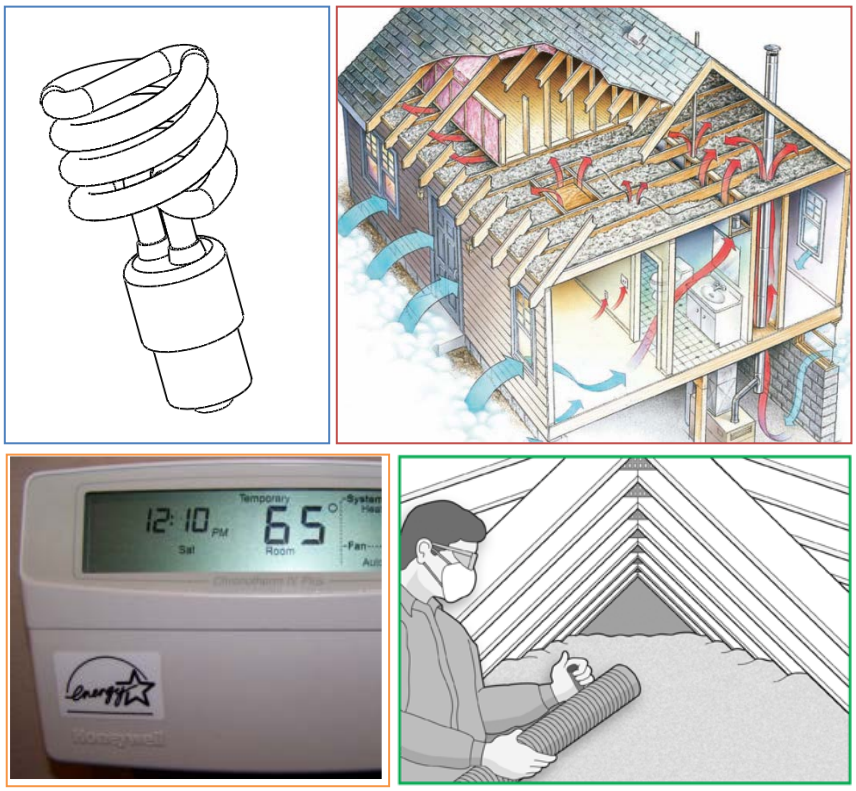
Delaware's Energy Efficiency Potential and Program Scenarios to Meet Its Energy Efficiency Resource Standard



prepared for the

Office of the Secretary

Department of Natural Resources and Environmental Control

State of Delaware

Center for Energy and Environmental Policy

University of Delaware

May 2011

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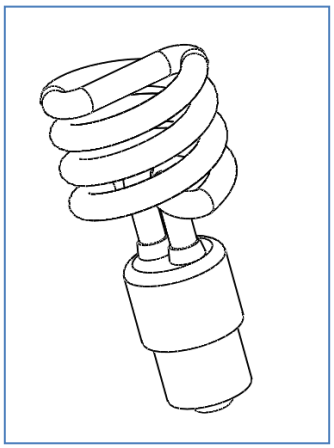
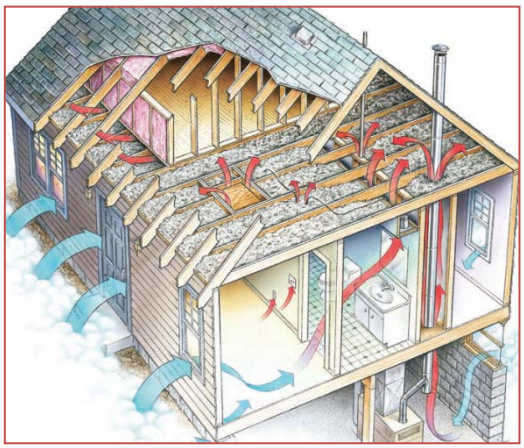

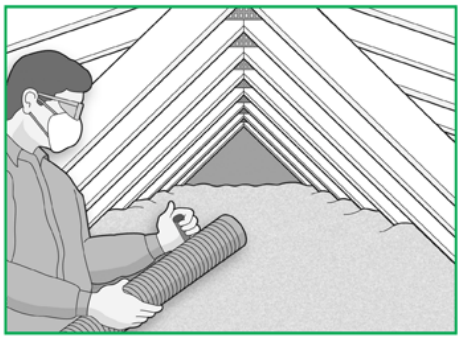

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Center for Energy and Environmental Policy

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ABBREVIATIONS

ACEEE: American Council for an Energy-Efficient Economy

billion cf: billion cubic feet, herein with regards to natural gas

BAU: business as usual

CEEP: Center for Energy & Environmental Policy, University of Delaware

CHP: combined heat and power

DEC: Delaware Electric Cooperative

DEMEC: Delaware Municipal Electric Corporation

DNREC: Department of Natural Resources and Environmental Control

DOE: U.S. Department of Energy

DP&L: Delmarva Power & Light Company

EE: energy efficiency

EERS: Energy Efficiency Resource Standard

EIA: U.S. Energy Information Administration

EPA: U.S. Environmental Protection Agency

GF: Green Financed approach for energy efficiency program implementation

GWh: gigawatt hours, energy unit for electricity

kWh: kilowatt hour, energy unit for electricity

LCOE: levelized cost of electricity

MMCF: million cubic feet of natural gas; MCF: thousand cubic feet

MUSH: municipal & state governments, universities and colleges, K-12 schools, and hospitals

MW: megawatts, power unit for electricity

MWh: megawatt hour, energy unit for electricity

NG: natural gas

SEU: Sustainable Energy Utility, Delaware's sustainable energy services and renewable energy administration framework

SB 106: Delaware Senate Bill 106, establishes a policy framework for an EERS

$tMTCO_2$: thousand metric tons of carbon dioxide, a greenhouse gas

TI: Traditional Incentive approach for energy efficiency program implementation

EXECUTIVE SUMMARY

The 2009 enactment of Senate Bill (SB) 106 by the Delaware General Assembly created an Energy Efficiency Resource Standard (EERS), a least-cost energy efficiency policy mechanism requiring electricity and natural gas savings throughout the State. The legislation mandates a 15% reduction in Delaware electricity consumption and a 10% reduction in natural gas consumption by 2015, relative to 2007 levels of energy use. The passage of the policy, in concert with a proven record of leadership in renewable energy and innovation in the provision of sustainable energy services, establishes Delaware as an aggressive leader among states in achieving a cost-effective, secure, and environmentally responsible energy future.

This report presents the findings from research conducted by the Center for Energy & Environmental Policy (CEEP) for the Department of Natural Resources and Environmental Control (DNREC), evaluating EERS reduction targets and strategies to meet SB 106 program goals for energy savings.

The study estimates the technical, economic, and program potential for energy savings within the parameters established by SB106.[1] CEEP researchers, in consultation with the Office of the Secretary of DNREC, considered three implementation scenarios (Green, Blue, and Red) to achieve energy savings targets established by SB106.[2] CEEP's analysis concludes that meeting the electricity and natural gas reduction targets legislated in SB 106 within the specified 5-year time-frame could require exceptionally high consumer participation rates previously unobserved in even the most aggressive state energy efficiency programs. However, if the most moderate implementation scenario, the Green Target[3] (see Table 2, p. 6) is adopted, the EERS would have broad and deep impact on energy and financial savings, spur economic growth and job creation, and result in a significant reduction in emissions of greenhouse gases.

---

[1] See Section 2 of the report for a detailed description of report methodology.

[2] See Table 2, p. 6, for complete definitions of implementation scenarios. Empirical comparisons with other leading state energy efficiency programs - and their respective participation rates - resulted in CEEP concluding the Red Target is not achievable by 2015 and consequently this target was not included in the analysis of economic or program potential. The Blue Target, while technically and economically achievable, would demand program participation rates greater than 100%, making it impossible to achieve within the 5-year time frame of the EERS. While estimations of its impacts and savings potential have been conducted, these findings are not included in the executive summary.

[3] Empirical analysis at CEEP suggests meeting this target would require a cumulative 53% program participation rate (10.6% per year) for electricity reduction and a 67% cumulative participation rate (13.4% per year) for natural gas reduction.

Green Target Impacts

To successfully meet the Green Target implementation scenario, Delawareans must reduce the state's cumulative electricity consumption by 1,780 GWh and natural gas consumption by 3,464 MMCF. For electricity, the implementation of energy efficiency technologies and practices at this scale would have the concurrent impact of reducing peak consumption. Demand reduction for the Green Target scenario, through energy efficiency measures, is estimated to be as high as 392 MW. At this level of reduction, EERS implementation would positively and materially impact economic growth, energy savings, and the environment. Applying the estimated Green Target savings to forecasted energy prices through 2015, CEEP researchers derived financial savings from avoided electricity costs at $1.9 billion by 2015, and savings from avoided natural gas costs at $546 million. Further economic benefits to the Delaware community will be realized by significant numbers of new jobs created to build the infrastructure and capacity to reach the target. Based on empirical analysis of the impacts of energy efficiency on job growth, CEEP researchers estimate the investment required to reach the Green Target would generate more than 7,000 new jobs in Delaware (see Section 6).

Energy efficiency and conservation, likewise, are the most effective and immediate tools to reduce greenhouse gas emissions in the attempt to curb further climate change. Required Green Target electricity reductions would mitigate between 1.5 and 1.6 million $MTCO_2$ and natural gas reductions would mitigate 189 thousand $MTCO_2$ by 2015.

These significant benefits, however, must be tempered by consideration of the program costs necessary to accelerate participation to meet the target within the 5-year scope of the current legislation. CEEP estimates that cumulative program costs to meet the EERS target for electricity to be $264 and $283 million.[4] Program costs to meet the EERS target for natural gas are estimated to be between $73-$78 million. As noted previously, successfully meeting the Green Target within the specified five year time-frame will demand high participation rates that this analysis finds unlikely in the near future and within the context of current market conditions and fiscal constraints. DNREC may wish to consider modifications of the EERS, such as adjusting the timeframe in which the ambitious 15% target is to be reached.

[4] Including both TI and GF programs, but excluding other programs including weatherization, building code, and CHP funding.

Leading and Aggressive State Participation Rate Results

CEEP researchers conducted an empirical analysis of existing state energy efficiency programs to determine a more likely, but still aggressive, array of energy savings potential achievable within the five-year scope of the EERS. Based on empirical research and reported participation rates for energy efficiency programs in the 14 leadings states (see Table 33) and the most aggressive state's energy efficiency program (Vermont), CEEP's analysis generated likely program implementation scenarios and determined the annual and total target-year (2015) savings achieved through each strategy. Table ES-1 summarizes total estimated potential for electricity and natural gas savings across all sectors, as well as demand savings for electricity. CEEP estimates a likely 2015 electricity program savings potential to be between 797 GWh and 1,190 GWh, corresponding to a target-year electricity savings of between 6.7% and 10.0% below the 2007 baseline. The implementation of these measures would have the additional benefit of reducing peak electricity consumption, and could result in demand savings of between 175 MW and 262 MW. Annual savings for natural gas are estimated to fall between 996 MMCF and 1,750 MMCF, corresponding to a target-year savings of between 2.9% and 5.0% below the 2007 baseline.

Table ES-1 illustrates sector energy savings achieved by the combination of two program sources of energy savings: Traditional Incentives (TI), and a Sustainable Energy Utility administered Green Financing (GF) (see Tables 39-41, p. 71-73 of the report for a complete summary of savings by program type).[5,6] The combination of these two approaches and with other existing energy efficiency programs will accelerate the deployment of energy efficiency technologies throughout the state and will develop a sustainable infrastructure and financing mechanism for realizing greater efficiency opportunities beyond the scope of the EERS.

In exploring the potential for energy savings through 2015, CEEP's analysis also evaluated the savings potential of other energy efficiency programs, including the low-income home weatherization program, new building codes, and opportunities to expand the diffusion of combined heat and power (CHP) technologies. These programs offer additional savings, which

[5] For a complete explanation of the components of TI and GF program design, see Table 15, p. 32, and Figure 18, p. 33. Sections 4.4 and 4.5 of the report provide a full evaluation of program savings from both TI and GF strategies.
[6] It is noteworthy that Vermont, which has the most aggressive program participation rate in the country, utilizes an SEU-style mechanism, although it has yet to design a GF mechanism like the one available to Delaware's SEU.

vary by sector, and will, in conjunction with the EERS, be a strong engine for job growth and reductions of greenhouse gas emissions. Some discussion and analysis of these programs are included throughout the report, but neither the costs nor their impacts are included in the EERS, and savings from them should not be counted toward the targets established by SB106.

Table ES-1: Summary of Implementation Pathway Energy Savings Potential

Annual and Cumulative Energy Savings and Demand Reduction for EERS Implementation Pathways			
Estimated Annual Electricity Savings at 2015 EERS Target-Year	Leading State Cumulative Participation Rate 15.8%	Most Aggressive State Cumulative Participation Rate 30.5%	Green Target Cumulative Participation Rate=52.6 %
Total Annual Residential Savings (GWh)	208	401	670
Total Annual Commercial Savings (GWh)	+ 479	+ 607	648
Total Annual Industrial Savings (GWh)	+ 110	+ 182	462
Total Annual Savings Achieved/*Required* (GWh)	*= 797*	*= 1,190*	*1,780*
Green Target-Year % Savings	6.7%	10.0%	**15.0%**
Annual Demand Savings (MW)	175 MW	262 MW	
Demand Realized at Target-Savings (MW)			392 MW
Estimated Annual Natural Gas Savings at 2015 EERS Target-Year	Leading State Cumulative Participation Rate 15.0%	Most Aggressive State Cumulative Participation Rate 30.8%	Green Target (Cumulative Participation Rate=66.7%)
Total Annual Residential Savings (MMCF)	277	570	1,000
Total Annual Commercial Savings (MMCF)	+ 422	+ 594	863
Total Annual Industrial Savings (MMCF)	+ 297	+ 586	1,601
Total Annual Savings Achieved/*Required* (MMCF)	= 996	= 1,750	*3,464*
Green Target-Year % Savings	2.9%	5.1%	**10.0%**

To reach the statute's goal of a reduction of the equivalent of 15% in 2007 electricity sales, CEEP estimates that compliance can be reached between 2018 and 2021 (depending upon whether the participation rate of Vermont or the 14 most aggressive states in the country is used). For natural gas, CEEP's estimate of the compliance period is between 2020 and 2027 for a 10% reduction of sales based on 2007 consumption.

Table ES-2 summarizes financial impacts of EERS implementation at the leading-state and aggressive state levels of participation assessed by this report. EERS implementation, resulting in sustained statewide energy efficiency investments, will stimulate job growth throughout Delaware. The positive net employment benefits of energy efficiency investments are well

documented and outpace job creation rates of all conventional and even most renewable energy industries, adding well-paying trade and professional positions (see ASES, 2007). Job creation can help to reduce Delaware's unemployment rate from over 8% currently (U.S. BLS 2010). EERS implementation is estimated to create 2,323-4,045 jobs if participation rates are similar to those experienced by leading states in achieving energy savings (during the five-year timeframe of SB 106; see ASES, 2007 for job creation multipliers). Because the technical and economic potential for energy savings remains considerably higher than savings targeted within the 5-year scope of the EERS, significant opportunities for sustained job growth exist further into the future. More detailed discussion of employment benefits of EERS implementation and the methodology used by CEEP can be found in Section 6 of the report.

The investment in energy efficiency and conservation has an additional economic benefit. Table ES-2 provides estimates of the dollar savings associated with investments at different participation rates for the cumulative 5-year scope of the program. These are more than $1.1 billion to $1.6 billion for electricity-focused investments and $175-$307 million for natural gas-focused investments.[7] By lowering the cost of energy use, real incomes in all sectors of the Delaware economy are lifted. Estimated savings over the measure lifetime[8] returned to the participants range from nearly $1.255 billion (at an achievable 16% participation rate) to almost $1.937 billion in 2010 dollars (at the most aggressive state participation rate of 30%).[9] SEU-assisted Green Finance initiatives can produce a further economic advantage in attracting ongoing private sector investment in Delaware, as tax-exempt and taxable bond buyers can continually direct capital to the state's economy. In this regard, EERS implementation represents an economic development policy, as well as an energy and environmental policy.

[7] Based on likely to aggressive participation rates of 15%-16% and 30%-31%, and a typical measure life of 15 years.
[8] In most cases, a fifteen year life expectancy for energy efficiency technologies and improvements is assumed.
[9] See Table 41, p. 67.

Table ES-2. Summary of EERS Impacts on Financial Energy Savings and Job Growth

Cumulative Program Savings ($million) and Employment Benefits of EERS Implementation Pathways			
Electricity Savings ($million)	Leading State Cumulative Participation Rate*	Most Aggressive State Cumulative Participation Rate*	Green Target Cumulative Participation Rate*
Elec. Cumulative Savings ($m)	$1,080	$1,630	$1,930
Natural Gas Savings ($m)			
NG Cumulative Savings ($m)	$175	$307	$546
Total Cumulative Savings ($m)	$1,255	$1,937	$2,476
Job Creation			
Job Creation (Elec. + NG)**	2,323	4,045	7,084

* Participation rates vary for electricity and natural gas, likewise for all sectors. Estimated participation rates utilized are shown in ES1 based on energy savings, whose methodology is described in Section 4.4.
** Estimated jobs created include combined electricity & natural gas programs. All values are estimates for a five-year continuous investment effort.

Table ES-3 summarizes the environmental benefits of EERS implementation. While the environmental impacts of reducing energy consumption are broad and varied, the impact will be a significant reduction in emissions of greenhouse gases that contribute to climate change. Delaware has made commitments in the past to address its emissions and contributions to climate change that threatens Delaware's population, economy, shoreline and other ecosystems. Energy efficiency and conservation are the most cost-effective and immediate tools to curtail Delaware's emissions. Under a best-case scenario, EERS implementation is anticipated to result in a decrease of 0.7-1.1 million metric tons of carbon dioxide emissions (million $MTCO_2$) from avoided marginal off-peak electricity generation. For similar levels of participation, annual savings of natural gas correspond to a direct reduction of CO_2 emissions of 54-95 thousand $MTCO_2$. A comprehensive discussion of the environmental impacts of EERS strategies and implementation can be found in Section 7 of the report.

Table ES-3. Summary of Environmental Impacts of EERS Implementation

Annual Greenhouse Gas Reduction Impacts of EERS Implementation Pathways			
*Annual Electricity Emissions Reductions*** *(thousand $MTCO_2$)*	Leading State Cumulative Participation Rate*	Most Aggressive State Cumulative Participation Rate*	Green Target Cumulative Participation Rate*
Marginal Power Gen. On-Peak Emissions Reduced	691	1,032	
Marginal Power Gen. Off-Peak Emissions Reduced	732	1,092	
Emissions Reductions at Target-Savings: On-Peak			1,543
Emissions Reductions at Target-Savings: Off-Peak			1,634
*Annual Natural Gas Emissions Reductions*** *(thousand $MTCO_2$)*			
Annual CO_2 Emissions Reduced	54	85	
Emissions Reductions at Target-Savings			189
Total Emissions Reductions at Target Savings (*Off-Peak electricity + natural gas*)	786	1,177	1,823

* Participation rates vary for electricity and natural gas, likewise for all sectors. Estimated participation rates utilized are shown in ES1 based on energy savings, whose methodology is described in Section 4.4

** Emissions reductions include reductions from TI and GF savings.

Tables ES-4 and ES-5 summarize the incremental investment costs and program costs respectively of each conservation strategy. These costs are associated with achieving the implementation scenarios and their associated participation rates. Investments in efficiency, while high in first cost, offer significant rates of return, which will only increase as energy prices continue to rise and political and economic instability threaten to make energy markets volatile and unpredictable in the near and distant future.[10]

[10] The investment costs assessed here are the total incremental cost of energy efficiency, shared in the case of TI by the program administrator and the consumer, and in the case of GF by private sector capital investment.

Table ES-4. Electricity and Natural Gas Efficiency Incremental Investment Costs

2015 Scenario Incremental Investment Cost by Sector ($million)			
Electricity Incremental Investment Costs by Sector ($million)*	Leading State Cumulative Participation Rate**	Most Aggressive State Cumulative Participation Rate**	Green Target Cumulative Participation Rate**
Elec. Residential Sector ($million)	$83.6-$87.5	$161.4-$168.8	$267.9-$280.3
Elec. Commercial Sector ($million)	$48.1-$49.0	$66.0-$67.8	$71.3-$73.3
Elec. Industrial Sector ($million)	$28.2-$28.8	$45.5-$50.5	$129.7-$132.6
Elec. All Sector Investment ($million)	$160.0-$165.3	$276.9-$287.1	$468.9-$486.2
Natural Gas Incremental Investment Costs by Sector ($million)			
NG Residential Sector ($million)	$22.9-$23.9	$46.9-$49.1	$81.6-$85.4
NG Commercial Sector ($million)	$9.3-$9.5	$14.4-$14.9	$22.1-$22.9
NG Industrial Sector ($million)	$5.4-$5.6	$10.9-$11.1	$29.6-$30.3
NG All Sector Investment ($million)	$37.6-$39.0	$72.2-$75.1	$133.3-138.6
Elec. + NG Total Incremental Investment ($million)	**$197.6-$204.3**	**$349.1-$362.2**	**$602.2-$624.8**

* Investment costs include both TI and GF programs. For complete cost breakdown, see Table 41, p. 73

** Participation rates vary for electricity and natural gas, and by sector. Estimated participation rates utilized are shown in Table ES1. The methodology is described in Section 4.4.

