and NO <sub>2</sub> )
REC:	Renewable Energy Credit
RGGI:	Regional Greenhouse Gas Initiative, a regional cap and trade system of 10 states, including DE, to limit and reduce CO <sub>2</sub> emissions from power plants over 25 MW capacity.
RPS:	Renewable Energy Portfolio Standard
RTO:	Regional transmission organization
SEU:	Sustainable Energy Utility, an organization formed by the DE legislature in 2008 to promote energy efficiency and distributed (small scale) renewable energy sources
SO <sub>2</sub> :	Sulfur Dioxide
Solar PV:	Photovoltaic, the generation of electrical power from sunlight falling on a semiconductor
SREC:	Solar Renewable Energy Credit, an SEC for solar energy
Ton:	A unit of heating/cooling capacity use for geothermal power. 1 Ton = 3.5 kW
TPY:	Tons per year, applied to rates of emission of air pollutants from power plants
V2G:	Vehicle to Grid
VMT:	Vehicle miles traveled
WILMAPCO:	Wilmington Area Planning Council, the regional transportation planning organization for Cecil County, Maryland and New Castle County, Delaware

## **APPENDIX B: Energy Legislation Enacted in Delaware 2003-2008**

### Enacted in 2004

HB434: Energy Advisory Council (Energy Plan Bill)

Created Governor's Energy Advisory Council and Cabinet Committee on Energy

SB435: Energy Star Purchasing (Energy Plan Bill)

Requires state agencies to purchase Energy Star products when feasible

SB306: Building Code (Energy Plan Bill)

Updated Building Code for energy efficiency to IECC 2000 and ASHRAE/ESNA Standard 90.1-1999

SB 307: Life Cycle Costing (Energy Plan Bill)

Requires contracting agencies to use life cycle costing analysis to determine the lowest responsible and responsive bidder or offeror in the award of contracts for goods and services, professional services and public works contracts

### Enacted in 2005

SB74: Renewable Portfolio Standards (idea supported in energy plan, though not directly a result of the Energy Plan)

Established RPS note: Law revised in 2007

SB 73: Energy Performance Contracting Act (Energy Plan bill)

Gives State Agencies the authority to enter into performance contracts to finance energy efficiency upgrades based on the projected savings those upgrades will generate

SB44: Green Energy Fund

Biodiesel manufacturing facilities added to green energy fund regarding eligibility for demonstration project funding

SB127: Outdoor Lighting

Good outdoor lighting practices consistent with energy conservation, safety needs and preservation of the natural night environment. Only regulates lighting when state funds are involved

HB78: Public Utilities Assessment

Increased the assessment public utilities regulated by the Public Service Commission pay for the cost of regulation

### Enacted in 2006

HJR22: Ensuring Delaware's Energy Future Summit (Ensuring Delaware's Energy Future bill)

Hold a business summit on energy to assist Delaware businesses facing substantial increases in electricity rates

SB281: Energy Efficiency Financial Incentives Act (Ensuring Delaware's Energy Future bill)

Appropriated \$8 million for Energy Efficiency Programs (DNREC) note: became the Energy Answers program

HB6: Oversight of Public Utilities that Distributed and Supply Electricity to Retail Customers

Amended Electric Restructuring Act of 1999 to include provisions designed to stabilize pricing. Requires Integrated Resource Planning and programs designed to reduce or shift electric consumption by customers.

Required an RFP for building cost-effective merchant generation in the State to serve some of the DP&L load requirement. Deferred some of the rate increases

SB280: Delaware Energy Assistance Program (DHSS) (Ensuring Delaware's Energy Future bill)  
Appropriated \$2 million for Delaware Energy Assistance Program

HB5: State Electricity Procurement (Ensuring Delaware's Energy Future bill)  
Enables State procurement of electricity in the retail or wholesale market

SB242: \$5 Million to Create Energy Fund (DOE)  
Funding for energy cost increases

SS1 for SJR3: Independent Consultant to Study Utility Re-Regulation  
Required hiring of independent consultant to study re-regulation of electric power note: resulted in Brockway Report

#### Enacted in 2007

SS1 for SB8: Increase in Net Metering  
Amended net energy metering standards to increase the net-metering capacity limit for non-residential facilities to 2 megawatts per DP&L meter, 500 kilowatts per DEC meter, and 500 kilowatts per municipal electric meter. Also allows all net-metering customers to carry over excess energy credits from month to month during a 12 month period to account for seasonal variance in generation and energy consumption.