Table ES-5. Electricity and Natural Gas Efficiency Program Costs

2015 Scenario Program Cost by Sector ($million)			
Electricity Program Costs by Sector ($million)*	Leading State Cumulative Participation Rate**	Most Aggressive State Cumulative Participation Rate**	Green Target Cumulative Participation Rate**
Elec. Residential Sector ($million)	$44.3-$48.2	$85.5-$93.0	$142.4-$156.7
Elec. Commercial Sector ($million)	$38.9-$39.8	$48.2-$49.9	$51.1-$53.2
Elec. Industrial Sector ($million)	$17.2-$17.8	$28.3-$29.3	$70.3-$73.6
Elec. All Sector ($million)	$100.4-$105.8	$162.0-$172.2	$263.8-$283.5
Natural Gas Program Costs by Sector ($million)			
NG Residential Sector ($million)	$12.1-$13.2	$24.9-$27.0	$43.7-$47.4
NG Commercial Sector ($million)	$7.0-$7.2	$9.6-$10.1	$13.7-$14.5
NG Industrial Sector ($million)	$3.0-$3.1	$5.5-$6.0	$15.6-$16.3
NG All Sector ($million)	$22.1-$23.5	$40.0-$43.1	$73.0-78.2
Elec. + NG Total Program ($million)	**$122.5-$129.3**	**$202.0-$215.3**	**$336.8-$361.7**

* Program costs include incentives and program administration for TI and administration for GF.
** Participation rates vary for electricity and natural gas, likewise for all sectors. Estimated participation rates utilized are shown in ES1 based on energy savings, whose methodology is described in Section 4.4.

The Sustainable Energy Utility and Green Financing to Accelerate Energy Efficiency

While the implementation pathways examined for this report may seem aggressive given a history of relative inaction in Delaware,[11] the state has a special advantage in meeting an ambitious EERS – its Sustainable Energy Utility (SEU). Delaware has the potential to leverage performance contracting that, through the SEU administered Green Financing (GF) program, can aggregate guaranteed energy savings and thereby significantly lift project and overall savings. A GF framework is already in place in the SEU to administer energy efficiency programs comprehensively. The SEU can enlarge energy efficiency market share through securitized

[11] In 2008, before the SEU was implemented, ACEEE ranked Delaware as tied for last place among 50 states in energy efficiency (ACEEE, 2008b).

Green Energy Saving Bonds[12] by integrating capital intensive long-term projects with projects that have a short payback period through monetized guaranteed savings agreements. Estimated saving potentials through an SEU-administered GF framework point to the possibility of more closely approaching EERS savings goals, and in so doing would showcase Delaware's recent leadership in the promotion and use of sustainable energy technologies and practices.

An important advantage of Green Financing is that it promises to lower the levelized cost of saved energy (LCOSE). For electricity, the State would enjoy a significant reduction, from the nearly 3 cents per kWh for TI efforts to less than 1 cent per kWh for GF (see Table ES-6). Similarly, a GF approach to natural gas savings is projected to cost only $1.63/MCF, while TI initiatives are expected to cost $4.51/MCF.[13]

Table ES-6. Levelized Cost of Saved Energy

	(All Sectors)	
Program LCOE	Saved Electricity ($/kWh)	Saved Natural Gas ($/MCF)
TI	$0.03/kWh	$4.51/MCF
GF	$0.01/kWh	$1.63/MCF

If the modeled pathways of this study are pursued, Delaware will rival the nation's leading states in energy savings commitment on a per capita basis. Delaware's aggressive energy efficiency goals complement its pioneering role in 21st century policy solutions, exemplified by the Sustainable Energy Utility's special advantages in coordinating and delivering sustainable energy services, and establishing long-term market signals for citizens and businesses to invest in this cost-effective resource (Byrne & Martinez, 2009). As energy savings grow, economic development and environmental benefits will likewise multiply, further showcasing Delaware's leadership role in building a green economy for a sustainable future.

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[12] See *Transforming the National Energy Infrastructure: A Sustainable Energy Utility Strategy* (2010), prepared by J. Byrne (CEEP, University of Delaware) and T. Allen (Citi). Available at: http://www.seu-de.org/docs/minutes/US_2010_SEU_Green%20Energy%20Financing%20Primer_GESB_SEAB_RLF_SolarShare_SustainableCommunities_May.pdf

[13] Typical life span of energy efficiency measure was assumed at 15 years. LCOSE for TI are based on data reported in ACEEE (2008a and 2009). LCOSE values for GF are based on data from Citygroup (2009), LBNL (2010), and personal communications with selected ESCOs.

Finally, as EERS implementation goes forward, it is important to note that Delaware has deregulated its electricity and natural gas markets, permitting the entry of third-party energy suppliers. These suppliers furnish 34% of the state's total electricity and 48% of natural gas sales, and therefore are critical to long-term efficiency improvements. However, SB 106 is silent on the obligations of these suppliers to meet EERS targets. DNREC needs to consider how to address this issue.[14]

[14] This report assumes EERS compliance for all users. Summary tables excluding consumers served by third party suppliers are included in Appendix D.

1 INTRODUCTION

Delaware's enactment of Senate Bill (SB) 106 in 2009 establishes a policy framework for an Energy Efficiency Resource Standard (EERS), a policy mechanism to encourage energy efficiency in electricity and natural gas consumption. SB 106 establishes a specific goal for energy savings (Section 1502):

> 1. For each affected Electric Energy Provider, Energy Savings that is equivalent to 2% of the Provider's 2007 electricity consumption, and coincident peak demand reduction that is equivalent to 2% of the Provider's 2007 peak demand by 2011, with both of the foregoing increasing from 2% to 15% by 2015.
>
> 2. For each affected Natural Gas Distribution Company, Energy Savings that is equivalent to 1% of the Company's 2007 natural gas consumption by 2011, increasing to 10% by 2015.

With the passage of SB 106, Delaware joins 22 other states that have adopted EERS targets as of April 2010.[15] Because energy efficiency is the least-cost resource available to meet energy needs generally and in Delaware, EERS near-term impacts can have a positive co-benefit of job creation and economic stimulus (ACEEE, 2009a; ACEEE, 2008; SEU, 2008; ASES, 2007). According to the American Council for an Energy-Efficient Economy, "the EERS has proven to be an important policy tool to foster job growth in recession-battered industries like construction and manufacturing, all while reducing electricity demand and utility bills for consumers and businesses."[15]

The EERS establishes a long-term market signal to promote access to this cost-effective resource, thereby reducing risk and improving investment opportunities in energy efficiency. This report presents the findings from research conducted by the Center for Energy & Environmental Policy (CEEP) regarding Delaware's EERS reduction targets and strategies to meet them. Consideration of several factors affecting energy use is required by the statute and were examined as part of this research effort. CEEP researchers undertook the task of developing a scenario analysis of alternatives to meet the statute's energy saving targets and to

[15] ACEEE, 2010. *The State Current: ACEEE State Network Update* (April). Available online at http://www.aceee.org/energy/state/current.htm#EERS

estimate their state- and sector-wide impact. The data collected for this purpose and the model built by CEEP's researchers to evaluate the State's options are documented. It is hoped that the report can assist the state's Sustainable Energy Utility (SEU), its investor-owned, municipally-owned and cooperatively owned utilities and its energy users in meeting the EERS goals of SB 106.

1.1 Delaware's Historical Energy Use and Growth Rates

Electricity and natural gas consumption have increased at an average annual rate of 2.3% and 0.6%, respectively, since 1990. Table 1 notes that the residential and the commercial sectors in the state have witnessed annual growth in electricity use in excess of 3%. While the largest natural gas growth rate has been by the commercial sector (4.1% per year since 1990).

Table 1. Calculated 2007 Energy Use and Historical Growth Rates 1990-2008

	2007 Electricity Use	% Electricity Yearly Growth Rate	2007 NG Use	% NG Yearly Growth Rate
Residential	4,470 GWh	3.1%	10.0 billion cf	1.7%
Commercial	4,321 GWh	3.7%	8.6 billion cf	4.1%
Industrial	3,078 GWh	0.0%	16.0 billion cf	-0.2%
Power Generation	NA	NA	13.4 billion cf	-0.5%
Total	11,869 GWh	2.3%	48.0 billion cf	0.6%

Data Sources: EIA, 2010a; EIA, 2010b.

Historical electricity use is shown in Figure 1 and Figure 2 depicts recent trends in natural gas use by utility provider. Evident in both figures, Delmarva Power is the largest utility energy provider in the State, accounting for nearly 75% of the state's delivered electricity, and nearly 70% of its delivered natural gas. Beginning in 1999, (the year following enactment of Delaware's deregulation statue), industrial and commercial electricity sales for Delmarva Power decreased as customers in both sectors migrated to new third-party providers.[16]

[16] Figure 1 records the drop in electricity generation sales by Delmarva Power and the switch to delivery-service only. In this regard, third-party suppliers are important to any energy policy analysis in Delaware, and EERS implementation must consider whether this aspect of the market is subject to the SB 106 goals. However, the EERS Workgroup had not reached a decision regarding third-party supply when CEEP undertook its research. The main text of the report assumes EERS compliance for all suppliers, except the natural gas power sector. The alternative summary tables excluding third party suppliers are included in Appendix D.

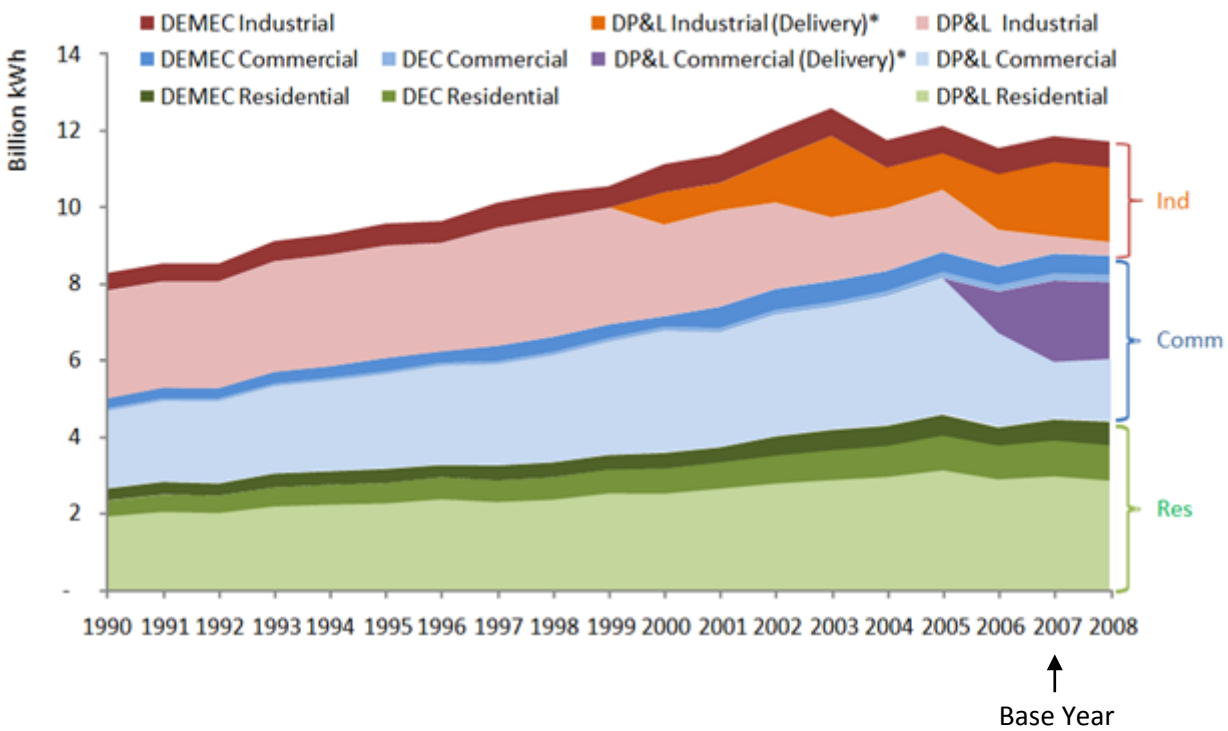


Figure 1. Electricity Consumption in Delaware by Providers 1990-2008
* "Delivery" indicates that a utility is not responsible for securing generation; it is only responsible for the delivery of electricity service. Third party providers bear the responsibility of acquiring supply for this segment.
Data Source: EIA, 2010a

The natural gas market in the state is summarized in Figure 2. Commercial and Industrial users account for over 50% of sales and the power sector uses around 30% of annual natural gas deliveries. The residential sector accounts for 20% of this fuel's use. 25.2% of commercial natural gas is third party supplied (4.5% of the total), and 90.2% the industrial natural gas is third party supplied (30.1% of the total).

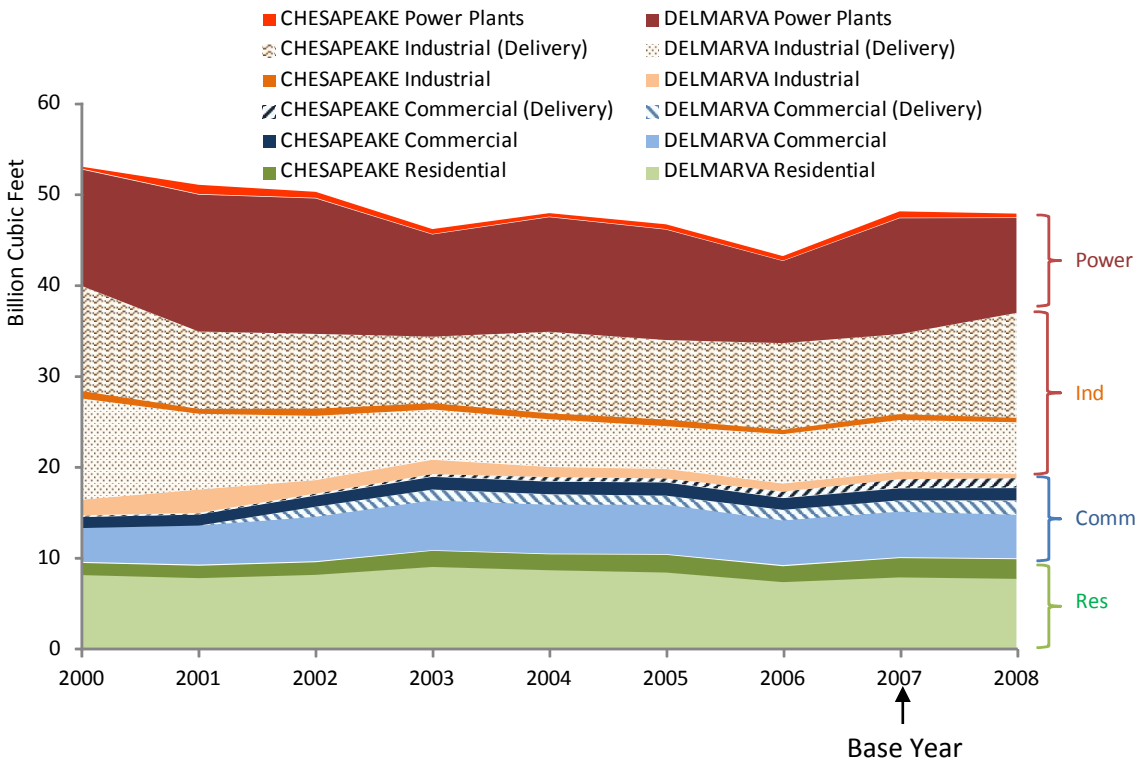


Figure 2. Natural Gas Consumption in Delaware by Providers 2000-2008
Data Source: EIA, 2010b

2 METHODOLOGY

The research methodology used to assess energy efficiency potential and to select and evaluate implementation strategies is built upon the framework established by the U.S. Department of Energy in collaboration with the U.S. Environmental Protection Agency. In their 2007 *Guide for Conducting Energy Efficiency Potential Studies*, these agencies discuss three measures of potential for the assessment of energy efficiency resources: technical, economic, and program potential (NAPEE 2007). As a generalized framework, these three categories represent the scope of any energy efficiency study for a given policy initiative. Figure 3 illustrates how these concepts are related, and defines their capacity for assessing various energy efficiency resources.

The categories of technical, economic and program potential are consistent with those used by other energy efficiency surveys (e.g., see Itron, 2006: Figure 3-2). It should be recognized that specific definitions vary depending on the economic and policy framework context, along with the timeframe of the analysis. The Delaware EERS timeframe for instance is five years. As a result, only a portion of Delaware's appliances and equipment will reach their end of life, and only that subset may be economic to replace.

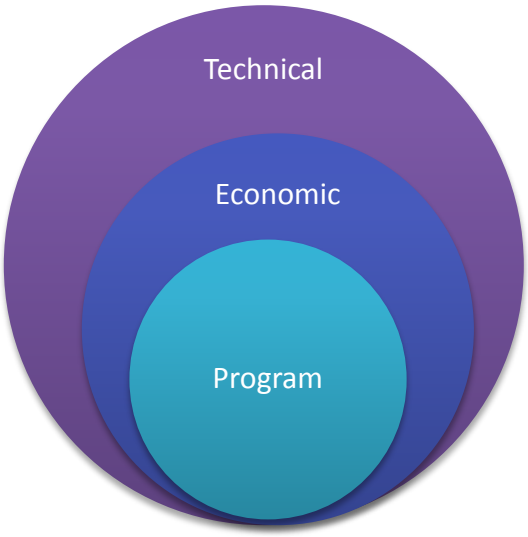


Figure 3. Implementation Scenarios

Technical: represents the theoretical maximum amount of energy efficiency. It disregards all non-engineering constraints such as cost, measure life/turnover rate, and end user participation.

Economic: includes the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources; with no regard for the gradual "ramping up" process of programs.

Program: measures the amount of energy that can be displaced based on specific program participation and funding levels for a specific timeframe, policy and measure life/turnover rate.

Using this conceptual framework, the research reported here then relied upon measure selection and assessment methods developed by the American Council for an Energy-Efficient Economy (ACEEE). According to the ACEEE, "cost-effectiveness of more efficient technologies, compared to a standard baseline technology, is determined from the customer's perspective, i.e., a measure is deemed cost-effective if its levelized cost of conserved energy (CCE) is less than the average retail energy price for a given customer class" (ACEEE, 2009).[17] The evaluation of Delaware's EERS implementation targets is based on this definition of cost effectiveness.

Program savings are measured in the same units used by ACEEE, namely savings per household, savings per square-foot (for commercial users), and savings per fixed value of shipments (for industrial customers). The EIA "value of shipments" definition was used for this analysis: "value of shipments and receipts consists of the total receipts for products manufactured, services rendered, and the re-sales of products bought and sold without further manufacture. It is the dollar value received by the manufacturer for the products it sells" (EIA 1994).

Lastly, this assessment includes only existing technologies and practices available as of 2008.[18] CEEP anticipates that new and emerging technologies and market learning will increase the cost-effective resource potential of energy efficiency in the coming decades. However, the study treats savings associated with technology improvements to affect post-2015 experience. In this respect, reported savings estimates are likely to understate actual results.

[17] Levelized cost is defined as the present value of the total cost of building and operating a generating plant over its economic life, converted to equal annual payments. Costs are levelized in real dollars (i.e., adjusted to remove the impact of inflation). See http://www.eia.doe.gov/glossary/index.cfm?id=l

[18] This is the latest year for which robust data sets are available. In this respect, the study is based on empirical rather than speculative methods.

3 SCENARIOS

In consultation with the Office of the Secretary of the Department of Natural Resources and Environmental Control (DNREC), CEEP considered three implementation scenarios to achieve the energy savings targets established by SB 106. Each of the three scenarios, defined in Table 2, is based on a different interpretation of the legislated level of electricity and natural gas reduction found in the statute. These definitions were presented to the Working Group created by SB 106 and its suggestions were included in the final versions used for the analysis. The Working Group agreed that the red target was unachievable for the reasons discussed in Section 4 of this report. The Blue and Green Target scenarios provide the basis for all of scenario analyses reported in Sections 4 - 9.