SS1 for SB18: Delaware Sustainable Energy Utility  
Created the Delaware Sustainable Energy Utility (SEU). The SEU will use competitive markets and leveraged private-financing to deliver cost-effective end-use energy services that allow Delawareans to save 30% of their annual energy usage. The SEU will coordinate services that target residential, commercial, industrial, and transportation energy end-users in all energy markets, including electricity, heating fuels, green buildings, clean vehicles, customer-sited renewable energy, and affordable energy. The SEU will use competitively selected Implementation Contractors to deliver services utilizing performance based contracts.

SB19: New Renewable Portfolio Standards  
Amended existing law by increasing the required minimum percentage of electrical energy sales to Delaware end-use customers from renewable energy resources through the year 2019. Requires that, between 2009 and 2019, the minimum percentage of sales from solar photovoltaics increase from 0.03% to 2%. Sets a solar annual compliance payment and allows it to be adjusted by the Delaware Energy Office at an amount higher than, but not more than 20% higher than, the estimated competitive market cost for purchasing renewable energy credits (RECs)

SB35: Doubling the Green Energy Fund  
Increased the system benefit charge for the Green Energy Fund by adding 18 cents per month to the average residential customer's electricity bill.

#### Enacted in 2008

SB228 and SB276 with SA1: Amendments to the SEU  
SB228 - Provided that the SEU will be a nonprofit entity but that the Contract Administrator retained by the SEU may be a for-profit entity. Created a new Board of Directors with a clarification of the Board's responsibilities. The bill also authorized the Board to appoint an Advisory Committee whose members would have diverse backgrounds and expertise.

SB276 – Placed additional requirement on the Board of Directors, including applicability of the Freedom of Information Act.

**SB263: Regional Greenhouse Gas Initiative & Carbon Dioxide Trading**

Granted legal authority for Delaware to participate in the Regional Greenhouse Gas Initiative (RGGI) CO2 cap and trade program. This bill further requires that all proceeds from the sale of RGGI CO2 allowances be used for public benefit purposes and directs revenues to the SEU for the promotion of energy efficiency and renewable energy technologies, to programs designed to help low income ratepayers, to a Greenhouse Gas Reduction Program and to DNREC for administration of the program.

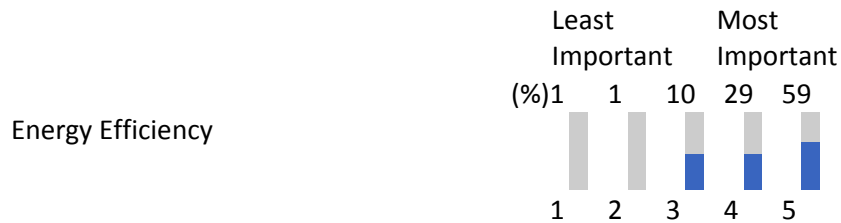
**SB328: Off-shore Wind Power**

Promotes the establishment of clean off-shore wind energy off the coast of Delaware, while minimizing the cost concerns related to off-shore wind installations and encouraging Delmarva Power (DPL) to execute off-shore wind power purchase agreements for customers by: (1) Creating a 350% off-shore wind renewable energy credit multiplier, (2) Making the 350% renewable energy credit multiplier available for the life of off-shore wind contracts, and (3) spreading both the cost and the benefits of off-shore wind power contracts executed by DPL to DPL's entire customer base, rather than only to DPL's standard offer service customers.



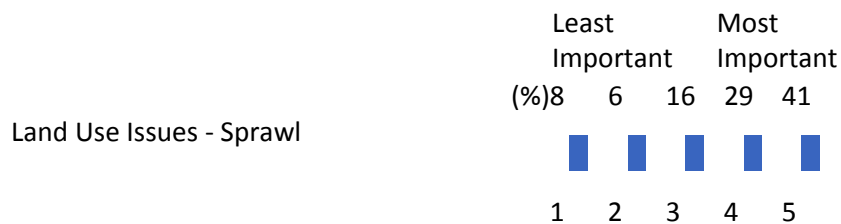
## APPENDIX C: Energy Issues Survey Results

1. Energy Efficiency: Energy efficiency includes using energy efficient appliances, lighting, heating and cooling systems, and building design in homes, commercial and public buildings



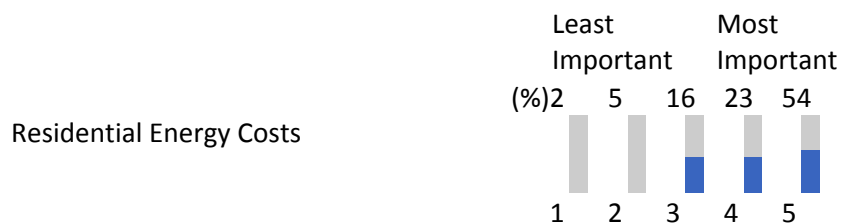
Total: 1081

2. Land Use Issues - Sprawl: The impacts of sprawl on energy use through increased driving/commuting and on the energy infrastructure; i.e. the ability to get the electricity and heating fuels out to the homes