Table 2. Scenario Definitions

Electricity Scenarios:	**Natural Gas Scenarios:**
(Red) By 2015 electricity consumption will be 15% below the State's 2007 level.	**(Red)** By 2015 NG consumption will be 10% below the State's 2007 level.
(Blue) By 2015 electricity consumption will equal 85% of projected 2015 consumption.	**(Blue)** By 2015 NG consumption will equal 90% of projected 2015 consumption.
(Green) By 2015 electricity consumption will equal projected 2015 consumption MINUS 15% of 2007 consumption.	**(Green)** By 2015 NG consumption will equal projected 2015 consumption MINUS 10% of 2007 consumption.

4 BASELINE AND ECONOMIC POTENTIAL

4.1 Establishing a Baseline

Accurate projection of baseline consumption is critical to evaluating each scenario definition. This report uses data provided by the utilities (i.e., DP&L, Chesapeake, Delaware Electric Cooperative, and Delaware Municipal Electric Corporation) and the U.S. EIA (EIA: 2003; 2008; 2009; 2010; 2010a; 2010b). Figure 4 displays the projected electricity savings requirement for each scenario (Red, Blue & Green). As required by SB 106, the baseline year is 2007.

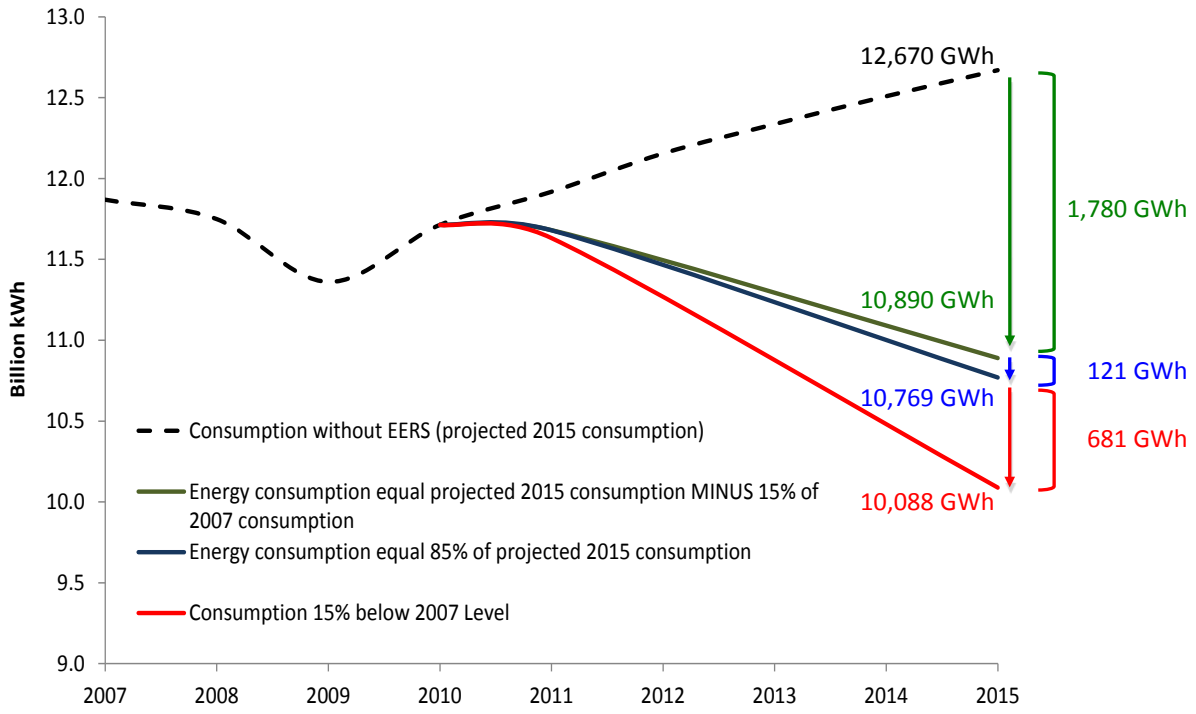


Figure 4. Aggregate Electricity Sales and Target Projections (Base Year 2007)

Although electricity consumption fell slightly from 2007 through 2010, as reported by each electricity provider, projections from the utilities and the 2009 *Delaware Energy Plan* estimate that without an EERS program, electricity consumption will climb to more than 12,600 GWh by 2015. The most conservative interpretation of the 15% reduction, the Green Target, projects a

required savings of 1,780 GWh below 2015 business-as-usual (BAU) projections. The more aggressive Blue Target estimates a further 121 GWh in savings, while the most aggressive scenario, the Red Target, projects another 681 GWh in savings beyond the Blue Target.

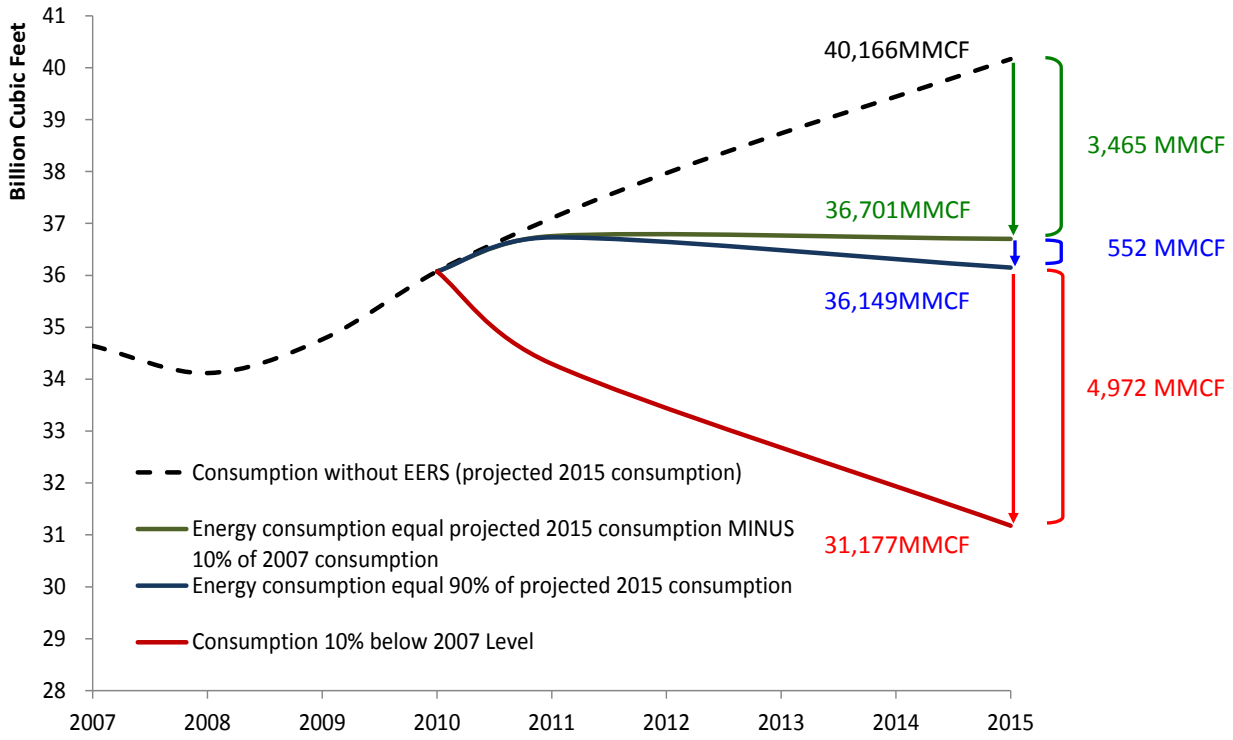


Figure 5. Aggregate Natural Gas Sales and Target Projections (Base Year 2007)
* Assumes 1% growth for 3rd-party delivery (excludes power sector consumption)

Projections from the service providers and the 2009 *Delaware Energy Plan* estimate that, without an EERS program, natural gas consumption will climb to more than 40,000 MMCF by 2015, assuming a 1% annual growth rate for 3rd-party delivery and excluding sales for the power sector. The most conservative interpretation of the 10% reduction, the Green Target, projects a required savings of 3,465 MMCF below 2015 business-as-usual (BAU) projections. The more aggressive Blue Target estimates a further 552 MMCF in savings, while the most aggressive scenario, the Red Target, projects another 4,972 MMCF in savings beyond the Blue Target.

Because each of the three electric and two natural gas utilities considered in this report maintain distinct baselines and have demand projections, and have different mixes of customers,

targets and their impacts vary accordingly. Each utility baseline is generated from the BAU projections available at the time of this report.[19]

4.2 Technical Potential

Using the broadest definition for energy efficiency savings potential, the theoretical maximum amount of energy efficiency reductions can be estimated. Taking into account only this engineering potential, (hence disregarding all non-engineering constraints such as cost, measure life/turnover rate, and end user participation), Delaware's technical potential is illustrated below in Table 3 based on 100% participation for the technologies considered during the course of this research (see Appendix A through C for complete lists of the more than 200 technologies considered). This level of energy savings results from using the best-in-class technologies available today. New energy efficiency technologies not yet available in the market are not considered.

Table 3. Technical Potential for Delaware Electricity & Natural Gas Efficiency Savings

	Electricity Savings (GWh)	% of Sector 2007 Electricity Consumption	Natural Gas Savings (MMCF)	% of Sector 2007 Natural Gas Consumption
Residential Sector	1,624	37%	3,772	38%
Commercial Sector	1,642	38%	2,793	32%
Industrial Sector	853	28%	3,688	23%
Total of 3 Sectors	4,119	35%	10,253	30%

* Source: CEEP model and calculations.

Bearing in mind this technological potential, of the three energy efficiency targets considered, the Red Target is the most aggressive, beginning immediately, requiring reversal in the growth of energy consumption and a very aggressive cumulative participation rate (more than 80% for electricity and above 100% for natural gas) to successfully reach the target. Based on the achieved participation rates of other state and utility efficiency programs, CEEP has concluded that the Red and Blue Targets are not technologically achievable by 2015.[20] For this

[19] DEMEC's projections are from the *Delaware Energy Plan* (DNREC 2009), while the DP&L, DEC, and Chesapeake projections are derived using data they supplied directly for this report.
[20] The SB 106 Working Group concurred at meetings held to discuss trends and baselines.

reason, the Red and Blue Targets were not pursued in the estimate of state energy efficiency potential.

The Green Targets represent CEEP's best estimate of the technical potential within a five-year timeframe, assuming no new efficiency opportunities beyond those already in the market. That is, the State's technically achievable target for electricity savings is estimated to be 1,780 GWh in 2015. For natural gas, the potential is estimated to be 3,465 MMCF in 2015. These estimates assumed that 15% savings for electricity users and 10% savings for natural gas customers is the near-term maximum. The assumption comports with findings in the research literature (Chandler and Brown 2009; Itron 2006; SEU 2008; ACEEE 2009, ACEEE 2010a).

4.3 End-Use Sector Baseline and Economic Potential

The three sectors of the Delaware energy market – residential, commercial, and industrial – have different compositions by fuel type, level of consumption, and end-use. Particularly due to this last factor, the economic efficiency potential of each sector varies widely. Because of the relatively short timeframe of the EERS program, future federal and state policies (including carbon taxes or trading mechanisms), and other rebates, taxes, or subsidies were not considered in assessing the economic potential of the efficiency measures discussed below.[21]

In order to assess the potential economic savings over the five-year term of the EERS target, this report draws on a range of sector-specific electricity and natural gas efficiency measures and determines the levelized cost of saved energy for each measure (LCOE). LCOE saved is a function of incremental energy savings, incremental cost, measure life, turnover rate, and the discount rate. Here we generally define incremental energy saved as the difference in consumption between an available high efficiency piece of equipment and the standard equipment, building envelope, or process control measures in use currently in the market. In some cases, particularly in the commercial and industrial sectors, with high volumes of demand based on differing technologies and production processes, it may be cost-effective to retrofit still useful older technologies with newer, more efficient measures, achieving higher gross savings but increasing the levelized cost of energy saved. In most cases, the turnover rate is determined by the expected measure life of a given piece of equipment or building improvement.

[21] If new policies are enacted by the federal and/or state governments in the next 2-3 years (to allow for impacts to appear by 2015) it is possible that economically achievable efficiency can grow above the estimates in this report.

Incremental cost, likewise, is defined here as the difference in capital cost between a high efficiency measure and a standard measure.

In each sector, the economic efficiency potential is measured by a model developed by CEEP which links several factors: the percent of household or institution energy saved as a result of a measure, levelized cost of energy (defined above), and projected annual savings potential in MWh or MCF per $1,000 of program spending (including program administration costs – see Table ES-1). This last metric derives from the assumption that, apart from program administrative costs, the cost of all efficiency measures will be born equally by the consumer and the program administrator.[22] The formula used to derive the annual energy saved per $1000 is the net present value (NPV) divided by the annual savings. NPV includes capital cost plus operating and maintenance costs and a discount rate of 5% over the expected lifetime of each measure.

We note here that further dialogue is needed to address the role of non-utility energy generators and consumers. Non-utility entities – principally power generators and large industrial and commercial sector users – consume more than 60% of natural gas in the State of Delaware, and more than 30% of electricity sales in the state are served by non-utility providers. If utility costs rise as a result of the EERS statute, some consumers may migrate to non-utility providers not currently under the umbrella of the EERS legislation.

4.3.1 Residential Energy Use and Economic Savings Potential

Delaware's residential electricity consumption in the baseline year of 2007 was 4,470GWh, or 37.6% of the State's total electricity use. For natural gas, residential users accounted for 10.0 billion cubic feet, or 20.8% of the State's total natural gas consumption. Economic savings potential for the residential sector was determined through research on 50 electricity and efficiency measures and 43 natural gas efficiency measures (see Appendix A).

[22] In Delaware, the Sustainable Energy Utility is responsible for implementation of energy efficiency programs (in close coordination with the utilities). Demand response programs are the responsibility of the State's electric and natural gas utilities.

A detailed portrait of this end-use sector is provided below. Figure 6 examines the end-use consumption characteristics for electricity, where per household average electricity use is 11,500 kWh per year.

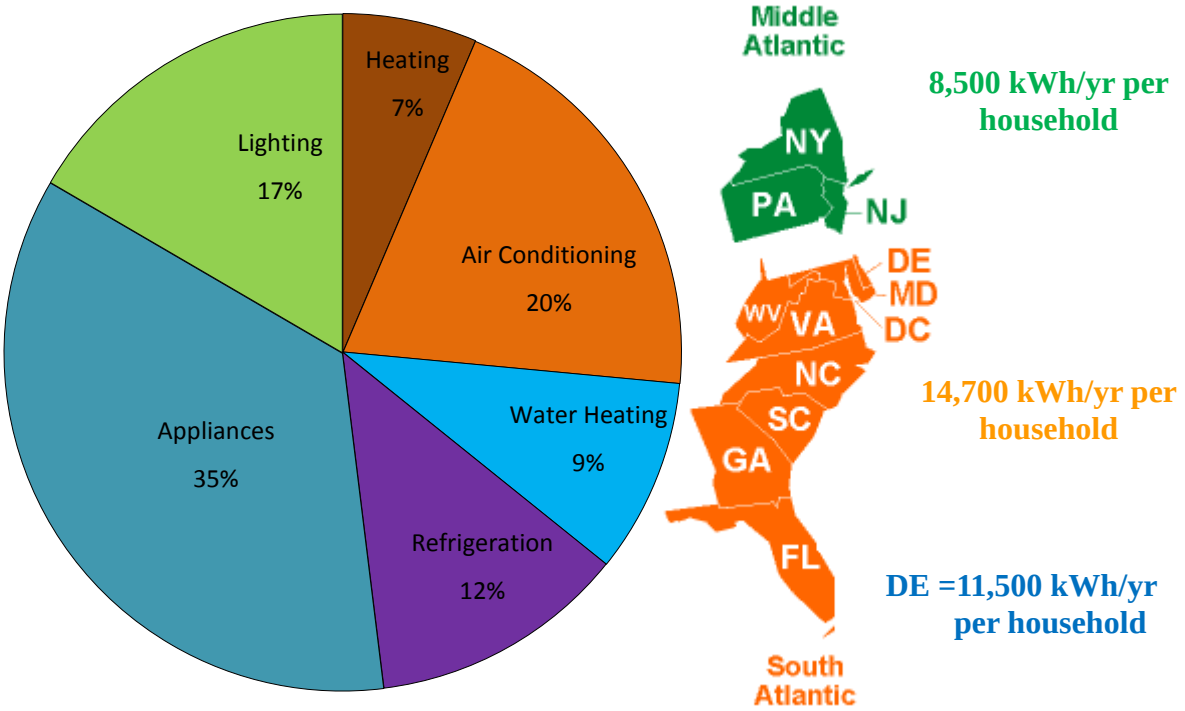


Figure 6. Residential Electricity Consumption by End Use
Derived from EIA, 2008.

Economic Potential of Electricity Savings in the Residential Sector

The economic potential for electricity savings is defined as the sum of efficiency measures whose levelized cost of savings is equal to or less than the projected electricity rate. The analysis of economic potential considers new measures to replace existing technologies as they reach the end of their useful life within the 5-year timeframe of the EERS statute. Thus, existing appliances whose measure life expires after 2015 are not considered for either cost or energy savings. Measures for single-family and multi-family residences are separately considered. This report estimates economic potential savings from electricity end-use efficiency improvements of 1,227 GWh through a variety of housing shell, appliance, and equipment upgrades (Table 4). Employing measures identified in Appendix A, in 2015 households in Delaware could save approximately 27.8% at an average levelized cost of savings of $0.04/kWh. Annual economic

efficiency potential per $1000 of program spending is estimated at 4.0-4.4 MWh, depending on administrative costs. These estimates are for savings over the five-year lifetime of the EERS and are a composite of savings for single- and multi-family housing. When separated, these housing segments differ in economic potential: single-family homes are projected to have an economic savings potential of 31%; households in multi-family buildings are projected to have a lower rate of 13%. Again, these estimates are for measures adopted in the five-year EERS timeframe.

Table 4. Residential Electricity-Economic Efficiency Potential and Costs by End-Use

End Use	Savings (GWh)	Savings per household (%)	Levelized Cost of Saved Energy ($/kWh)	Energy Saved per Incentive Paid (MWh per $1000)*
Improved Housing Shell Performance	388	8.8%	$0.04	3.0-3.2
HVAC Equipment Upgrades	64	1.4%	$0.08	2.1-2.2
Water Heating Upgrades	70	1.6%	$0.06	3.1-3.4
Lighting Upgrades	432	9.8%	$0.01	15.9-17.2
Refrigeration Upgrades	63	1.4%	$0.11	1.2-1.3
Furnace Fan Upgrades	49	1.1%	$0.03	4.4-4.8
Plug Load Upgrades	91	2.1%	$0.03	9.7-10.5
Electricity Use Feedback Install	71	1.6%	$0.05	3.7-4.0
Existing Homes Totals	1,227	27.8%	$0.04	4.0-4.4

* Assumes 15% and 25% administrative costs and equally shared incremental cost. These percentages were taken from studies completed by Eldridge et al. in ACEEE, 2008a: 55.
Source: CEEP model and calculations.

As illustrated in Figure 6, residential electricity consumption is principally driven by appliance use, heating and cooling, and lighting. Delaware straddles the Middle Atlantic amd South Atlantic regions used by EIA to report the results of its surveys on end use of energy. Averages were constructed from the data for both regions to characterize Delaware's electricity end uses. Without this adjustment, Delaware's winters and summers would be assumed to

resemble those of the Carolinas. An inspection of daily temperatures indicates the inaccuracy of such an assumption especially for the northernmost county of New Castle.

Because of differences such as levelized cost of savings and measure life, the percent of total electricity consumption for a given end-use does not necessarily translate to an equivalent economic savings potential. For example, lighting comprises 17% of total residential electricity consumption (Figure 6), but accounts for more than 33% of total cost-effective electricity savings potential (Figure 7). Light-emitting diodes (LED) fixtures could offer even greater potential energy savings, but are not yet considered cost-effective and were not included in this study (ACEEE, 2009: 16). Appliances comprise 35% of consumption but account for approximately 10% of potential savings. The economic potential for savings in residential electricity is estimated by end-use technology in Figure 7. Housing shell performance – characterized by improvements to insulation, duct-sealing, reduced air-infiltration, and upgraded windows – represents the largest wedge of economic potential, at more than 32% of total savings.

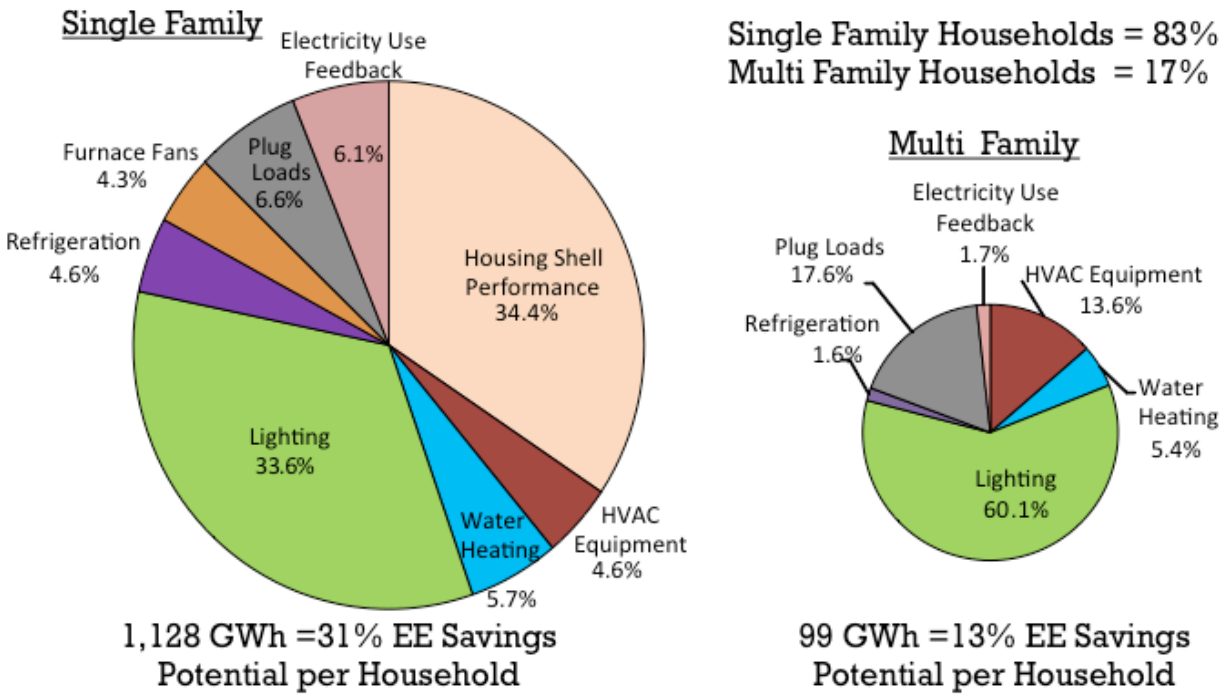


Figure 7. Residential Electricity-Economic Efficiency Potential by End-Use
Source: CEEP analysis

Economic Potential of Natural Gas Savings in the Residential Sector

Residential natural gas consumption is dominated by both space and water heating, at 63% and 28% of consumption, respectively (see Figure 8). These estimates are based on regionally reported survey data assembled by EIA (2008). Because Delaware straddles two of the EIA regions (Middle Atlantic and South Atlantic), averages were constructed to represent the state.[23] This report estimates an economic potential for residential natural gas savings of 1,850 MMCF by 2015 (Table 5). If realized, these energy savings would translate to approximately an 18.6% savings rate per household at an estimated levelized cost of natural gas saved of $5.50/MCF. As with electricity, this report primarily considers technologies whose measure life expires within the five-year timeline of the EERS (see Appendix A for a list of measures). Annual economic efficiency potential per $1,000 of program spending is estimated at 21.1-22.9 MCF, depending on the assumed level of administrative costs.

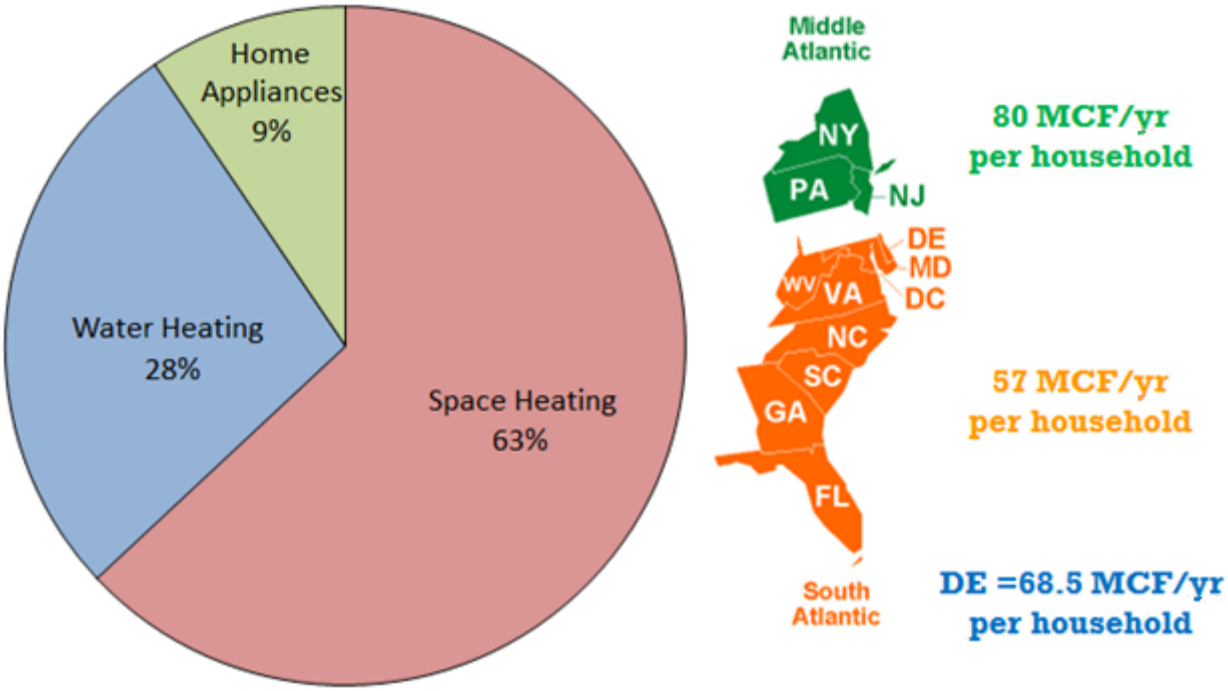


Figure 8. Residential Natural Gas Consumption by End Use
Source: Derived from EIA, 2008.

[23] Without averaging, Delaware would be assuming to have summers and winters similar to the Carolinas. This is not correct, especially for its northernmost county of New Castle.

Table 5. Residential Natural Gas-Economic Efficiency Potential and Costs by End-Use

End Use	Savings (MMCF)	Savings per house hold (%)	Levelized Cost of Saved Energy ($/MCF)	Energy Saved per Incentive Paid (MCF per $1000)*
Space Heating (Improved Shell Performance)	1,342	13.5%	$5.0	21.9-23.9
Space Heating (Equipment) Upgrades	167	1.7%	$7.2	15.2-16.5
Water Heating Upgrades	328	3.3%	$6.8	22.1-24.0
Cooking	14	0.1%	$8.6	16.3-17.7
Existing Homes	1,850	18.6%	$5.5	21.1-22.9

* Assumes 15% and 25% administrative costs and equally shared incremental cost.

As Figure 9 illustrates, housing shell improvements (mainly upgrades to windows, insulation, and added ductwork) offer the greatest opportunities to reduce natural gas consumption. These upgrades are less costly than space heating equipment upgrades (which account for an estimated 1.7% of household gas savings), as well as water heating and cooking upgrades (which account for 3.3% and 0.1% of potential savings respectively). Thus improvements to the building envelope represent the largest single savings potential for natural gas in Delaware's residential sector, and could save the average Delaware household as much as 13.5% in energy consumption and costs (Table 5).

Water heating, after space heating, comprises the second largest consumption of natural gas. The successful implementation of direct water heating efficiency measures such as improved water heaters and pipe insulation, combined with indirect end-use measures, such as low-flow showerheads and water-conserving dish- and clothes-washing machines, can result in a potential savings of approximately 328 MMCF, about 18% of total natural gas saved. Gains in efficiency may be realized by the replacement of electric and older natural gas cooking equipment with more efficient natural gas technologies, but the savings rate is estimated to be less than 1%. This is to be expected; these end-uses dominate residential natural gas use and technology improvements in both cases continue to be cost-effective and available in the market.

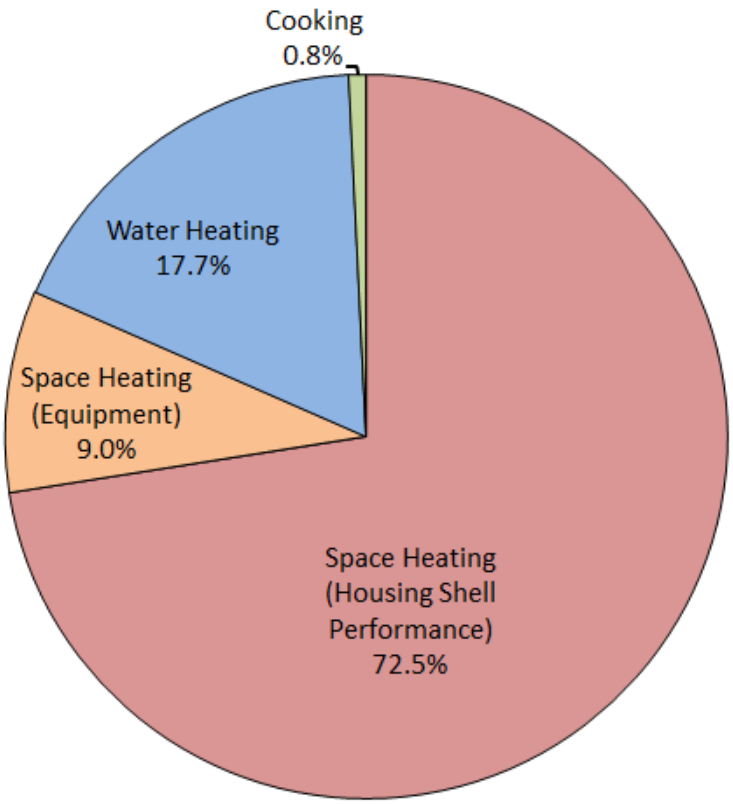


Figure 9. Residential Natural Gas-Economic Efficiency Potential by End-Use
Source: CEEP analysis

4.3.2 Commercial Energy Use and Economic Savings Potential

Delaware's commercial energy use is currently 4,321 GWh, or 36.4% of the state total for electricity consumption, and 8.6 billion cubic feet, or 17.9% of the state total for natural gas consumption (see Table 1). Economic savings potential were determined through research on 33 electricity efficiency measures and 25 natural gas efficiency measures (see Appendix B).

Economic Potential of Electricity Savings in the Commercial Electricity Sector

Figure 10 indicates that lighting is the single largest source of electricity consumption, and Table 6 reports estimates of electricity intensity for the commercial sector, based on surveys conducted by the EIA in 2003. Electricity use in Delaware's commercial sector stems mostly from lighting and HVAC end-uses. Lighting constitutes 38% of total commercial electricity consumption, more than twice that of any other single end-use category. Cooling and HVAC

related uses, such as ventilation, along with refrigeration, also command a significant wedge of consumption (41% of sector electricity use).

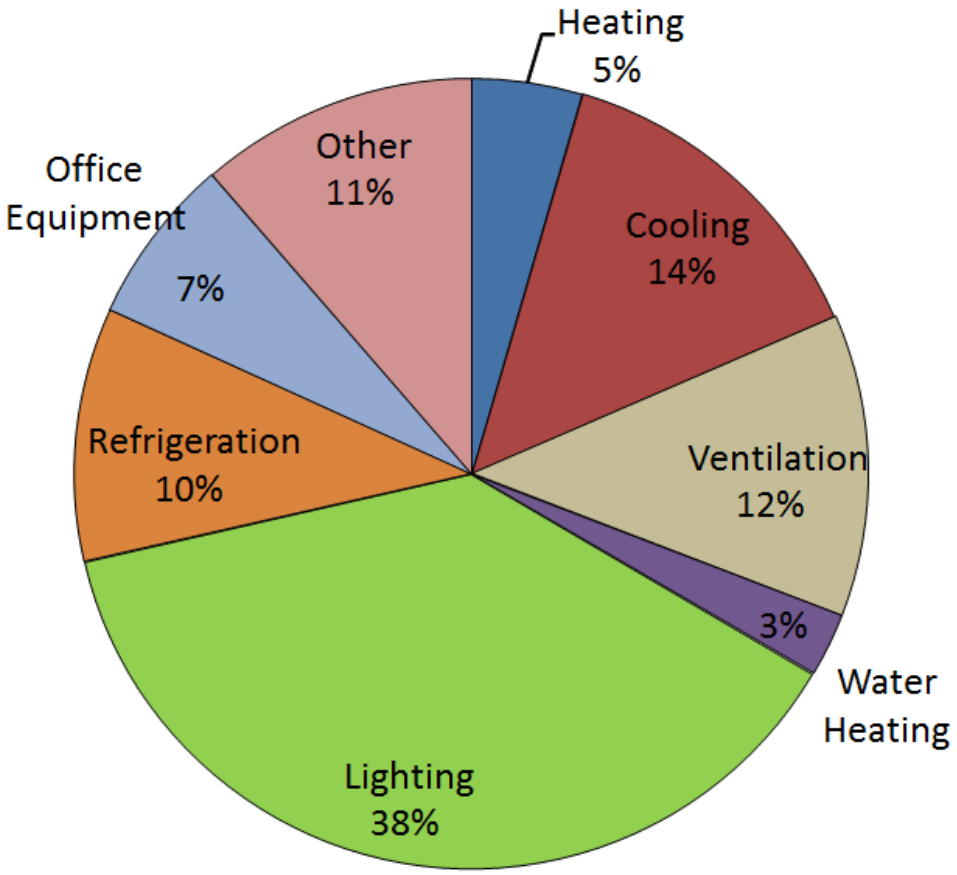


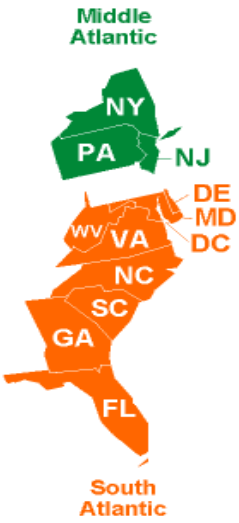
Figure 10. Commercial Electricity Consumption by End-Use
Source: Derived from EIA, 2003.

Electricity intensity of various measures is detailed in Table 6, and represents a valuable metric for evaluating the comparative potential of various end-use efficiency strategies in the commercial sector. Electricity intensity estimates for the commercial sector were derived by averaging available Energy Information Administration data from its 2003 *Commercial Buildings Energy Consumption Survey* (EIA, 2003). Because of the census division breakdown of the CBECS analysis, Delaware is included as part of the edge of the South Atlantics census region, although it also borders the Mid-Atlantic region. This report takes an average of aggregate data for the Mid-Atlantic and South Atlantic regions to find a more climate-specific electricity intensity for Delaware's commercial sector.

Table 6. Commercial Sector Electricity Intensity (kWh per SF)

End Use	Middle Atlantic	South Atlantic	Average
Heating	0.7	0.7	0.7
Cooling	1.0	3.3	2.2
Ventilation	1.7	2.1	1.9
Water Heating	0.2	0.6	0.4
Lighting	5.1	6.6	5.9
Refrigeration	1.2	2.0	1.6
Office Equipment	1.0	1.1	1.1
Other	1.6	1.9	1.8
Total	12.5	18.3	15.4

Source: Derived from EIA, CBECS 2003.



Economic potential for this sector was assessed using efficiency measures whose levelized cost of saved energy is equal to or lower than the current sector price for electricity. Both upgrades to expiring technologies and retrofits of still useful technologies and building shell elements were considered here, based on the estimated difference in lifetime savings and capital investment.

By evaluating a suite of 36 electricity efficiency measures implemented over the five-year timeframe, CEEP researchers estimate that the commercial sector could realize a total savings of approximately 800 GWh at an average levelized cost of saved electricity of 1.4 cents/kWh – well under the projected price of electricity for the sector (see Table 7). Approximately 12-13 MWh in savings are expected per $1,000 of program investments. A breakdown of this economic potential is provided by end-use technology in Figure 11.

Table 7. Commercial Electricity Economic Efficiency Potential & End-Use Costs

End-Use	Savings (GWh)	Savings (%)	Levelized Cost of Saved Energy ($/kWh)	Energy Saved per Incentive Paid (MWh per $1000)*
Building Shell Improvements	75.5	1.7%	$0.016	7.9-8.7
Heating & Cooling Upgrades (equipment & controls)	210.4	4.9%	$0.024	9.0-9.8
Water Heating Upgrades	12.1	0.3%	$0.043	4.5-4.9
Refrigeration Upgrades	51.6	1.2%	$0.021	10.3-11.2
Lighting Upgrades	293.9	6.8%	$0.012	15.5-17.0
Office Equipment Upgrades	167.6	3.9%	$0.001	NA
Appliance and Other Equipment Upgrades	0.9	0.0%	$0.065	2.9-3.2
Existing Buildings	812.1	18.8%	$0.014	11.8-12.9

* Assumes between 10% and 20% for administrative costs and equally shared incremental cost.

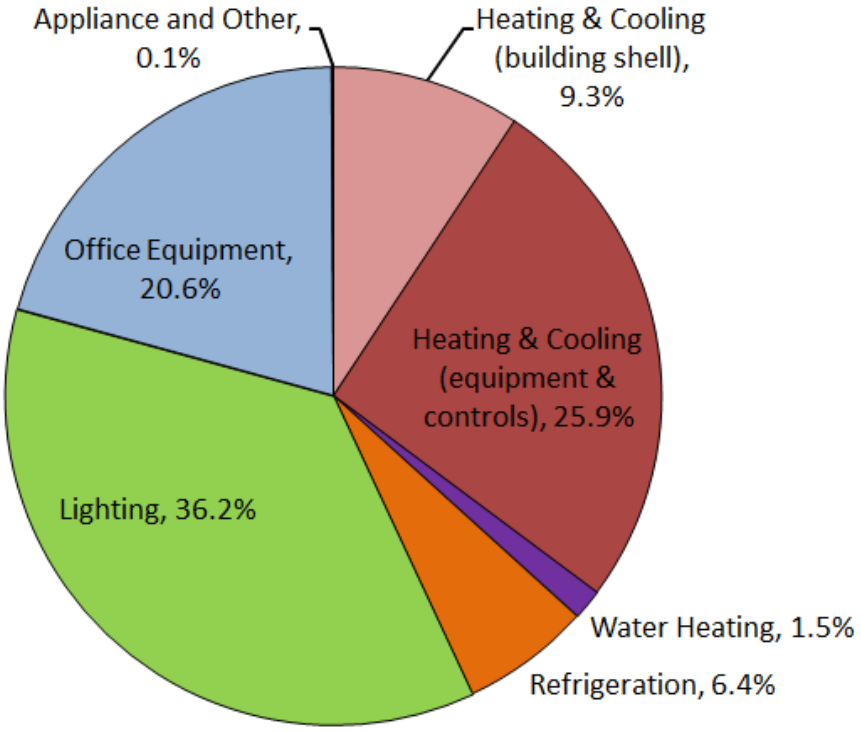


Figure 11. Commercial Electricity-Economic Efficiency Potential by End-Use
Source: CEEP analysis

Economic Potential of Natural Gas Savings in the Commercial Sector

The methodology to determine commercial natural gas end use percentage for the sector draws on EIA's 2003 Commercial Building Energy Consumption Survey data. The results for Delaware can be found in Figure 12. Delaware's commercial sector natural gas consumption is dominated by space heating (62%), followed by water heating (18%) and cooking (10%).

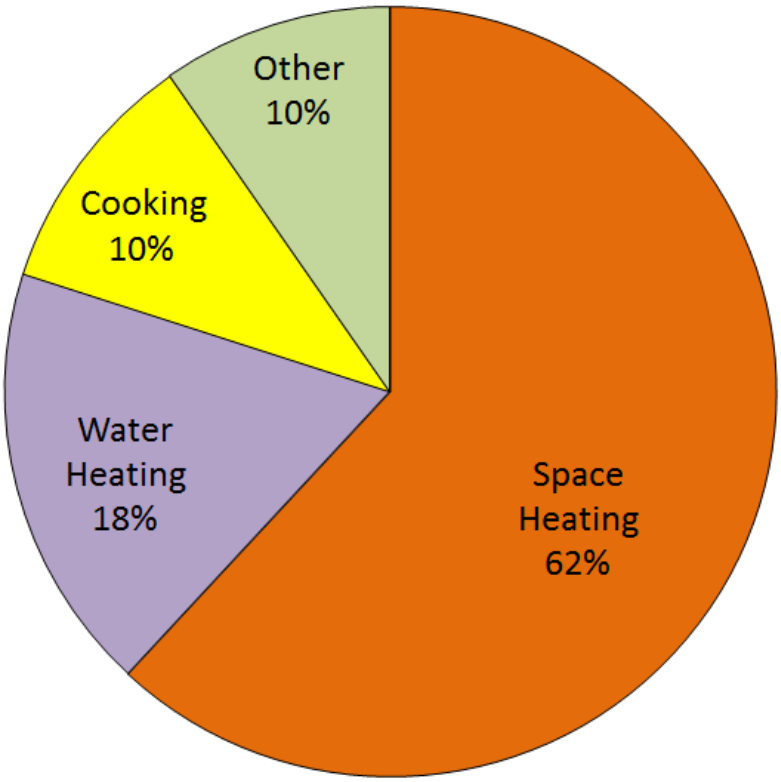


Figure 12. Commercial Natural Gas Consumption by End Use
Source: Derived from EIA, 2003.