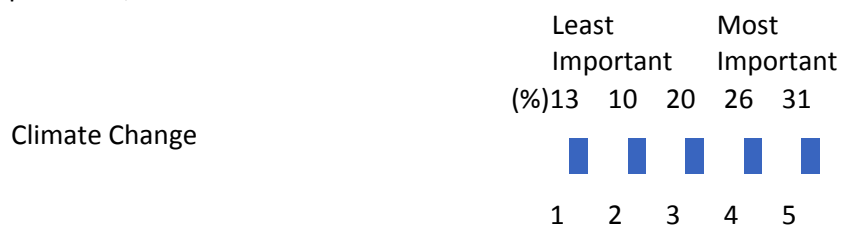
Total: 1079

3. Residential Energy Costs: Impact on residents of the cost of electricity, heating fuels, and means to mitigate cost increases



Total: 1083

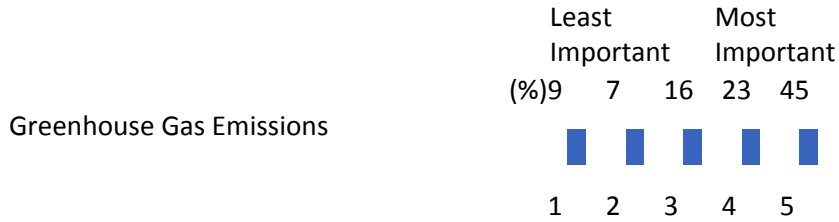
4. Climate Change: Evaluating and preparing for impacts on Delaware and Delawareans of changing temperatures, weather and sea level rise



Total: 1077

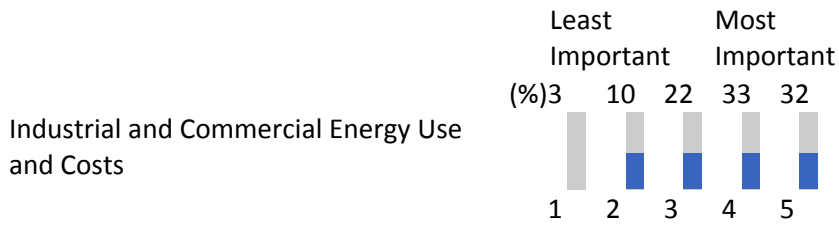
5. Greenhouse Gas Emissions: Reducing releases of greenhouse gases, such as carbon dioxide and methane,

from people, transportation, and businesses



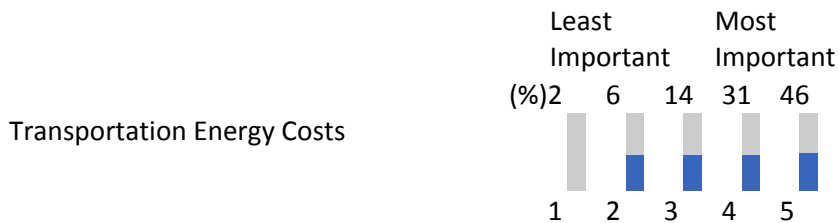
Total: 1077

6. Industrial and Commercial Energy Use and Costs: Impacts of energy costs on costs of goods produced, industrial energy efficiency, prices relative to neighboring states, etc.



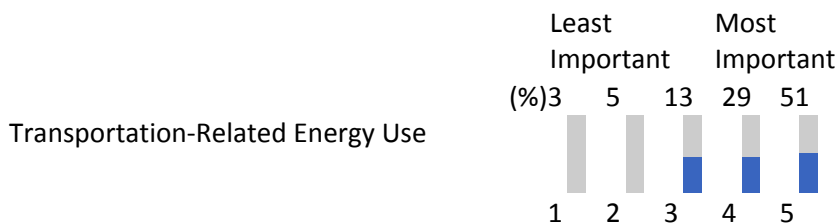
Total: 1070

7. Transportation Energy Costs: Impact on residents and businesses of the cost of transportation fuels



Total: 1067

8. Transportation-Related Energy Use: Mass transit (buses, light rail), vehicle fuel efficiency, alternatives for reducing overall energy consumption in the transportation sector, and transportation-related pollution in urban areas