Based on a menu of 28 natural gas efficiency measures implemented over the five-year timeframe of the EERS, CEEP researchers estimate that the commercial sector could realize savings of nearly 1,089 MMCF at an average levelized cost of natural gas saved of $2.77 cents/MCF – well under the projected price of natural gas for this sector. Potential cost-effective savings for the sector are estimated to be 12.6% for the five-year timeframe. Annual economic efficiency potential per $1,000 of program spending is estimated at 59.9-65.4 MCF (see Table 8). The breakdown of this economic potential by end-use technology is provided in Figure 13.

Table 8. Commercial Natural Gas-Economic Efficiency Potential End-use & Costs

End-Use	Savings (MMCF)	Savings (%)	Levelized Cost of Saved Energy ($/MCF)	Energy Saved per Incentive Paid (MCF per $1000)*
Building Shell	176	2.0%	$4.11	28.8-31.4
HVAC Equipment & Controls	414	4.8%	$2.26	68.4-74.6
Water Heating	77	0.9%	$2.56	59.0-64.4
Cooking	141	1.6%	$2.31	90.7-98.9
Other	281	3.3%	$2.95	89.1-97.2
Existing Buildings	1,089	12.6%	$2.77	59.9-65.4

* Assumes between 10% and 20% for administrative costs and equally shared incremental cost.

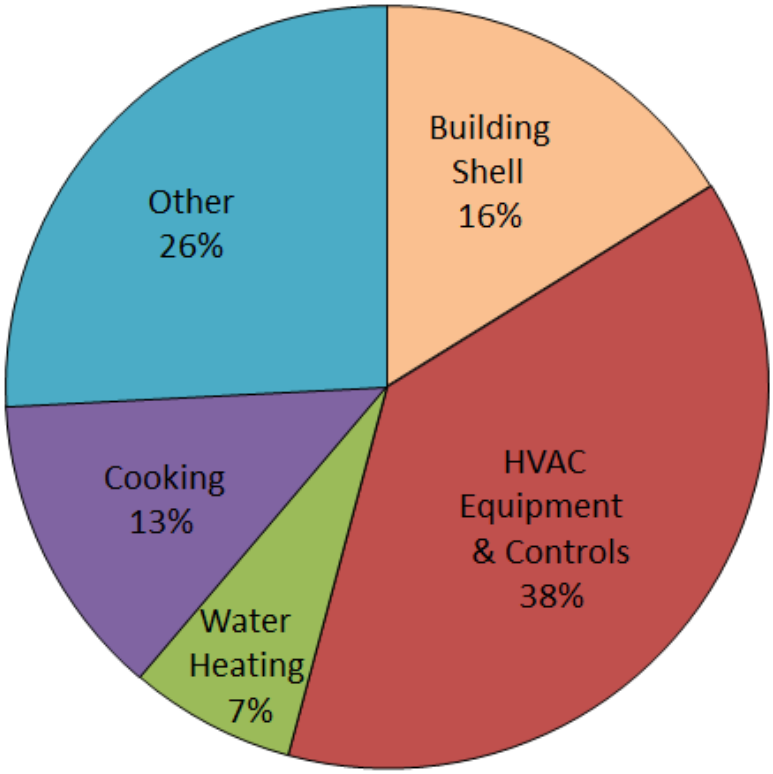


Figure 13. Commercial Natural Gas Economic Efficiency Potential By End-use
Source: CEEP analysis

4.3.3 Industrial Energy End Use and Economic Savings Potential

Delaware's industrial sector is comprised of a diverse group of manufacturing and other industrial companies. Different parts of the state are served by different types of industry, from a strong agricultural presence, consuming nearly 119,000 MWh in Southern Delaware, to a large chemical and pharmaceutical industry in Northern Delaware, consuming approximately 540,000 MWh and 415,000 MWh, respectively. Delaware's industrial electricity use is currently 3,078 GWh, or 25.9% of the state of Delaware's total electricity consumption, and 16 billion cubic feet, or 33% of the state total for natural gas consumption (see Table 1).

Economic Potential of Electricity Savings in the Industrial Sector

Electricity consumption in the industrial sector varies widely based on the type of industry being considered. Figure 14 displays the end-use characteristics for industrial electricity consumption. Motors account for the majority of the sector's electricity consumption (58.7%), while HVAC systems and non-HVAC process heating consume a further 22.5% of the sector's sales volume (Figure 14). A breakdown of the nearly 60% of sector electricity use for motor applications shows that pumps and motors associated with materials processing are the most common sources (12.4% and 16.3%, respectively). Table 9 identifies Delaware electricity consumption based on the NAICS classification system.

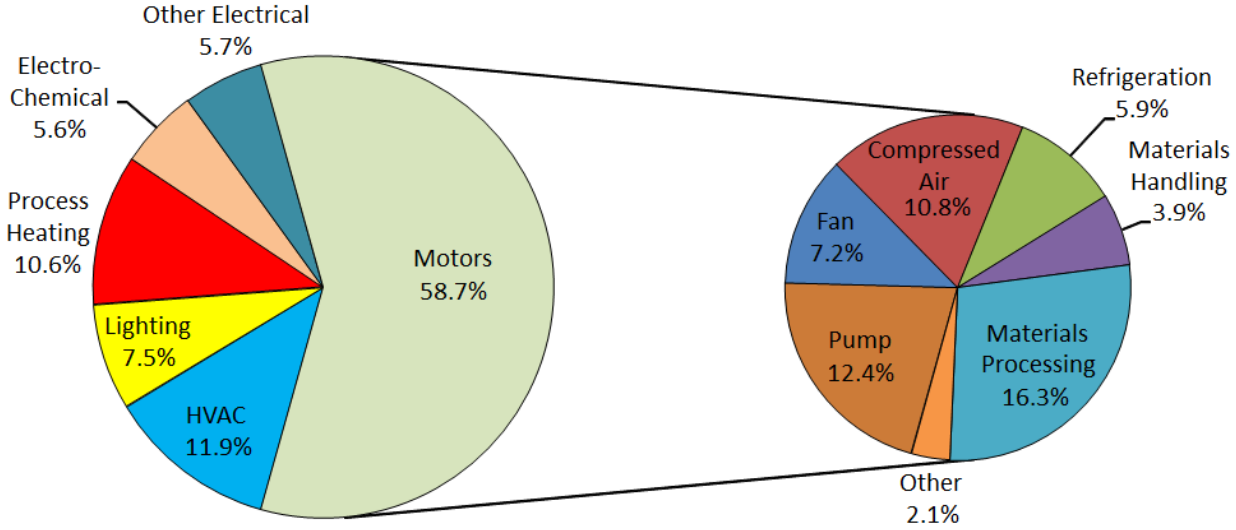


Figure 14. Weighted Average of Total DE Industrial Electricity End-Uses
Source: Derived from US Census Bureau, 2010; EIA 2010; XENERGY, 1998.

Table 9. Delaware 2007 Electricity Consumption by Industry

Industry	NAICS Code	Consumption (MWh)	%
Agriculture	**11**	**118,946**	**3.9%**
Construction	**21**	**98,118**	**3.2%**
Mining	**23**	**3,427**	**0.1%**
Manufacturing		**2,857,963**	**92.8%**
Food mfg	311	283,743	9.2%
Chemical mfg	325		
Basic chemical mfg	3251	249,219	8.1%
Pharmaceutical & medicine mfg	3254	416,087	13.5%
Soap, cleaning compound, & toilet preparation mfg	3256	56,386	1.8%
Other chemical mfg		289,699	9.4%
Plastics & rubber products mfg	326	140,458	4.6%
Nonmetallic mineral product mfg	327	78,457	2.5%
Fabricated metal product mfg	332	60,303	2.0%
Computer & electronic product mfg	334	60,914	2.0%
Transportation equipment mfg	336	193,566	6.3%
Furniture & related product mfg	337	18,665	0.6%
Miscellaneous mfg	339	32,436	1.1%
Other		978,029	31.8%
Total Industrial		**3,078,454**	**100.0%**

Sources: Derived from US Census Bureau, 2010; EIA, 2009; US Bureau of Economic Analysis, 2010.

A single comprehensive data set for Delaware's industrial sector electricity consumption was not available at the time of this report. EIA only reports total sector electricity sales volumes. For this reason, CEEP researchers needed to rely on several data sources. This circumstance meant that a significant wedge for the sector, amounting to 31.8% of its electricity use, falls into the category "Other" (Table 9). Additionally research is needed to better define consumption by type of industry in order to more accurately evaluate the economic and program potential of efficiency measures. With this caveat in mind, CEEP researchers were able to differentiate electricity use among several industrial classifications, summing to over two-thirds of the state's industrial sector.

Based on methodology outlined in an Itron 2006 report for California and an ACEEE 2009 report on energy efficiency potential for Pennsylvania, this report evaluates a range of 14 electricity efficiency measures with the greatest savings potential in this sector (See Appendix

C). The measures focus primarily on manufacturing process improvements. As illustrated in Figure 15, duct/pipe insulation (35%), motors (19%) and compressed air (18%) – all primarily used in manufacturing processes, rather than building operations – present the greatest potential savings.

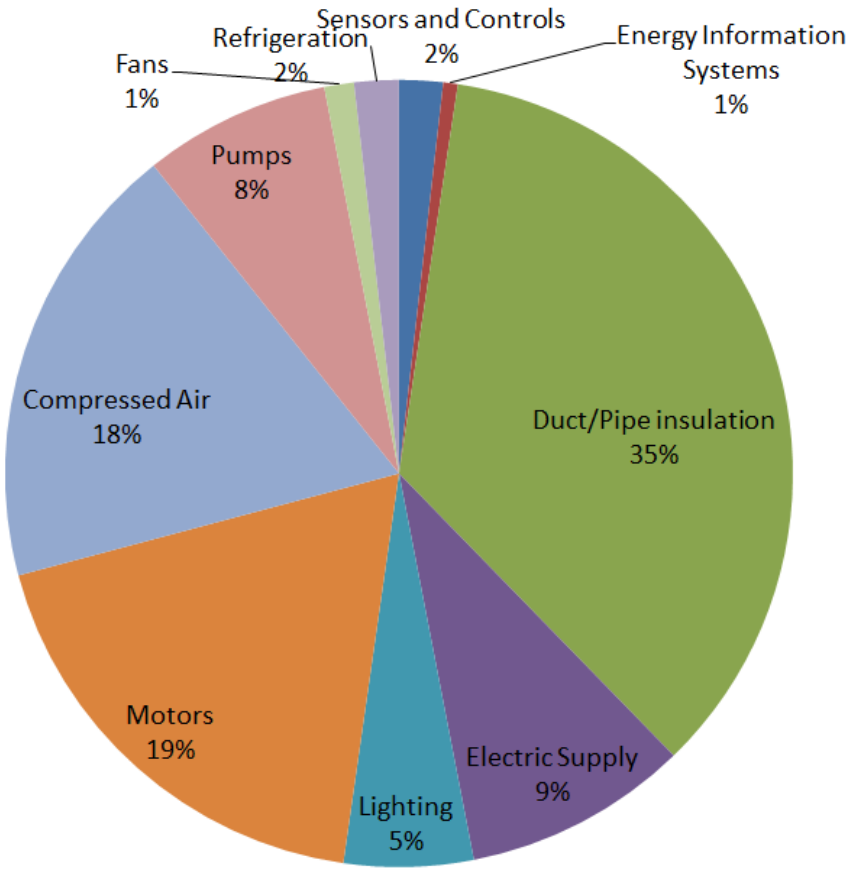


Figure 15. Industrial Electricity-Economic Efficiency Potential by End-Use
Source: CEEP analysis

The results in Table 10, below, represent CEEP's best estimates of cost-effective electricity savings based on the most current data available for the region and state. This report projects an economic potential savings of 463 GWh of electricity, at an average LCOE saved of 2.7 cents/kWh. Annual economic potential per $1,000 of program spending is estimated to be 5.9-6.2 MWh, depending on assumed administrative costs.

Table 10. Economic Potential of Industrial Sector Electricity Savings & Costs by End-Use

End-Use	Savings (GWh)	Savings (%)	Levelized Cost of Saved Energy ($/kWh)	Energy Saved per Incentive Paid (MWh per $1000)*
Sensors and Controls	5.6	0.2%	$0.014	12.0-12.5
Energy Information Systems	1.9	0.1%	$0.061	2.7-2.9
Duct/Pipe insulation	109.2	3.5%	$0.051	2.7-2.9
Electric Supply	28.6	0.9%	$0.010	16.7-17.5
Lighting	16.4	0.5%	$0.020	8.2-8.6
Motors	57.4	1.9%	$0.028	9.9-10.3
Compressed Air	57.1	1.9%	$0.001	NA
Pumps	23.7	0.8%	$0.008	21.0-21.9
Fans	3.8	0.1%	$0.024	7.0-7.3
Refrigeration	5.6	0.2%	$0.003	51.2-53.5
Subtotal	**309.3**	**10.1%**		
Additional savings at large energy-intensive facilities**	153.9	5.0%	NA	NA
Total	**463.2**	**15.1%**	**$0.027**	**5.9-6.2**

*Assumes between 10% and 15% administrative costs and equally shared incremental cost.
** ACEEE, 2008a for MD; ACEEE, 2009 for PA. For both states, ACEEE estimates additional savings opportunities from large, energy-intensive manufacturing facilities of 5%-10%. A rate of 5% was applied to Delaware.

Economic Potential of Natural Gas Savings in the Industrial Sector

Natural gas consumption by the industrial sector varies widely among the industries operating in the state. Manufacturing in the state consumes the vast majority of industrial sector natural gas – more than 93% (Table 11). Within the manufacturing category, the chemicals industry (includes basic chemistry, pharmaceutical, cleaning and other chemical products) is the largest single consumer of natural gas, at 36.3% of the sector total. Similar to industrial electricity consumption, a significant 34% of industrial natural gas consumption is allocated to unknown industrial applications due to previously discussed data limitations. Further investigation and data collection is necessary to fully interpret the distribution of natural gas use

among industries and effectively evaluate the economic potential of natural gas savings utilizing available technologies and known programs.

Figure 16 reports industrial sector natural gas sales by end use. The majority of industrial natural gas consumption is allocated to process heating (39%) and conventional boiler use (27%).

Table 11. Industrial Natural Gas Consumption by Type of Industry

Industry	NAICS Code	Consumption (MMCF)	%
Agriculture	**11**	**280**	**1.7%**
Construction	**21**	**824**	**5.1%**
Mining	**23**	**34**	**0.2%**
Manufacturing		**14,952**	**93.0%**
Food mfg	311	1,758	10.9%
Chemical mfg	325		
Basic chemical mfg	3251	1,459	9.1%
Pharmaceutical & medicine mfg	3254	1,423	8.8%
Soap, cleaning compound, & toilet preparation mfg	3256	233	1.4%
Other chemical mfg		2,728	17.0%
Plastics & rubber products mfg	326	221	1.4%
Nonmetallic mineral product mfg	327	611	3.8%
Fabricated metal product mfg	332	238	1.5%
Computer & electronic product mfg	334	63	0.4%
Transportation equipment mfg	336	668	4.2%
Furniture & related product mfg	337	26	0.2%
Miscellaneous mfg	339	53	0.3%
Other		5,470	34.0%
Total Industrial		**16,089**	**100.0%**

Sources: Derived from US Census Bureau, 2010; EIA, 2009; US Bureau of Economic Analysis, 2010.

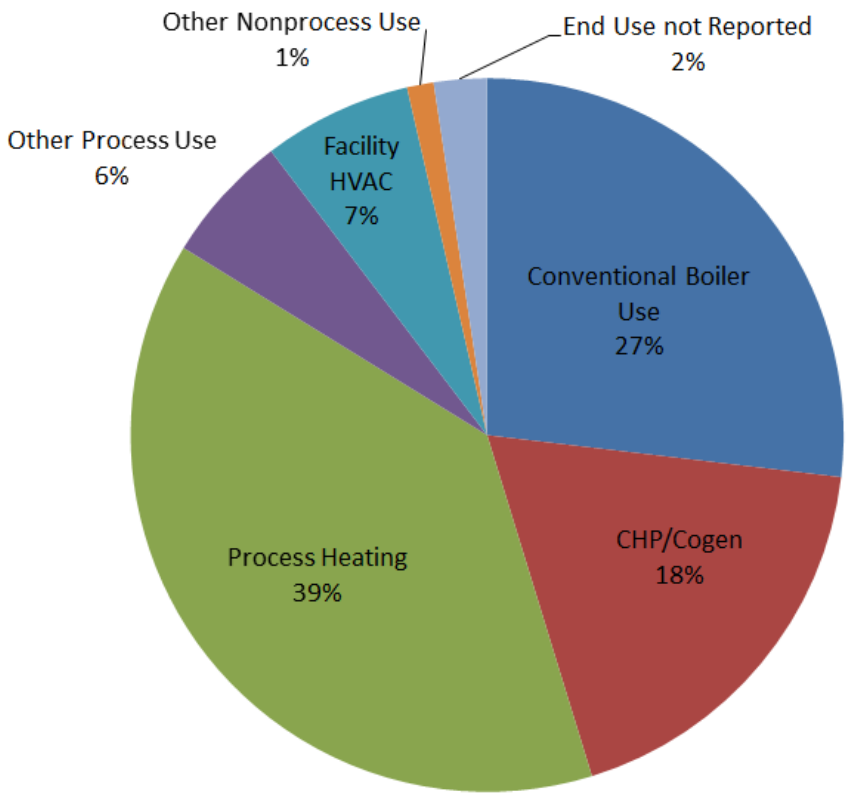


Figure 16. Industrial Natural Gas Consumption by End-use
Source: Derived from US Census Bureau, 2010; EIA 2010; XENERGY, 1998.

Boiler and process heating technologies consume the vast majority of the industrial sector's natural gas, and the economic potential for efficiency-based savings is also weighted heavily toward these applications. Specific measures are broken down in Figure 17. Steam trap and boiler maintenance together account for 36% of projected industrial sector natural gas efficiency potential. When all boiler efficiency measures are summed, 62% of the sector's economic potential for natural gas savings is projected to derive from improvements related to this technology and its use. Process heat measures represent an additional 36% of cost-effective savings. HVAC measures account for just 2% of economic potential for natural gas saving.

Table 12 presents CEEP's best estimates of cost-effective natural gas savings and the levelized cost of that saved energy. For the industrial sector, CEEP projects an economic potential savings of 1,828 MMCF from natural gas efficiency upgrades, at an average LCOE saved of $1.71/MMCF. Annual economic potential per $1,000 of program spending is estimated at 98.4-102.8 MCF, depending on assumptions about program administration costs.

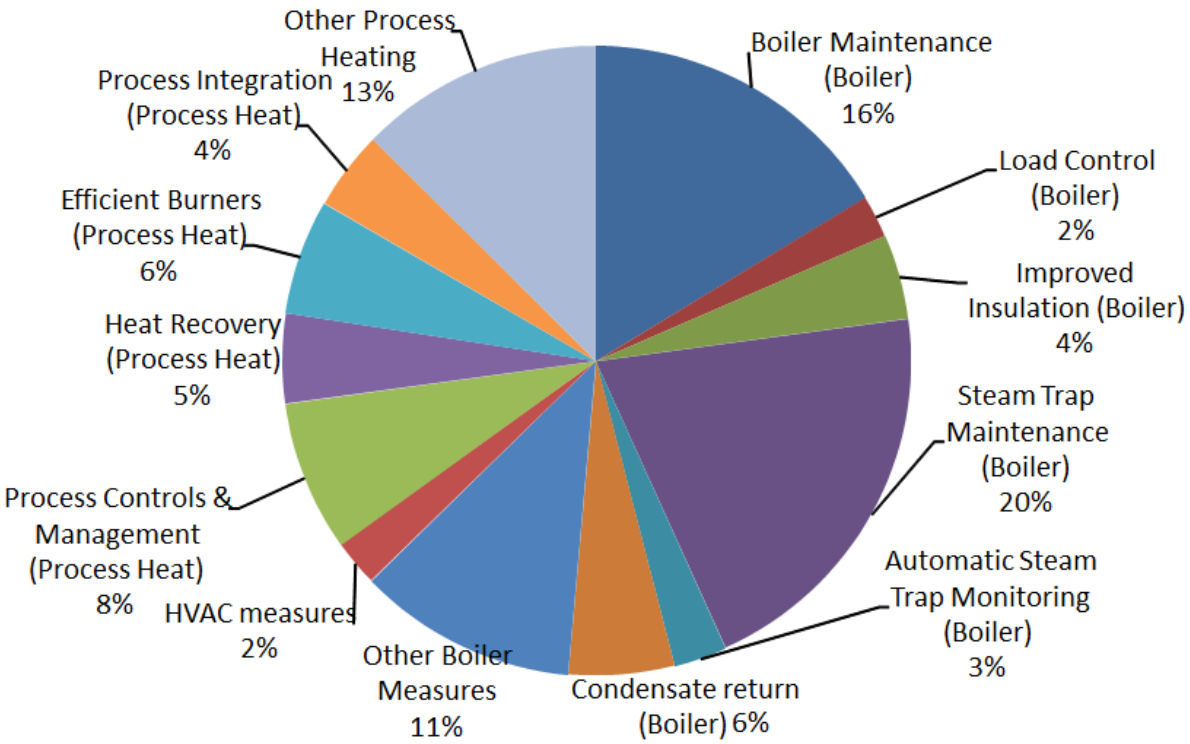


Figure 17. Industrial Natural Gas-Economic Efficiency Potential by End-use
Source: CEEP analysis.

Table 12. Economic Potential of Industrial Sector Natural Gas Savings & Costs by End-Use

End-Use	Savings (MMCF)	Savings (%)	Levelized Cost of Saved Energy ($/MCF)	Energy Saved per Incentive Paid (MCF per $1000)*
Boiler Measures	644	4.0%	$0.33	873.3-913.0
HVAC Measures	25	0.2%	$4.15	34.6-36.1
Process Heat Measures	359	2.2%	$4.02	39.9-41.8
Subtotal	**1,027**	**6.4%**		
Additional savings at large energy-intensive facilities**	801	5.0%	NA	NA
Total	**1,828**	**11.4%**	**$1.71**	**98.4-102.8**

* Assumes between 10% and 15% administrative costs and equally shared incremental cost.
** ACEEE, 2008a for MD; ACEEE, 2009 for PA. For both states, ACEEE estimates additional savings opportunities from large, energy-intensive manufacturing facilities of 5%-10%. A rate of 5% was applied to Delaware.

4.3.4 Additional Energy Savings Potential for Delaware

CEEP's report includes, in its energy impact and cost savings analyses, other program and projects outside of the anticipated EERS implementation scheme, but which contribute to DE reaching the targeted savings prescribed by SB 106. Additional energy savings over the five-year EERS timeframe were attributed to recently adopted new building energy codes. Effective July 1, 2010, new buildings constructed in Delaware must comply with the 2009 International Energy Conservation Code (IECC) for the residential sector and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2007 for commercial sector building (BCAP, 2010). According to calculations performed by the Building Codes Assistance Project (BCAP, 2010a) for the state of Delaware, by 2015 due to new building codes the state can annually save 0.6 trillion BTU in new residential and 1.0 trillion BTU in new commercial buildings, respectively. Based on EIA (2010c) data these savings correspond to 0.9% and 1.7% of total energy consumption in the residential and commercial sectors, respectively. Based on total electricity consumption in these sectors, additional electricity savings in the residential and commercial sector can be estimated at 40 GWh and 73 GWh, respectively. Likewise natural gas savings can be estimated at 90 MMCF for the residential sector and 147 MMCF for commercial sector.

Further savings can be captured by increased application of combined heat and power plants in the commercial and industrial sectors. Combined heat and power potential in Delaware's commercial sector by 2015 is derived from data in ACEEE's studies of CHP opportunities in Maryland and Pennsylvania. ACEEE estimates of generation potential in the two state studies ranged from 975 GWh in Maryland to nearly 2,800 GWh in Pennsylvania, delivering an average 2.8% of state commercial and industrial electricity consumption (Table 13). For Delaware, based on comparative electricity consumption among the states, this can correspond to 207 GWh potential savings for its commercial and industrial sectors. Financial data from the Pennsylvania study projected an annual savings of 14.7 MWh per $1,000 investment.

Table 13. Comparison CHP Potential for MD & PA

	New CHP Generation Potential (GWh)	CHP Potential Compared to State 2007 C&I Consumption (%)	Cumulative Investment (Cost $Million)	Cumulative Incentive Payments (Cost $Million)	Annual Savings (MWh per $1000)
Maryland	975	2.7%	NA	NA	NA
Pennsylvania	2,799	2.9%	442	191	14.7

Sources: ACEEE, 2009; ACEEE, 2008a

After estimated additional savings from new building codes and CHP applications are included, the total end-use economic potential for energy savings within the five-year EERS timeframe is estimated to be 23.8% for electricity and 14.5% for natural gas. These rates reflect measure life and turnover rates for the technologies that are targeted in CEEP's 200-measure list (Appendix A-C). The results by savings category are presented in Table 14.

While, due to insufficient data, CHP implementation costs are not included in the EERS implementation analysis, investment in energy savings through CHP technology, given its high capital cost but substantial energy savings, is an attractive potential extension for the GF program strategy (see Section 4.4 for greater details on GF strategy).

A final additional portion of non-EERS energy savings, applicable only to residential sector electricity and natural gas consumption, is government spending on low-income home-weatherization measures. While the EERS analysis considers weatherization across sectors, low-income home-weatherization targets this small proportion of the residential sector.

Table 14. Economic Potential for Delaware Electricity & Natural Gas Efficiency Savings

	Electricity Savings (GWh)	Natural Gas Savings (MMCF)
Residential	1,227	1,850
Commercial	812	1,089
Industrial	463	1,828
CHP	207	NA
New Building Codes	113	237
Total	2,822	5,004
% of 2007 Consumption	23.8%	14.5%

4.4 Program Potential of Energy Savings from Efficiency Measures

The report next explores the potential for electricity and natural gas savings established in Section 4.3 to be captured by actual programs. Two factors where considered in estimating program potential:

- General Program Design
- Likely Participation Rates.

This report considers two program designs to implement Delaware's EERS: Traditional Incentive (TI) and Green Financing (GF). Table 15 and Figure 18, below, break down the apportionment of costs by program design and full project implementation cost.

Table 15. Program Types and Costs

Traditional Incentive (TI) Cost Components
TI Project Cost = Base Unit Cost + Incremental Cost
TI Incremental Cost = Premium Cost* + Customer Administrative Cost** + TI Program Cost
TI Program Cost = Incentive Cost + Administrative Cost***
Green Finance (GF) Cost Components
GF Project Cost = Base Unit Cost + Incremental Cost of Higher Efficiency Bundle
GF Incremental Cost Basis = Incremental Cost + Administration Cost****
GF All Cost Basis = Base Unit Cost + Incremental Cost + Administrative Cost****

* Equals the additional cost of a higher efficiency measure after rebate financing subsidies are deducted, and which is borne on the customer.
** Assumes 2% customer burden for energy efficiency measure implementation.
*** 10%-25% rate applied to Incentive Cost for TI programs and varies by sector. Based on ACEEE 2008a.
**** Administrative costs of GF programs are assumed to be 2% of total project cost. Based on IRS Tax Code, Section 103, pertaining to tax-exempt bonds issued by non-profit entities.

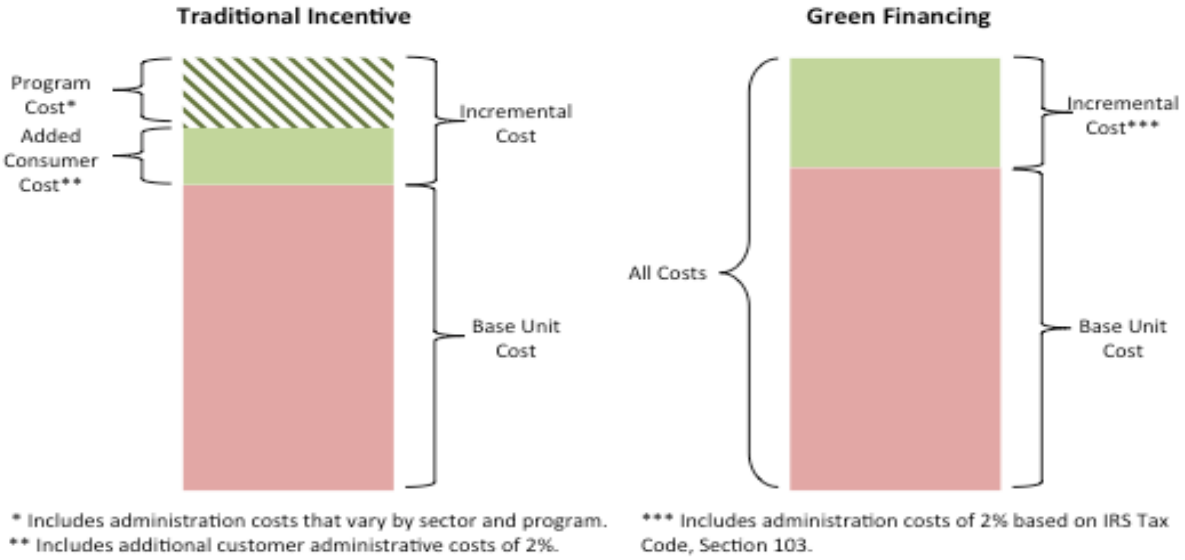


Figure 18. Breakdown of Project Cost Components

TI programs utilize premium buy-downs through rebates, low-cost financing and after-market techniques that have historically been used by state and utility EE programs. TI program costs reflect sector-wide aggregates of base unit and incremental costs. The primary components of the TI approach include the base unit cost (the aggregate cost of standard replacement technology), the premium over the base unit cost incurred by selecting more energy efficient alternative technologies, and program administration costs.. The incremental cost premium is broken into two portions: the program cost (that is, the cost of rebates or financing subsidies and program administration costs) and the customer cost (a portion of the premium borne by the customer, including a small additional administrative cost). For each modeled TI program, the cost includes an incentive equal to 50% of initial program costs, and administrative costs ranging between 10% and 25% depending upon the sector and program (ACEEE 2008a). The report also assumes and incorporates into its calculations of total TI incremental cost an added 2% for consumer administrative costs.

Funding for TI programs typically comes from grants and assessments on utility bills (such as system benefit charges). Fund replenishment depends upon continuation of government grants and regulatory support for dedicated assessments. Increased funding occurs if tax revenues dedicated for this purpose are increased, and/or if regulatory actions are taken to increase utility rates or revenues are set aside for the special purpose of investing in sustainable energy options.

TI programs have been extensively used by utilities, municipalities and cooperatives for 30 years. Usually, funding streams are allocated for measure-specific (e.g., CFL lights) or user and measure-specific (e.g., residential air conditioning) purposes. Because TI designs depend upon the use of public (such as taxes) or all-ratepayer (such as system benefit charges) sources, a detailed analytical system of independent monitoring and verification (M&V) is required. The estimates provided in this section (i.e. Section 4.4) are based on TI designs.

A second program design is Green Financing (GF). While in use for nearly as long, GF strategies tend to be concentrated in the public, commercial and industrial sectors. Models have been developed by energy service companies (ESCOs) in which guaranteed savings contracts are signed with clients and the guaranteed savings stream is then used to retire debt incurred on behalf of the investment. In the GF model, there are no upfront costs for the participants (unlike TI programs in which participants must pay or finance amounts not covered by the incentive).

This approach targets larger public and private sector buildings with high energy bills. Because the clients are large building owners, suites of actions, rather than specific measures are implemented. Maintenance and performance benchmarks are specified in contracts with penalties if an ESCO fails to perform. Funding is market-based, commonly tax-exempt and taxable bonds and various forms of bank financing. Availability of funds and efforts to increase capital flows depend upon the ability of guaranteed savings to be identified that can cover all costs associated with the investment (see Byrne & Allen, 2009 and 2010). This design often aggregates projects into participant pools in order to drive down administration and financing costs. As a result GF programs produce large-dollar transactions (usually in the millions of dollar)[24] and results in much higher energy savings per square foot (for example) – see LBNL, 2010. These programs are not dependent upon government or regulatory funding commitments and have grown faster than TI programs (although the range of participation is narrow).

Delaware's Sustainable Energy Utility is authorized to support GF programs. Because this approach attracts new private sector investment, it has a special ability to support economic development goals.

Section 4.5 develops estimates for GF opportunities in Delaware.

The other major factor affecting program potential is participation. A broad range of factors impact participation rates, including technology turnover within the defined evaluation period (here, through 2015), end-use relevance (the percentage of customers to whom an efficiency measure could apply), and the level of program funding and availability of capital to end users and its costs. For a given energy savings measure participation rates record effectiveness in diffusing a measure (e. g., the diffusion of Energy Star™ refrigerators). Among measures within a program there may be different participation rates (e. g., more participants might install CFL lighting compared to blown-in wall insulation).

On the aggregate level, participation rates reflect the average sector level of participation relative to the average energy savings per participant. Energy savings per participant will vary according to specific energy end-use characteristics and the number of end users who can participate. Differences can be pronounced in the industrial sector, where energy savings per

[24] Because the transaction involves millions of dollars, securitization plays a key role. Loss reserves and other financial supports are usually required to attract investors.

dollar value of shipments will notably differ among industries. Aggregate residential and commercial sector participation rates often vary less than those for the industrial sector.

Sections 4.4.1 - 4.4.3 report CEEP's estimates of program potential for TI programs only and are based on empirically observed participation rates by end-use sector. The report also "reverse engineered" the savings, solving for the participation rates necessary to reach the Green Target scenario.[25] Four TI participation rates are examined: (1) the empirically observed participation rates derived from leading states with energy efficiency programs (ACEEE 2009a-b and 2003a); (2) the empirically observed participation rates from the 'most aggressive' states reported in several studies (ACEEE 2009a-b, and ACEEE 2003a); and (3) the calculated participation rate required to meet the Green Target.

Participation rates in category (1) above were derived from 14 states with well-performing electricity efficiency programs and 10 states with highly ranked natural gas saving programs (ACEEE, 2009a; ACEEE, 2009b). For electricity, the average annual savings rate for the 14 states was reported at 0.75% annually; for natural gas, it was 0.43% (see Table 33 and). The method to obtain aggregate participation rates is to divide reported annual savings by annualized economic potential. The resultant electricity sector participation rate is 15.8%, and, for natural gas sector, is 15.0%, for a five-year program period (see Table 16).

An 'aggressive' participation rate is utilized for each utility fuel and is based on the highest observed participation in states that have well-performing programs. For electricity, 1.45% annual energy savings per year is used to derive a 30.5% participation rate for five years and is based on Vermont's performance; and a natural gas savings of 0.89% annually by Iowa corresponds to a 30.8% participation rate for five years. Table 16 summarizes these calculations.

Table 16. Efficiency Potential per Year and Participation Rates

	Electricity	Natural Gas
Annual Savings under Economic Potential	4.76%	2.89%
Annual Savings for Most Aggressive States	1.45%	0.89%
Annual Savings for Leading States	0.75%	0.43%
Derived Participation Rates for Most Aggressive States	30.5%	30.8%
Derived Participation Rates for Leading States	15.8%	15.0%

Sources for aggressive & leading states: ACEEE, 2009a; ACEEE, 2009b

[25] As explained in Section 4.2, the Red and Blue Targets are deemed by CEEP to be not feasible within the five-year timeframe established by the legislation, and is not considered in the program analysis.

The participation rates necessary to meet SB 106 targets (defined as the Green and Blue Target scenarios – see Section 3 and Section 4.2) are derived by dividing the consumption reduction requirement for each target by the savings per customer for each of the three end-use sectors. We then determine the program cost (for two levels of administrative costs) of reaching each target by dividing the "Energy Saved per Incentive Paid" (MWh or MCF per $1,000) for each end-use sector into the energy efficiency reduction requirement. Summary data for the Green Target and projected program cost for electricity and natural gas are provided below in Table 17 and Table 18.

Table 17. Total Electricity Savings and Program Cost: All Sectors using TI approach

2015 Scenario Energy Savings by Sector (GWH), Range of Program Costs, (Cumulative Savings)			
Estimated Annual Savings at 2015 EERS Target Year, Incremental Cost ($million)	Leading State Cumulative Participation Rate 15.8%	Most Aggressive State Cumulative Participation Rate 30.5%	Green Target* (Cumulative Participation Rate=53.0%)
Residential Savings (GWh) Incremental Cost ($million)	208 $44.3-$48.2	401 $85.5-$93.0	670
Commercial Savings (GWh) Incremental Cost ($million)	137 $18.2-$19.1	265 $27.5-$29.3	648
Industrial Savings (GWh) Incremental Cost ($million)	79 $17.7-418.3	151 $28.7-$29.8	462
Total Annual Savings (GWh)	424	817	1,780
Total Incremental Costs ($million) Cumulative Savings ($million)**	$80.2-$85.6 ($592.4)	$141.7-$152.1 ($1,141.9)	NA***

* Green Target participation rates vary by sector.

** Present value dollar savings ($million) includes total return to participants & program as applicable to a TI implementation.

*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

Table 18. Total Natural Gas Savings and Program Cost: All Sectors using TI approach

2015 Scenario Energy Savings by Sector (MMCF), Range of Program Costs, (Cumulative Savings)			
Estimated Annual Savings at 2015 EERS Target Year, Incremental Cost ($million)	Leading State Cumulative Participation Rate 15.0%	Most Aggressive State Cumulative Participation Rate 30.8%	Green Target* (Cumulative Participation Rate=67.0%)
Residential Savings (MMCF) Incremental Cost ($million)	277 $12.1-$13.2	570 $24.9-$27.0	1,000
Commercial Savings (MMCF) Incremental Cost ($million)	163 $2.5-$2.7	335 $5.1-$5.6	863
Industrial Savings (MMCF) Incremental Cost ($million)	274 $2.7-$2.8	563 $5.5-$5.7	1,601
Total Annual Savings (MMCF)	717	1,468	3,464
Total Incremental Costs ($million) Cumulative Savings ($million)**	$17.3-$18.7 ($125.5)	$35.5-$38.3 ($258.1)	NA***

* Green Target participation rates vary by sector.
** Present value dollar savings ($million) includes total return to participants & program as applicable to a TI implementation.
*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

4.4.1 Residential Potential (TI)

To reach the Green Target, the residential sector must achieve a 2015 reduction of electricity consumption by 670 GWh. Program savings include reduced transmission and distribution losses. Avoided T&D losses are calculated on the basis of total GWhs saved.[26]

The necessary cumulative five-year participation rates for the Green Target Scenario (see the last column) is projected to 51% (Table 19). This level of participation is indicative of Efficiency Vermont's Community Energy Initiatives, where for instance Hardwick and Northfield achieved 45% and 50% respective participation rates for their entire communities, "with savings totaling approximately 2,700 MWh" (Efficiency Vermont, 2008: ii).

[26] The impact of Delaware's implementation of new building codes and the impact of its existing weatherization assistance program were estimated at 18 GWh and 43 GWh, respectively. However, these estimated savings were not included in EERS saving and cost calculations reported in the tables of this report because the research team did not have the means to estimate the costs of these actions. The impact of building codes and expanded weatherization can be counted in energy savings estimates by adding 1.4% to the Green Target figures in Table 19.

Table 19. Meeting EERS Electricity Targets: Residential Sector TI Programs Savings

2015 Program Initiative (GWh Potential)	Cumulative Participation Rate 15.8% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.5% (Vermont – most aggressive state program)	Cumulative Participation Rate 51.0% (Green Target)
TI EE Programs	194	375	626
T&D Savings	14	26	44
Total Annual Savings	208	401	670
5-yr Percent Energy Savings compared to Green Target*			
Green Target	4.6%	9.0%	**15.0%**
Costs ($million)		5-yr Program Costs	
Incentive Cost ($m)**	$44.3-$48.2	$85.5-$93.0	$142.4-$156.7
Incremental Cost ($m)**	$83.6-$87.5	$161.4-$168.8	$267.9-$280.3

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 15% and 25% of total program costs. Costs reflect EE program costs only.

These participation rates are well above the observed cumulative rates from well-performing programs, which are usually in the aggregate range of 16% - 31% (see Table 16). When these participation rates are used, electricity savings of 208-401 GWh would be expected. Unless improved program participation can be realized, the residential sector's 5-year program potential may fall below 15% (most likely between 4.6% and 9.0%, depending upon the achieved participation rate; see Table 19).