Total: 1068

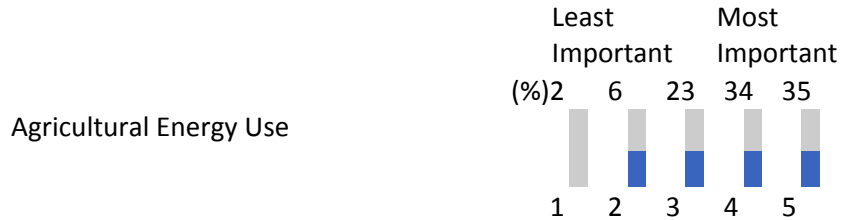
9. Transportation Fuels: Availability of fuels, cost of alternative fuels v. gasoline and diesel, production of bio-diesel, ethanol or other bio-based fuels, alternative fuel vehicles

Least                      Most



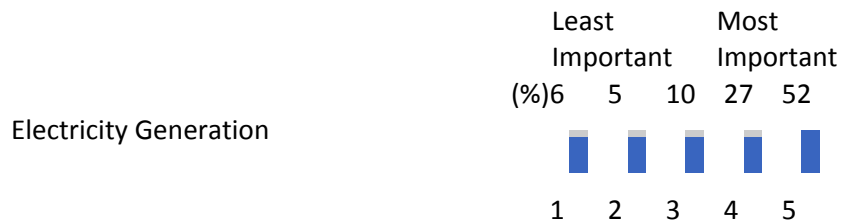
Total: 1072

10. Agricultural Energy Use: Impact of cost of fuel and energy on food prices, crops for food or fuel, impact of corn being grown for fuel on Delaware's poultry industry



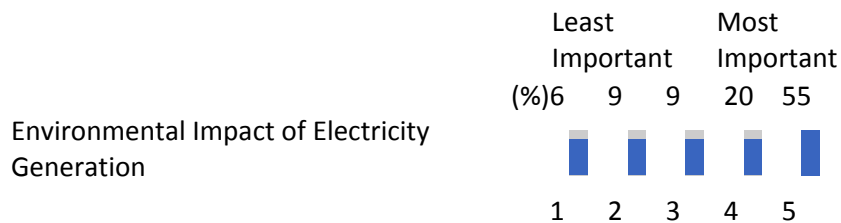
Total: 1070

11. Electricity Generation: Developing and maintaining capacity to meet future electricity needs in Delaware



Total: 1070

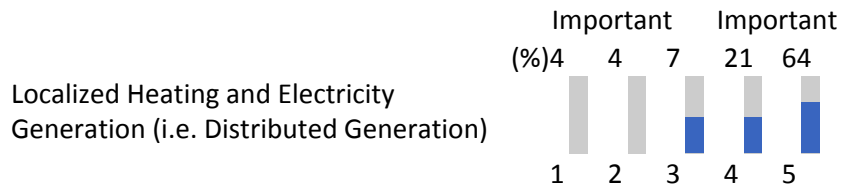
12. Environmental Impact of Electricity Generation: Types of fuels used to generate electricity (coal, natural gas, oil, wind, biomass, solar)



Total: 1075

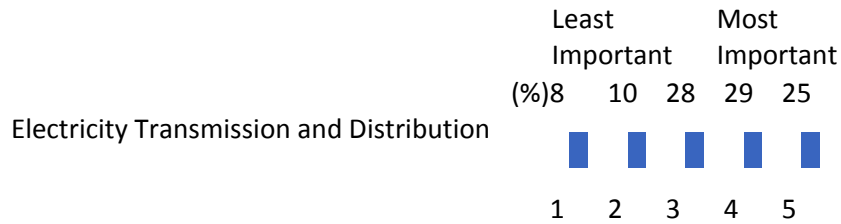
13. Localized Heating and Electricity Generation (i.e. Distributed Generation): Increasing the use of solar electricity generation, solar hot water, fuel cells, geothermal, small wind, etc

Least                      Most



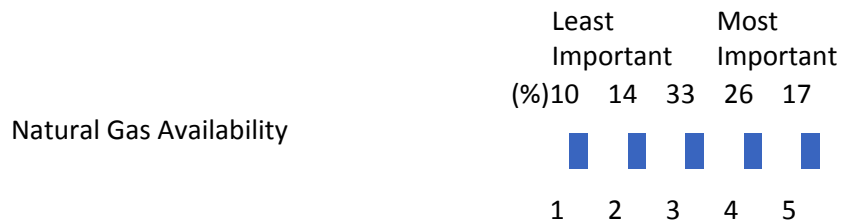
Total: 1078

14. Electricity Transmission and Distribution: New/expanded transmission through Delaware, right-of-way issues, and developing system capacity infrastructure to serve all areas of the State



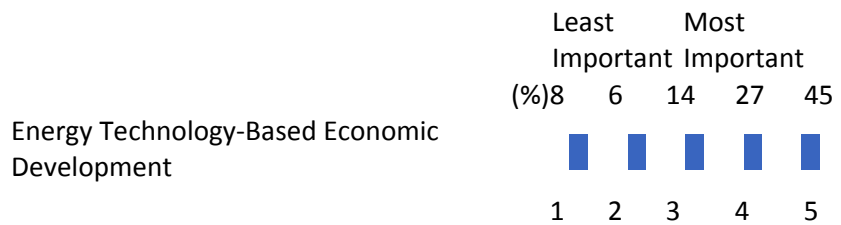
Total: 1076

15. Natural Gas Availability: Increasing areas of the state where natural gas is available for residential, commercial and industrial use



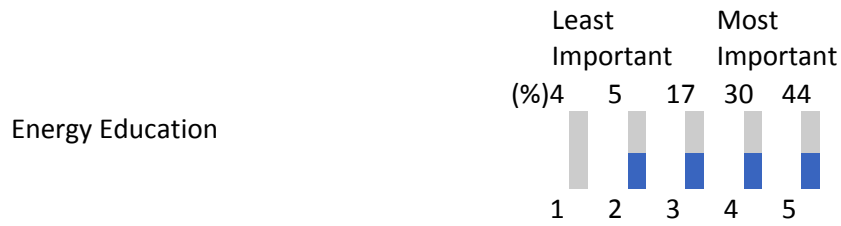
Total: 1074

16. Energy Technology-Based Economic Development: Encouraging the location and growth of businesses researching, developing, and producing advanced and alternative energy technologies



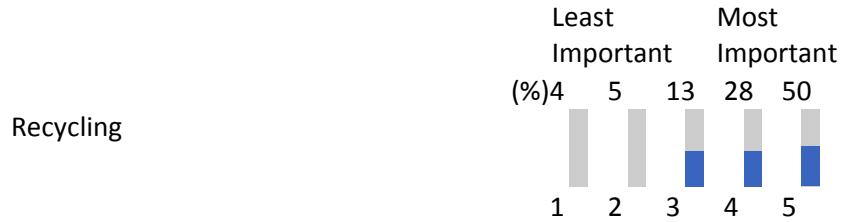
Total: 1073

17. Energy Education: Educating students, residents and businesses about energy issues and response options...



Total: 1076

18. Recycling: Developing feasible alternatives for residents and providing convenient recycling infrastructure



Total: 1077

19. For demographic purposes, please give us your 5 digit zip code.

- 19901 Number of Responses: 38 Percentage of Responses: 3%
- 19956 Number of Responses: 6 Percentage of Responses: 1%
- 19808 Number of Responses: 59 Percentage of Responses: 5%
- 19709 Number of Responses: 43 Percentage of Responses: 4%
- 19977 Number of Responses: 16 Percentage of Responses: 1%
- 19702 Number of Responses: 60 Percentage of Responses: 6%
- 19711 Number of Responses: 127 Percentage of Responses: 12%
- 19963 Number of Responses: 25 Percentage of Responses: 2%
- 19707 Number of Responses: 31 Percentage of Responses: 3%
- 19734 Number of Responses: 11 Percentage of responses 1%
- 19966 Number of Responses: 21 Percentage of Responses: 2%
- 19973 Number of Responses: 22 Percentage of Responses: 2%
- 19806 Number of Responses: 9 Percentage of Responses: 1%
- 19930 Number of Responses: 5 Percentage of Responses: 0%
- 19904 Number of Responses: 33 Percentage of Responses: 3%
- 19713 Number of Responses: 35 Percentage of Responses: 3%
- 19950 Number of Responses: 9 Percentage of Responses: 1%
- 19703 Number of Responses: 12 Percentage of Responses: 1%
- 19902 Number of Responses: 1 Percentage of Responses: 0%
- 19960 Number of Responses: 9 Percentage of Responses: 1%
- 19945 Number of Responses: 7 Percentage of Responses: 1%
- 19953 Number of Responses: 10 Percentage of Responses: 1%
- 19946 Number of Responses: 5 Percentage of Responses: 0%
- 19934 Number of Responses: 15 Percentage of Responses: 1%
- 19962 Number of Responses: 12 Percentage of Responses: 1%
- 19736 Number of Responses: 2 Percentage of Responses: 0%
- 19958 Number of Responses: 41 Percentage of Responses: 4%
- 19807 Number of Responses: 13 Percentage of Responses: 1%
- 19701 Number of Responses: 44 Percentage of Responses: 4%