To reach the Green Target by 2015, the residential sector must reduce natural gas consumption by 1,000 MMCF.[27] The necessary participation rates for Green scenario is projected at 54.1% (Table 20). Typical participation rates observed in well-performing natural gas savings programs for the residential sector range from less than 15% to 31% (cumulative) over a 5-year period. For this reason, CEEP projects likely savings to be between 277 MMCF and 570 MMCF, equivalent to a 2.7%-5.7% reduction from the 2007 baseline (Table 20).

[27] The impact of Delaware's implementation of new building codes and the impact of its existing weatherization assistance program were estimated at 90 MMCF and 37 MMCF, respectively. However, these estimated savings were not included in EERS saving and cost calculations reported in the tables of this report because the research team did not have the means to estimate the costs of these actions. The impact of building codes and expanded weatherization can be counted in energy savings estimates by adding 1.3% to the Green Target figures in Table 20.

Table 20. Meeting EERS Natural Gas Targets: Residential Sector TI Programs Savings

2015 Program Initiative (MMCF Potential)	Cumulative Participation Rate 15.0% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.8% (Iowa – most aggressive state program)	Cumulative Participation Rate 54.1% (Green Target)
TI EE Programs	277	570	1,000
	5-yr Percent Energy Savings compared to Green Target		
Green Target	2.7%	5.7%	**10.0%**
	5-yr Program Costs		
Incentive Cost ($million)** Incremental Cost ($million)**	$12.1-$13.2 $22.9-$23.9	$24.9-$27.0 $46.9-$49.1	$43.7-$47.4 $81.6-$85.4

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 15% and 25% of total program costs. Costs reflect EE program costs only.

4.4.2 Commercial Potential (TI)

To reach the Green Target by 2015, the commercial sector must reduce electricity consumption by 648 GWh. Savings from electricity efficiency programs, the impacts of efficiency programs on transmission and distribution losses are the possible sources of these savings.[28]

To reach the Green Target for Delaware's commercial sector, participation rates would need to be 74.6% (Table 21). These participation rates are well above the observed cumulative rates from well-performing programs, which are usually in the range of 16% - 31% (see Table 16). When these participation rates are used, electricity savings of 137-265 GWh would be expected. Unless improved program participation can be realized, the commercial sector's 5-year program potential may fall below 15% (most likely between 3.2% and 6.1%, depending upon achieved participation rate; see Table 21).

[28] The impact of Delaware's implementation of new building codes and utilization of combined heat and power (CHP) were estimated at 78 GWh and 129 GWh, respectively. CHP use was assumed to mirror the penetration rates used by ACEEE for its Maryland and Pennsylvania studies. These estimated savings were not included in EERS saving and cost calculations reported in the tables of this report because the research team did not have the means to estimate the costs of these actions. The impact of building codes and CHP utilization can be counted in energy savings estimates by adding 4.8% to the Green Target figures in Table 21Table 19.

Table 21. Meeting EERS Electricity Targets: Commercial Sector TI Programs Savings

2015 Program Initiative (GWh Potential)	Cumulative Participation Rate 15.8% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.5% (Vermont – most aggressive state program)	Cumulative Participation Rate 74.6% (Green Target)
TI EE Programs	128	248	606
T&D Savings	9	17	42
Total Annual Savings	137	265	648
	5-yr Percent Energy Savings compared to Green Target*		
Green Target	3.2%	6.1%	**15.0%**
	5-yr Program Costs		
Incentive Cost ($million)** Incremental Cost ($million)**	$10.0-$10.9 $19.2-$20.1	$19.3-$21.0 $37.1-$38.9	NA***

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 10% and 20% of total program costs. Costs reflect EE program costs only.
*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

To reach the Green Targets by 2015, the commercial sector must reduce natural gas consumption by 863 MMCF.[29] Only the savings needed from energy efficiency programs are used to determine their necessary participation rates. The necessary participation rate for Green Target is projected to be 79.2%.

Table 22. Meeting EERS Natural Gas Targets: Commercial Sector TI Programs Savings

2015 Program Initiative (MMCF Potential)	Cumulative Participation Rate 15.0% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.8% (Iowa – most aggressive state program)	Cumulative Participation Rate 79.2% (Green Target)
TI EE Programs	163	335	863
	5-yr Percent Energy Savings compared to Green Target*		
Green Target	1.9%	3.9%	**10.0%**
	5-yr Program Costs		
Incentive Cost ($million)** Incremental Cost ($million)**	$2.5-$2.7 $4.8-$5.0	$5.1-$5.6 $9.9-$10.4	NA***

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 10% and 20% of total program costs. Costs reflect EE program costs only.
*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

[29] The impact of Delaware's implementation of new building codes was estimated at 147 MMCF. These estimated savings were not included in EERS saving and cost calculations reported in the tables of this report because the research team did not have the means to estimate the cost of this action.

A review of empirical studies of commercial sector program participation suggests that the cumulative rate of participation (i.e., the percent of the sector's square footage which would be pledged to natural efficiency programs) is likely to fall between 15% and 31%, with resultant natural gas savings in the 167-335 MMCF range (Table 22). Saving from compliance with state building standards and codes were estimated at 147 MMCF. However these savings were not included in energy savings and costs calculations.

4.4.3 Industrial Potential (TI and Other Programs Only)

To reach the Green Target by 2015, the industrial sector must reduce electricity consumption by 462 GWh. Savings from electricity efficiency programs are used to determine necessary participation rates and program costs. Additional savings will be realized by the impacts of reduced transmission and distribution losses.[30] The necessary participation rates for Green Target scenario is 75% (Table 23). CEEP's review of empirical studies of industrial sector participation in electricity efficiency programs suggests that rates over the five-year period are likely to be between 15% and 31%. For this reason, CEEP regards a more realistic program potential for this sector to attain savings of 78 GWh to 151 GWh in 2015 (Table 23).

[30] The impact of utilization of combined heat and power (CHP) were estimated at 92 GWh. CHP use was assumed to mirror the penetration rates used by ACEEE for its Maryland and Pennsylvania studies. These estimated savings were not included in EERS saving and cost calculations reported in tables of this report because the research team did not have the means to estimate the costs of these actions. The impact of CHP utilization can be counted in energy savings estimates by adding 3.2% to the Green Target figures in Table 23.

Table 23. Meeting EERS Electricity Targets: Industrial Sector TI Programs Savings

2015 Program Initiative (GWh Potential)	Cumulative Participation Rate 15.8% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.5% (Vermont – most aggressive state program)	Cumulative Participation Rate 75% (Green Target)
TI EE Programs	73	141	345
T&D Savings	5	10	30
Total Annual Savings	78	151	462
	5-yr Percent Energy Savings compared to Green Target*		
Green Target	3.2%	6.1%	**15.0%**
	5-yr Program Costs		
Incentive Cost ($million)**	$11.8-$12.4	$22.9-$23.9	NA***
Incremental Cost ($million)**	$22.8-$23.4	$44.1-$45.1	

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 10% and 15% of total program costs.
*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

To reach the Green Target by 2015, the industrial sector must reduce natural gas consumption by 1,601 MMCF. Savings from energy efficiency measures are used to determine necessary participation rates for sector programs. The necessary participation rates for each scenario are projected to range from 88% to 93%. CEEP's review of empirical studies of industrial sector participation in natural gas efficiency programs suggests that rates over the five-year period are likely to be between 15% and 31%. For this reason, CEEP regards a more realistic program potential for this sector to realize savings of 274 MMCF to 563 MMCF in 2015 (Table 24).

Table 24. Meeting EERS Natural Gas Targets: Industrial Sector TI Programs Savings

2015 Program Initiative (MMCF Potential)	Cumulative Participation Rate 15.0% (Average for 14 aggressive state programs)	Cumulative Participation Rate 30.8% (Iowa – most aggressive state program)	Cumulative Participation Rate 88% (Green Target)
TI EE Programs	274	563	1,601
	5-yr Percent Energy Savings compared to Green Target*		
Green Target	1.7%	3.5%	**10.0%**
	5-yr Program Costs		
Incentive Cost ($million)** Incremental Cost ($million)**	$2.7-$2.8 $5.1-$5.3	$5.5-$5.7 $10.6-$10.8	NA***

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be between 10% and 15% of total program costs.
*** Cost estimates are not provided because satisfaction of the Target is impossible by use of TI programs only.

4.5 Energy Savings Potential: an SEU Framework of Green Financing (GF)

While the above implementation pathways may seem aggressive given a history of relative inaction in Delaware,[31] the state has a special advantage in meeting an ambitious EERS – its Sustainable Energy Utility (SEU). As a statewide utility focused on renewable energy and energy efficiency, the SEU is an innovative public-private partnership model focused exclusively on delivering sustainable energy services. Using one of the SEU's special tools – a Green Energy Savings Bond (see Byrne & Allen 2009 and 2010) – the energy efficiency potential is modeled for a GF program. Using already designed SEU bonding structures, a GF approach produces self-financing delivery of sustainable energy services. This section reports CEEP's best estimate of an SEU-based GF program potential to capture higher energy savings per participant with investment structures that can recirculate those savings back into the program – a prominent advantage over conventional EE programs.

Delaware's SEU is characterized by a number of distinct features: comprehensive programs, flexible incentives combined with a long-term policy framework, private sector-based capital procurement and program financing, and competitively bid projects based on guaranteed energy savings agreements. Achieving consistent and aggressive energy efficiency savings requires a

[31] In 2008, before the SEU was implemented, ACEEE ranked Delaware as tied for last place among 50 states in energy efficiency (ACEEE, 2008b).

comprehensive policy framework to address multiple barriers such as conventional energy use subsidies, supplying timely and relevant pricing information, contending with differentiated energy burdens across sectors, and the educational and trust gap in energy efficiency projects (Sovacool, 2009). Delaware's SEU, as the most comprehensive energy efficiency and renewable energy services model (see Houck & Rickerson, 2009), leads the nation in creating a policy framework for meeting Delaware's aggressive EERS goals. A key feature of Delaware's SEU framework is the utilization of the historical experience in performance-based energy service contracts and novel financing arrangements combined with guaranteed dollar savings contracts.

4.5.1 SEU Green Financing: Performance Contracting and Guaranteed Savings[32]

Delaware's SEU capitalizes on a private-public policy framework using monetized sustainable energy savings supported by performance-based energy service agreements – an administrative structure that is comprehensive, public-benefit based, responsive to the market, flexible, and managed by a public board (Houck & Rickerson, 2009). Capital procurement and self-financing for SEU capitalization operates within five funding vehicles ranging from tax-exempt public bonds to private investments and the coordination of bank funding (Byrne & Allen, 2010). Noteworthy for energy efficiency financing, the SEU Green Financing program offers several bonds of particular importance for their potential to attract new participants with savings rates that are much higher than TI approaches. Figure 19 offers an overview of Green Energy Saving Bond (GESBs), applicable to the public buildings, colleges and universities, schools, hospitals, and non-profits.

[32] In Sections 4.4.2 and 4.4.3, combined heat and power (CHP) opportunities were estimated. Such projects are amendable to bond financing – the key financing tool examined in this section. These savings could be readably assessed through Green Financing and included in a GF program.

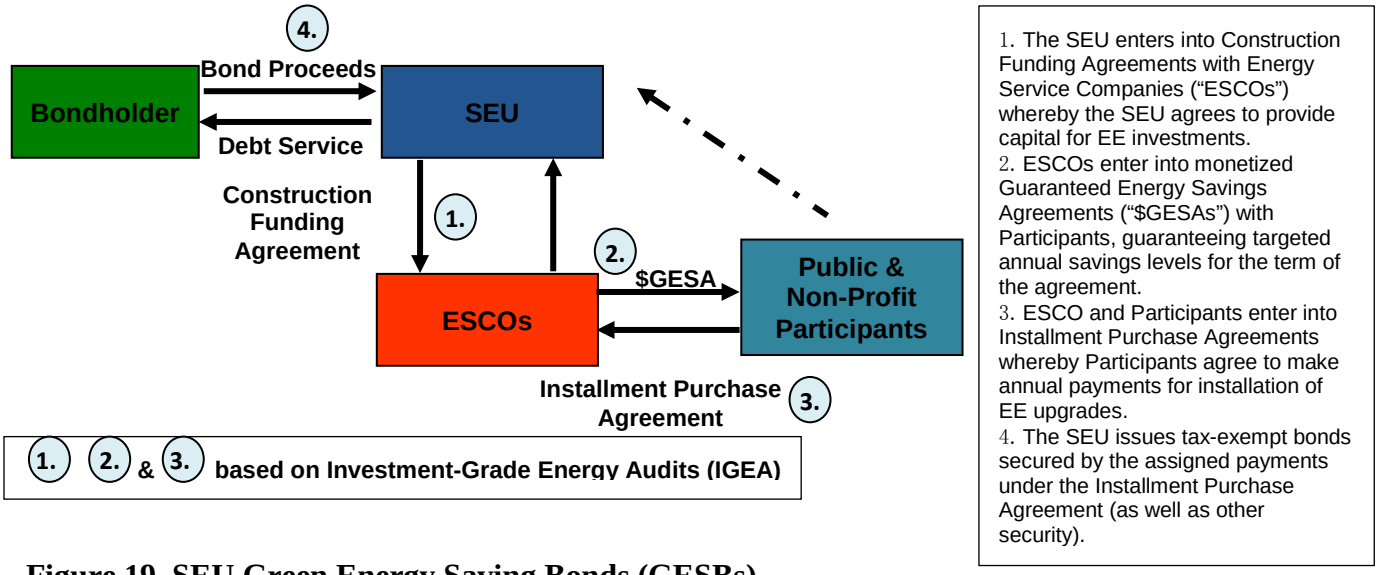


Figure 19. SEU Green Energy Saving Bonds (GESBs)
Source: adapted from Byrne & Allen, 2010

Green Energy Saving Bonds (GESBs), shown in Figure 19, are tax-exempt bonds issued by the SEU to provide capital for energy retrofits & renewable energy projects for public buildings, colleges and universities, schools, hospitals, and non-profit agencies. GESBs are secured by monetized Guaranteed Savings Agreements ($GESAs), which pledge bond payback savings and lower overall energy usage charges from retrofit and renewable energy projects.[33] Compared to Traditional Incentive (TI) energy efficiency programs, the GESB is able to recirculate program savings for continued GF implementation that establishes a long-term self-financing mechanism for energy efficiency. Houck & Rickerson (2009:101) summarize this well, stating that the "SEU … has the flexibility to operate much like an enterprise, where revenue streams from program activities repay liabilities, replenish public incentive funds, and enable program expansion."

SEU bond financing builds upon the historical experience of energy service companies (ESCOs) who have used guaranteed energy savings contracts for more than 20 years (LBNL, 2010). The innovative GESB enables investment in comprehensive projects at lower interest rates that in turn are anticipated to yield higher savings per participant. Guaranteed energy savings performance is based on standardized measurement and verification systems provided by the U.S. Department of Energy's International Performance Measurement and Verification

[33] Initially, the market will require additional security since this bond design is new.

Protocol (IPMVP) (DOE, 2002), an industry standard and requirement in several states that ensures reliability, predictability and enforceability (Vine, et al., 2007).

Financing to meet EERS goals can be supported in part by tax-exempt GESBs and the other SEU green financing vehicles.[34] Bond financing for guaranteed savings through $GESAs offers two distinct advantages that facilitate the pursuit of aggressive EERS goals. First, bond securitized energy efficiency projects have a lower risk index yet give a higher average return index compared to other typical investments (after ACEEE, 2008). In this way, GESBs enable "energy efficiency investments not previously available" (Jackson, 2010: 3872)[35]. Second, Green Financing can aggregate guaranteed energy savings in a comprehensive SEU framework, lowering cost administration and financing opportunities. By bundling and integrating capital intensive long-term projects with projects that have shorter payback periods, the GF approach can drive down long-term energy costs while deploying energy efficiency's "low-hanging fruit" to build the market. The end result "overcom[es] the upfront cost of sustainable energy measures, and structur[es] sustainable energy programs to grow without significantly increasing rate impacts" (Houck & Rickerson, 2009: 101).

4.5.2 Savings Potential of an SEU Administered GF Program

Quantifying the savings potential is hampered by the fact that ESCOs are private entities and typically do not release information on their contracts. Limited data exists (see, e.g., LBNL, 2010) and CEEP researchers were able to convince some companies to share information on recent projects.[36] At the same time, it is worth noting that energy efficiency measurement protocols have proven to be reliable, and California has shown that post-implementation measurements of actual energy savings "did not produce significant adjustments to [pre-installation energy savings] forecasts of net resource benefits once the actual program costs and program participation had been verified" (Vine, et al., 2007: 278). Because performance-based contracting adheres to these protocols, California's finding that ex-post impacts comport well

[34] Onsite renewable energy investments can be included in a GF program by the use of on-bill financing by public and non-profit participation. This option is not considered in this report (see Byrne & Allen, 2010)

[35] Jackson (2010: 3872) furthermore points out that "unlike the mortgage-backed securities that created the financial crisis of 2008, risk associated with efficiency investment-backed securities can be quantitatively measured and represented with [Value-at-Risk]-based analysis providing the improved risk transparency that will be required of future securitizations."

[36] CEEP has agreed not to identify the ESCOs. The information it received did not include the identities of the project participants.

with pre-installation calculated savings bodes well for expanding Delaware's performance-based energy services contracting.

Public, Non-Profit, & Private-Commercial Sector GF-induced Program Savings

For the past two decades, Lawrence Berkeley National Laboratory has published detailed reports on the ESCO industry, with the latest report released in June of this year (LBNL, 2010). With revenues of approximately $4.1 billion, the industry has grown by an order of magnitude since the early 1990s. The industry is expected to continue to grow by 26% through 2011, with many ESCOs noting "an increased demand by customers for more comprehensive and thus more capital-intensive retrofit strategies" (LBNL, 2010: vii-ix). The majority of ESCO revenues, about 84%, have been from guaranteed savings contracts with their primary customer base, municipal and state governments, universities and colleges, K-12 schools, hospitals, and non-profit agencies. This performance reflects the strong historical success of the ESCO $GESA model, and suggests a real opportunity exists for the $GESA strategy in Delaware.[37] A Delaware success story is a 2008 ENERGY STAR Top Performer, the Red Clay Consolidated School District in Wilmington, Delaware that since 2004 "has succeeded in improving district energy efficiency by more than 30 percent" (*EnergyStar* RedClay, 2008). Serving approximately 16,000 students in 25 facilities that have a combined building footprint of more than 2.8 million square feet, their energy efficiency measures yielded $4 million in savings during 2004-2008. Building on Red Clay Consolidated School District's success, performance contracting through SEU Green Financing has the potential to expand energy savings to "top performance" levels by facilitating much higher energy savings per participant than the typical rates for TI programs, 1% - 15% per participant.

For the public and non-profit sectors, the study likewise restricts GF strategies to 16% of the square footage of the building stock.

While currently representing one-fourth of the ESCO market, large private-commercial buildings and industrial facilities have begun to use the $GESA model to drive down energy costs. Recognizing that these participants are a small part of the sector, this study assumes only 16% of the square footage of the private, commercial buildings would be suitable for this

[37] Until now, Delaware's public and non-profit sectors have not taken advantage of performance contracting.

situation; and only 10% of industrial facilities are assumed to be good candidates for GF approaches.

This means that the GF strategy is capped at the lowest participation rates used in the study. On the other hand, the energy intensity of buildings in GF projects are expected to be one-third higher and measures chosen for these projects are projected to save 30% of annual energy consumption (compared to 3% - 12% for TI participants – see LBNL, 2010 and ACEEE 2009a-b).

Table 25. Meeting EERS Electricity Targets: GF Approach for Public, Non-Profit & Commercial Buildings

2015 Program Initiative (GWh Potential)	Performance Contracting Cumulative Participation Rate 15.8%
EE Annual Improvement from *GF*	319
Additional T&D Savings	22
Total Annual GF-induced Savings	342
5-yr Percent Energy Savings Compared to Green Target*	
GF-induced Improvement (*Commercial Sector only*)	7.9%
Green Target (*Commercial Sector only*: *TI + GF*)	**11.1%**
% Contribution of GF to EERS (*All Sectors*)	2.9%
5-yr Program Costs	
Incremental Cost ($million)**	$28.9

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be 2% of total program costs; federal regulations cap these costs for tax-exempt bonds; performance contracts finance the full project price.

CEEP estimates the target-year electricity savings for an SEU administered GF program focused on 16% of public, non-profit and private-commercial building square footage to be 342 GWh (including avoided T&D losses – see **Error! Reference source not found.**). Alone, this GF program-savings would be more than twice that of TI programs saving in the sector (see Table 21; excludes savings from building code and CHP). The GF program would add approximately a 7.9% reduction in commercial sector electricity sales, raising the sectors conservation rate at 11.1% (Green Target Scenario) after the impacts of TI programs are included. When the GF impact is evaluated on an all-sector basis, its contribution to the EERS

2015 goal is 2.9% - impressive when one considers this is the impact for a program targeted to a small portion of Delaware's building stock.