19803 Number of Responses: 57 Percentage of Responses: 5%  
19952 Number of Responses: 8 Percentage of Responses: 1%  
19706 Number of Responses: 5 Percentage of Responses: 0%  
19810 Number of Responses: 61 Percentage of Responses: 6%  
14042 Number of Responses: 1 Percentage of Responses: 0%  
19943 Number of Responses: 9 Percentage of Responses: 1%  
19971 Number of Responses: 31 Percentage of Responses: 3%  
19720 Number of Responses: 28 Percentage of Responses: 3%  
19940 Number of Responses: 2 Percentage of Responses: 0%  
19716 Number of Responses: 1 Percentage of Responses: 0%  
19936 Number of Responses: 1 Percentage of Responses: 0%  
19809 Number of Responses: 20 Percentage of Responses: 2%  
19939 Number of Responses: 5 Percentage of Responses: 0%  
19947 Number of Responses: 17 Percentage of Responses: 2%  
19801 Number of Responses: 15 Percentage of Responses: 2%  
19933 Number of Responses: 8 Percentage of Responses: 1%  
19802 Number of Responses: 14 Percentage of Responses: 1%  
10711 Number of Responses: 1 Percentage of Responses: 0%  
19710 Number of Responses: 2 Percentage of Responses: 0%  
19941 Number of Responses: 3 Percentage of Responses: 0%  
19970 Number of Responses: 5 Percentage of Responses: 0%  
19805 Number of Responses: 19 Percentage of Responses: 2%  
19975 Number of Responses: 4 Percentage of Responses: 0%  
19804 Number of Responses: 9 Percentage of Responses: 1%  
19968 Number of Responses: 16 Percentage of Responses: 1%  
19938 Number of Responses: 6 Percentage of Responses: 1%  
19730 Number of Responses: 2 Percentage of Responses: 0%  
10803 Number of Responses: 1 Percentage of Responses: 0%  
19944 Number of Responses: 1 Percentage of Responses: 0%  
19899 Number of Responses: 1 Percentage of Responses: 0%  
19955 Number of Responses: 1 Percentage of Responses: 0%  
19969 Number of Responses: 2 Percentage of Responses: 0%  
19931 Number of Responses: 1 Percentage of Responses: 0%  
19717 Number of Responses: 3 Percentage of Responses: 0%  
20878 Number of Responses: 1 Percentage of Responses: 0%  
19317 Number of Responses: 1 Percentage of Responses: 0%  
19964 Number of Responses: 1 Percentage of Responses: 0%  
18703 Number of Responses: 1 Percentage of Responses: 0%  
10031 Number of Responses: 1 Percentage of Responses: 0%  
19903 Number of Responses: 1 Percentage of Responses: 0%  
17368 Number of Responses: 1 Percentage of Responses: 0%

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Total: 1088

20. and select your age group

0-17

Number Of Responses3  
Percentage Of Responses(0%)



18-25

Number Of Responses65  
Percentage Of Responses(6%)



26-35

Number Of Responses128  
Percentage Of Responses(12%)



36-45

Number Of Responses179  
Percentage Of Responses(16%)



46-55

Number Of Responses265  
Percentage Of Responses(24%)



56-65

Number Of Responses244  
Percentage Of Responses(22%)



64 and older

Number Of Responses204  
Percentage Of Responses(19%)



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Total: 1088

## **APPENDIX D: Current Regulations on the Impact of Emissions of Greenhouse Gases and Other Pollutants**

### **Regional Greenhouse Gas Initiative**

The Regional Greenhouse Gas Initiative (RGGI) is a collaborative program encompassing 10 states in the Northeast and Mid-Atlantic region designed to reduce carbon dioxide emissions from power plants. The states (MD, DE, NJ, NY, CT, RI, MA, VT, NH, ME) have started a cap and trade program for CO<sub>2</sub> emission allowances, the first such program in the country. Each allowance corresponds to one short ton of CO<sub>2</sub>. The program was designed to hold CO<sub>2</sub> emissions constant through 2015 (based on 2000-2002 average annual emissions), and then reduce emissions 2.5% per year to reach 10% by the end of 2019. The program applies to any fossil fueled electric generating unit of greater than 25MW, if that unit sells more than 10% of the electricity it generates on the commercial market.

The RGGI program officially began in January 2009 and is composed of four, three year “compliance” periods. At the end of each compliance period, affected facilities will be required to surrender a number of CO<sub>2</sub> emission allowances equal to their total tons of CO<sub>2</sub> emitted over the preceding 3 years. Allowances will be made available by each state’s regulatory agency through auctions, sales or allocation (given free of cost) conducted on a periodic basis throughout the compliance period. Allowances will also be “created” through development of specific offset projects conducted by or for affected facilities. Each participating state is required to adopt its own regulations to implement the program. All states were required to have regulations in place by the close of 2008. Delaware has developed legislation and regulation to implement RGGI and will be one of the few participating state that will actually provide a reduction greater than 10% as soon as 2011.

### **Delaware Air Pollution Regulations that Apply to Power Plant Emissions**

- New Source Review: A delegated federal program that applies to power plants based on the date of construction/modification.
- Regulation No. 1112, NOx RACT: A state program that defines a minimum level of NOx control. Developed to aid in the attainment of the ozone standard.
- NOx Budget Program: collaboration among 13-states to reduce NOx emissions to aid in the attainment of the ozone standard. This program was succeeded by the federal NOx SIP Call.
- Regulation No. 1144, Stationary Generators: Designed to aid in ozone standard attainment by reducing NOx emissions from generators that have high peak day emissions, yet were uncontrolled because of low annual emissions.
- Regulation 1146 Multi-pollutant: Designed to reduce emissions of SO<sub>2</sub>, NOx, and Hg to aid in the attainment of ozone and fine particulate matter standards, and to reduce impacts of mercury emissions. Promulgated due to the ineffectiveness of federal programs for Delaware units.
- Regulation 1147, Regional Greenhouse Gas Initiative: Reduces CO<sub>2</sub> emissions as a first step to address climate change.
- Regulation 1148, Peaking Units: Designed to aid in ozone standard attainment by reducing NOx emissions from combustion turbines that have high peak day emissions, yet were uncontrolled because of low annual emissions.

The past and projected emissions as the regulatory requirements become effective are shown in Figures D1 through D4.<sup>120</sup>

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<sup>120</sup> Mercury and carbon emissions were not subject to regulation and/or tracking prior to the start of the data in their figures (11 and 12). The figures are not meant to imply that there were no emissions prior to those start dates.



### Sulfur Dioxide (SO<sub>2</sub>) Current & Projected Emissions from Delaware Electric Generating Units

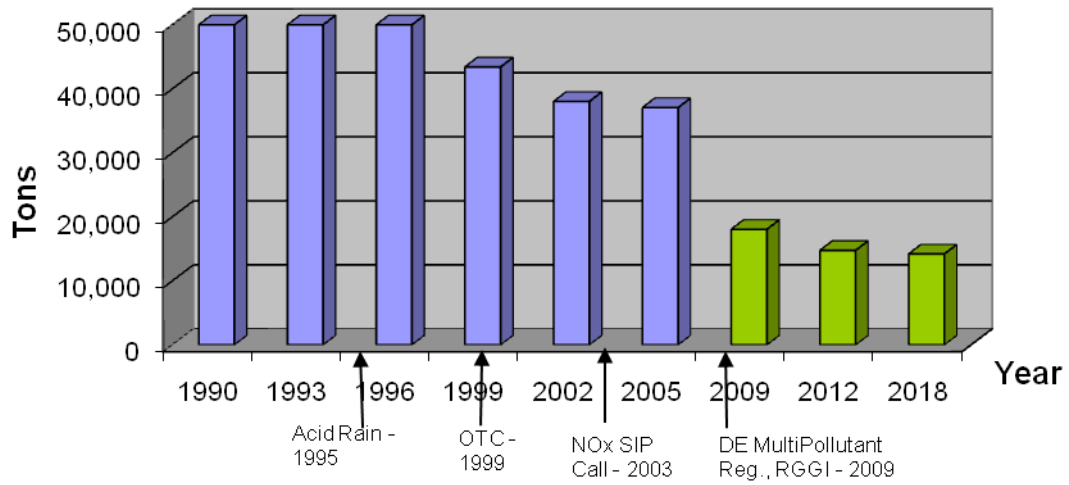


Figure D1

### NOx Current & Projected Emissions from Delaware Electric Generating Units

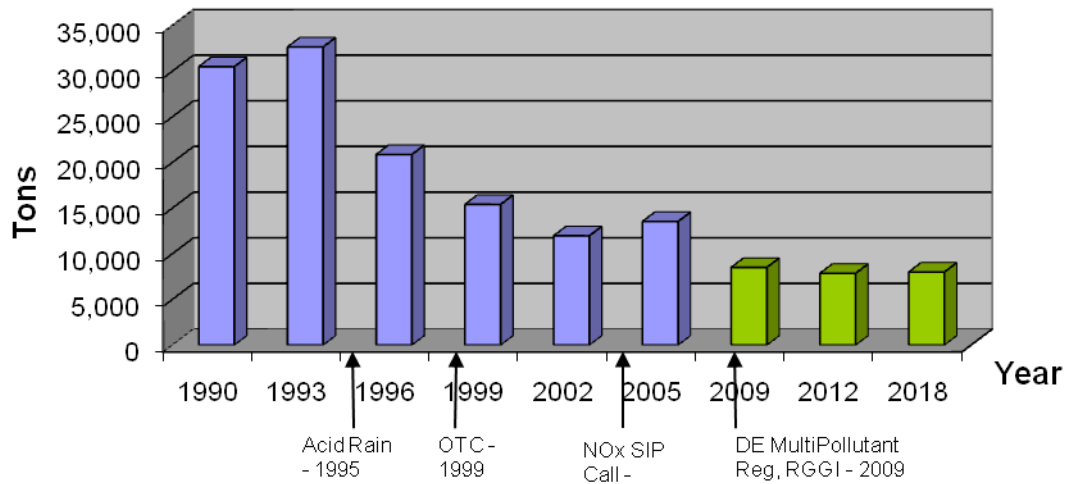


Figure D2

### Mercury (Hg) Current & Projected Emissions from Delaware Electric Generating Units

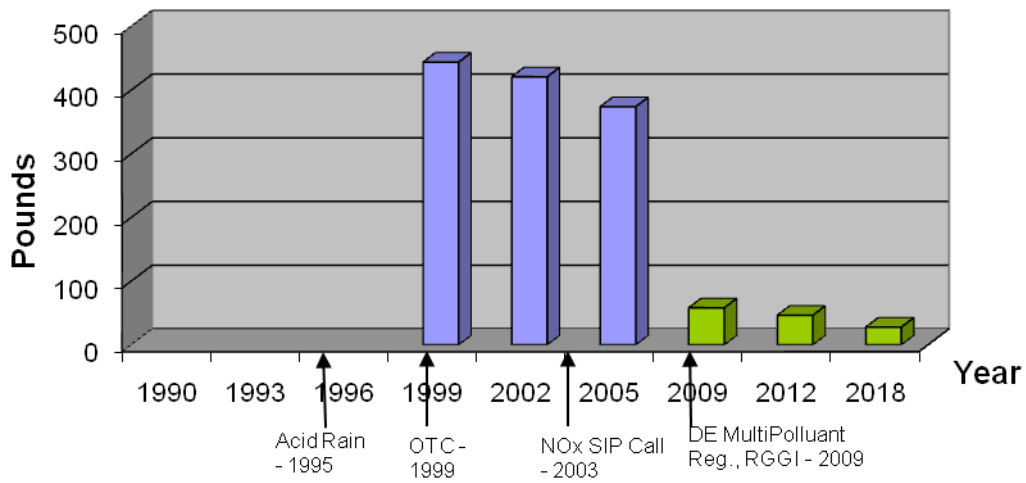


Figure D3

### Carbon Dioxide (CO<sub>2</sub>) Current & Projected Emissions from Delaware Electric Generating Units (≥25 MW nameplate capacity units only)

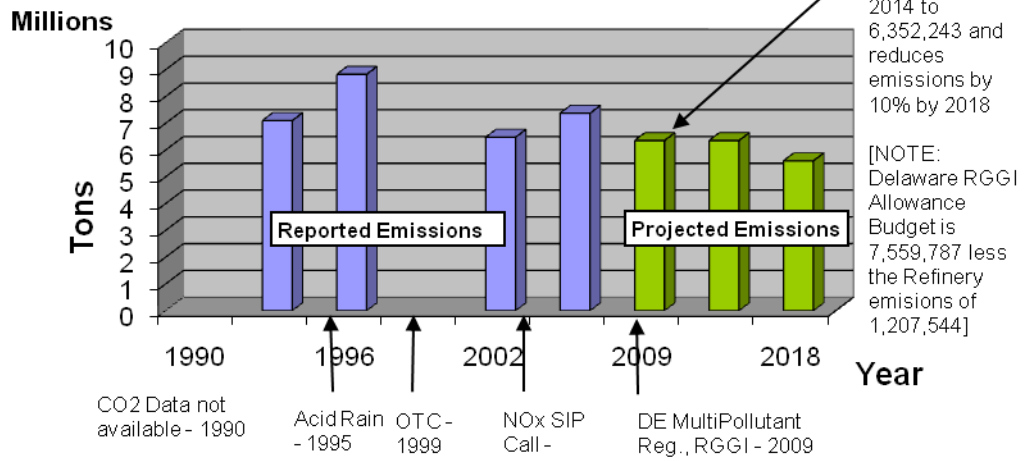


Figure D4

## **APPENDIX E-I: Work Group Final Reports**

APPENDIX E - Reducing Delaware's Energy Use Work Group Report to the Governor's Energy Advisory Council

APPENDIX F - Reducing the Environmental Footprint of the Energy Delawareans Use Work Group Report to the Governor's Energy Advisory Council

APPENDIX G - Transmission and Distribution Work Group Report to the Governor's Energy Advisory Council

APPENDIX H - Reducing Delaware's Transportation Energy Use Work Group Report to Governor's Energy Advisory Council

APPENDIX I - Supporting Delaware's Clean Energy Business Community Work Group Report to the Governor's Energy Advisory Council