The added cost on a GWh basis is well below that for TI programs. While financing $28.9 million of sustainable energy investments to cover incremental costs of higher efficiency bundles, the GF initiative would cost only $84.5 thousand per saved GWh, compared to a TI cost of $140.1-$146.1 thousand per saved GWh.

Applying the same methodology to estimate the effects of a GF commercial buildings strategy for natural gas, Table 26 reports GF-induced annual savings of 259 MMCF. Total 5th-year sector savings improve 4.9% (assessed against the Green Target) - impressive again when one considers that this would contribute nearly 50% more to the 163 MMCF of saving from the TI programs (see Table 22), and this the impact for a program targeted to a small portion of Delaware's building stock.

The added cost on a MMCF basis is well below that for TI programs. While financing $4.5 million of sustainable energy investments to cover incremental costs of higher efficiency bundles, the GF initiative would cost only $17.4 thousand per saved MMCF, compared to the TI cost of $29.4-$30.7 thousand per saved MMCF.

Table 26. Meeting EERS Natural Gas Targets: GF Approach for Public, Non-Profit & Commercial Buildings

2015 Program Initiative (MMCF Potential)	Performance Contracting Cumulative Participation Rate 15.0%
EE Annual Improvement from *GF*	259
5-yr Percent Energy Savings Compared to Green Target*	
GF-induced Improvement (*Commercial Sector only*)	3.0%
Green Target (*Commercial Sector only*: *TI + GF*)	4.9%
% Contribution of GF to EERS (*All Sectors*)	0.7%
5-yr Program Costs	
Incremental Cost ($million)**	$4.5

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be 2% of total program costs, federal regulations cap these costs for tax-exempt bonds; performance contracts finance the full project price.

Industrial Sector GF Energy Efficiency Potential

Program savings can also improve for the industrial sector by employing a Green Financing approach to garner high energy savings per participant for selected industrial facilities. In this case, taxable bonds could be dedicated to improvements at the state's industrial facilities in order to enhance their competitiveness. To estimate the GF impact for this sector, data from EPA (2007) on the ratio of energy savings through ESCO contracts in the commercial and industrial sectors were employed to derive Delaware-specific estimates.

SEU green financing could spur electricity savings of 31 GWh, seen in Table 27. This would be additional to the 78 GWh in savings that TI programs are projected to garner in the sector (see Table 23 –includes T&D savings). The GF program would add approximately a 1.0% reduction in industrial sector electricity sales in 2015, raising the sectors conservation rate to 3.5% (Green Target Scenario) after the impacts of TI programs are included. When the GF impact is evaluated on an all-sector basis, its contribution to the EERS 2015 goal is 0.3% - substantial when one considers this is the impact for a program targeted to a small portion of Delaware's industrial facilities.

Table 27. Meeting EERS Electricity Targets: GF Approach for Industrial Facilities

2015 Program Initiative (GWh Potential)	Performance Contracting Cumulative Participation Rate 15.8%
EE Improvement from *GF*	29
Additional T&D Savings	2
Total Annual GF-induced Savings	31
5-yr Percent Energy Savings Compared to Green Target*	
GF-induced Improvement (*Industrial Sector only*)	1.0%
Green Target (*Industrial Sector only*: *TI + GF*)	3.5%
% Contribution of GF to EERS (*All Sectors*)	0.3%
5-yr Program Costs	
Incremental Cost ($million)**	$5.4

* Measured from 2007 baseline year.

** Administrative costs of programs are assumed to be 2% of total program costs, federal regulations cap these costs for tax-exempt bonds; performance contracts finance the full project price.

The added cost on a GWh basis is well below that for TI programs. While financing $5.4 million of sustainable energy investments to cover incremental costs of higher efficiency bundles, the GF initiative would cost only $176.8 thousand per saved GWh, compared to the TI cost of $288.6-$296.2 thousand per saved GWh.

Applying the same methodology to estimate the effects of a GF industrial facilities strategy for natural gas, Table 28 reports GF-induced savings of 23 MMCF. This would contribute nearly 10% more to the 274 MMCF of saving from the TI programs (see Table 24). Total 5th-year sector savings improve nearly 1% – impressive again by the 10% improvement beyond TI when one considers this is the impact for a program targeted to a small portion of Delaware's industrial facilities.

The added cost on a MMCF basis is well below that for TI programs. While financing $260 thousand in sustainable energy investments to cover incremental costs of higher efficiency bundles, the GF initiative would cost only $11.5 thousand per saved MMCF, compared to the TI cost of $18.6-$19.3 thousand per saved MMCF.

Table 28. Meeting EERS Natural Gas Targets: GF Approach for Industrial Facilities

2015 Program Initiative (MMCF Potential)	Performance Contracting Cumulative Participation Rate 15.0%
EE Annual Improvement from *GF*	23
5-yr Percent Energy Savings Compared to Green Target*	
GF-induced Improvement (*Industrial Sector only*)	0.1%
Green Target (*Industrial Sector only*: *TI + GF*)	1.8%
% Contribution of GF to EERS (*All Sectors*)	0.1%
5-yr Program Costs	
Incremental Cost ($million)**	$0.3

* Measured from 2007 baseline year.
** Administrative costs of programs are assumed to be 2% of total program costs, federal regulations cap these costs for tax-exempt bonds; performance contracts finance the full project price.

The high EE savings per participant for GF-funded projects would be consistent with recent trends in demands for comprehensive mixes of energy service technologies based on ESCO performance contracts (LBNL, 2010). SEU green financing programs can therefore create the

long-term market signals needed to foster larger and fast EE program development (Vine, 2005; LBNL, 2010). It should be noted that U.S. ESCO investment volumes has been much lower than their counterparts in Asian and European countries (Vine 2005). Capitalizing on this opportunity, the SEU framework best positions Delaware's EERS program to capture higher energy savings per participant at lower cost by utilizing a funding structure that recirculates those savings back into the program – a prominent advantage over conventional EE programs.

Meeting Delaware's ambitious EERS goals through the SEU framework could put the state in the company of "a number of other leading states (California, Connecticut, Massachusetts, Rhode Island, and Washington) [that] have enacted statutes that *require utilities to obtain all achievable cost-effective energy efficiency opportunities*" (emphasis added; Barbose, et al., 2009: 4). In fact, using an SEU green financing program could thrust Delaware ahead of any other state in terms of sustainable financing for energy efficiency and conservation. Unlike TI programs - which depend ultimately on higher taxes and utility rates - financing with GESBs limits the state's investment only by the number of attractive self-financing projects that can be identified.

5 DEMAND REDUCTION POTENTIAL

In addition to implementing energy efficiency programs, many states and utilities have enacted concurrent demand reduction programs. Reducing demand becomes particularly important as grid congestion increases. The 2006 National Electricity Transmission Congestion Study by the US Department of Energy labeled the Delaware River Pathway (Wilmington to Philadelphia, and into New Jersey) and the Delmarva Peninsula areas of critical congestion. "Inside the [PJM] region, load pockets around Washing, DC, central Maryland, the Delmarva Peninsula, and New Jersey all need major investments in new transmission, generation and demand management to improve reliability and reduce consumer costs" (DOE, 2006: 23). Recent analysis by PJM Interconnection (2010) has noted a decline in transmission constraint and has concluded that certain expansion projects can be postponed. However, the problems of the region are likely to return with the recovery of the economy.

In addition to establishing reduction targets for energy consumption, SB 106 also establishes a 15% reduction target for electricity demand by 2015. Demand is defined as the level of power (electricity only) consumed at a single point in time. It is most commonly referred to in discussions of either base load (the minimum level of energy consumed during a specified timeframe) and peak demand (the highest amount of power demanded by the grid, typically measured sub-hourly, seasonally, and annually). Because demand is concentrated at certain times over the course of a day and year (peak demand typically falls in the late afternoon during the summer, driven primarily by air-conditioning usage), demand savings will vary over the day and over the year. Consequently, reductions of base load will be modest, while impacts on peak demand may be substantial.

Based on data provided by Delaware's utilities and the EIA, CEEP researchers estimate demand to rise from the 2007 base-year level of 2,652 MW to 2,944 MW in 2015, an increase of more than 293 MW (11% above base year).[38] The same target definitions used in the EERS consumption case were employed to derive demand reduction values for the Green and Blue Targets (Figure 18). The Green Target entails statewide demand reduction of 398 MW below a

[38] Weather adjustments were not used in defining the 2007 peak. Weather normalized values for peak estimates could be significantly different for individual utilities. For example, weather normalized peak demand in 2007 was 285 MW against actual demand of 345 MW for DEC, and 1,762 MW against 1,892 MW for DP&L. A common method to measure weather normalized peak demand was not available to CEEP researchers.

2015 business-as-usual (BAU) projections. The more aggressive Blue Target would require a further 44 MW in demand reduction.

Though not specifically a peak management program, energy programs like the EERS established by SB 106 can also be an effective tool for reducing electricity demand. While demand side management programs targeting peak loads can lead to demand reduction through load shifting, peak shifting is outside the scope of this analysis. A demand reductions resulting directly from energy efficiency measures were the only demand savings considered.

To estimate Delaware's projected demand savings from the EERS target scenarios considered above, CEEP researchers evaluated the observed demand reductions of 13 utility energy efficiency programs (Table 29), determining an average of 0.22 MW demand saved per GWh reduced. As shown below, demand reductions accompany the energy efficiency programs modeled for Delaware would achieve nearly all of SB 106's target demand reduction requirement (under a Blue or Green Target), provided that the rate of 0.22 MW demand saved per GWh reduced is reasonable to assume. The assumption is supported by separately by ACEEE's 2007 report that finds a 0.22MW/GWh reduction rate across 8 utility programs.

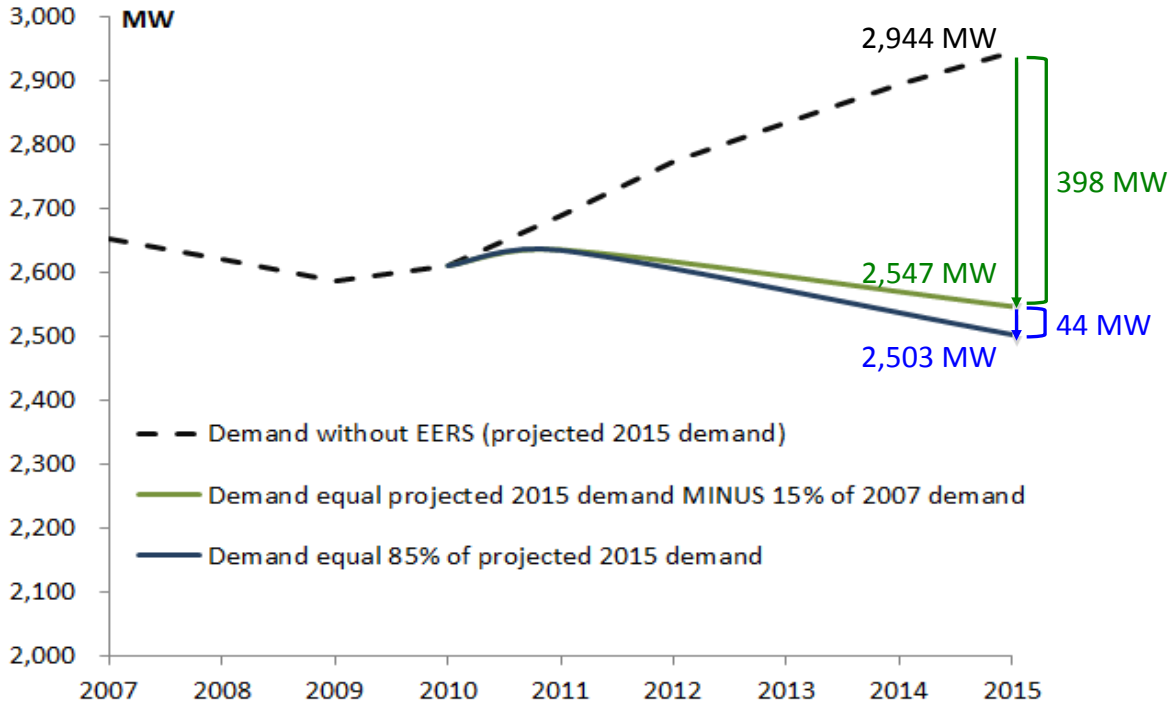


Figure 20. Electricity Demand and Reduction Target Scenarios
Source: 2007 demand based on EIA & Utility supplied data, 2015 data based on Utility supplied projections.

Table 29. Observed Demand Savings by 13 Utility Efficiency Programs

Utility	Demand Savings Ratio (MW per GWh)
Pacific Gas & Electric Co	0.16
Southern California Edison Co	0.20
Connecticut Light & Power Co	0.16
United Illuminating Co	0.16
Long Island Power Authority	0.15
PacifiCorp	0.19
Northern States Power Co	0.30
City of Seattle	0.12
Austin Energy	0.37
MidAmerican Energy Co	0.21
Interstate Power and Light Co	0.25
Nevada Power Company	0.26
Sierra Pacific Power Co	0.30
Mean	**0.22**

Source: EIA, 2009.

CEEP researchers applied this demand reduction rate to the anticipated energy consumption reductions from its modeling efforts reported in Sections 4.4 and 4.5. Table 30 summarizes the calculated 2015 demand reduction as a result of implementation of the Green Target scenario. From the table, it is clear that if the Green Target of electricity savings are met through a combination of TI and GF strategies, a reduction in peak demand will be significant, 392 MW. Indeed under the Green Target scenario, 98% of the demand reduction target in SB 106 could be met. However, if electricity savings are below these Targets, additional programs by the electric utilities will be needed. Thus, if total GWh savings range between 797 GWh and 1,190 GWh (see Table 30), MW reductions from efficiency programs will only meet 44%-66% of the SB 106 goal.

Table 30. Demand Savings under Green Target Scenario

2015 Savings Potential (GWh)	Cumulative Participation Rate 15.0%	Cumulative Participation Rate 30.8%	Green Target* (Cumulative Participation Rate=53.0%)
Residential Savings – ***TI***	208	401	670
Commercial Savings – ***TI***	137	265	648
Commercial Savings – ***GF***	342	342	
Industrial Savings – ***TI***	78	151	462
Industrial Savings – ***GF***	31	31	
Total Annual ***TI*** Savings	424 GWh	817 GWh	
Total Annual ***GF*** Savings	+373 GWh	+373 GWh	
Total Annual Savings: ***TI*** +***GF***	= 797 GWh	=1,190 GWh	1,780 GWh
2015 Demand Potential (MW)	Scenario Demand Savings		
Annual Demand Savings: ***TI*** + ***GF***	175 MW	262 MW	392 MW

* Participation rates vary by sector.
Note: SB 106 requires a demand reduction of 398MW.

6 EMPLOYMENT BENEFITS OF EERS IMPLEMENTATION

The current economic recession has resulted in layoffs by the millions. Delaware has seen its unemployment rate rise from around 3% in 2007 to over 8% currently (U.S. BLS 2010). With EERS implementation, sustained statewide energy efficiency investments could stimulate job growth, resulting in positive net employment increases that include well-paying trade and professional jobs. By their very nature, energy efficiency jobs are difficult and sometimes impossible to outsource, thus the bulk of energy efficiency investments made in Delaware will support employment efforts in Delaware.

Shown in Table 31 is CEEP's best estimate of the EERS job creation effects. Assuming realistic participation rates, job creation could be in the range of 1,843-3,565 permanent new jobs based on TI program funding, and increases by 479 permanent new jobs created by employing a GF approach towards energy savings (Table 31).

Table 31. Combined Jobs Impact from Energy Efficiency Scenarios

Total Jobs Created (Direct & Indirect)			
	Cumulative Participation Rate ~15%	Cumulative Participation Rate ~30%	Green Target
Jobs Created by TI programs*	1,843	3,565	6,605
Jobs Created by GF programs*	479	479	479
Jobs Created by TI and GF programs	2,323	4,045	7,084

* Jobs calculations includes the incremental costs, excluding administrative costs.

The methodology used to derive these employment benefits is consistent with the findings of other energy efficiency resource assessments (ASES, 2007; ACEEE, 2008; ACEEE, 2009; ACEEE, 2010a). Employment benefits will appropriately vary by sector and by energy end-use technology; with the range by sectors averaging 9 – 16 permanent new jobs per one million dollars of investment.[39] Roger Bezdek's 2007 study found that for every one million dollar investment in energy efficient appliances, lighting and HVAC systems, about five jobs are created, whereas 12-16 jobs are created in the insulation, energy service companies, utilities, and construction industries (ASES, 2007). For the values seen in Table 31, 12.5 jobs per million

[39] This includes direct and indirect jobs assumed to equal an average of 40 years of continues work.

dollars of investment was used to estimate Delaware's job creation potential, a calculation that includes direct and indirect employment.

7 ENVIRONMENTAL BENEFITS OF EERS IMPLEMENTATION

Implementation of Delaware's EERS policy will have positive benefits for job creation and economic recovery, but an additional benefit is the reduction in its energy-related environmental footprint. Reduced energy use is the "best way" to lower Delaware's environmental impact[40], resulting in improved air and water quality as well as assisting in habitat recovery for Delaware's diverse ecosystems. A detailed analysis of the environmental impact improvements is beyond the scope of this report, but to illustrate such an improvement, the impact on carbon dioxide emissions – the principle greenhouse gas as associated with climate change – are calculated below.

7.1 Avoided Carbon Dioxide Emissions from Target Implementation

Following the methodology established for the *Delaware Climate Action Plan* – that was based on research carried out at CEEP under the sponsorship of the Delaware State Energy Office and the U.S. EPA (CEEP 2000) – accurate and consistent emission factors were determined for electricity and natural gas savings.

Avoided electricity sector emissions are based upon regional changes in the quantities of fossil fuels used by power plants in the Delmarva Zone of the PJM Interconnection. The Delmarva Zone is a spatial area defined by the PJM for the purpose of planning electricity capacity and service. It includes the State of Delaware, northern Maryland and a small area of Virginia. Avoided emissions reported in Table 32 are calculated following PJM guidelines for estimating carbon dioxide reductions from demand response and energy efficiency measures. Reported PJM emissions factors can be used to determine the "average amount of CO_2 emitted for marginal units – generating units that are the last to be brought on-line and set the price for energy for that five-minute increment – during both peak and off-peak periods. Any reductions in power use or increase in emission free generation would reduce production and CO_2 emissions by marginal generation units."[41] Using the latest *PJM Emissions Report* covering 2005-2009[42],

[40] This is consistent with the finding from the Delaware Environmental Footprint Work Group that observed "The best way to reduce the environmental footprint from our energy use is to reduce consumption." Revised January 21, 2009: http://www.dnrec.delaware.gov/Admin/Documents/Footprint%20Work%20Group%20-%20Final%20Report%20rev%201-21-09a.pdf

[41] See: http://pjm.com/~/media/about-pjm/newsroom/2010-releases/20100325-pjm-reports-new-carbon-dioxide-emissions-data.ashx

CEEP averaged the marginal and grid average CO_2 emissions factors[43] and calculated the average emissions savings for each EERS target scenario. Emissions reductions potential from natural gas savings targets were calculated in a similar manner, and both TI and GF emissions reductions through energy savings are shown in Table 32 below. The emission factor for burning natural gas in Delaware can be directly calculated from EIA fuel emissions factors[44].

Early energy efficiency reductions for the electricity sector will directly affect marginal on- and off-peak emissions. The values shown in Table 32 might overstate the savings near the end of the SB 106 5-year timeframe due to the retirement of marginal generation capacity. As a minimum, the calculated grid-average emissions savings bound the emissions reductions potential for electricity and illustrate the substantial emissions reduction potential from energy efficiency programs. EERS implementation will need to consider Delaware's energy saving measures as they relate to PJM's energy efficiency trading scheme[45] and future PJM emissions reduction trends for marginal on- and off-peak emissions.

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[42] The *PJM Emission Report* can be used to estimate CO_2 reductions as a result of implementation in the region demand response and energy efficiency measures. See: http://www.pjm.com/documents/~/media/documents/reports/co2-emissions-report.ashx. PJM data on fuel mix are available at: http://www.pjm-eis.com/documents/documents.html

[43] From the PJM Emissions Report, 2005-2009 average emissions factors calculated where 0.000557 $MTCO_2$/kWh for the grid average, 0.000918 $MTCO_2$/kWh for marginal off-peak reductions, and 0.000867 MTCO2/kWh marginal on-peak savings.

[44] Natural gas emissions factor used is 0.0546 $MTCO_2$/MCF, from the U.S. EIA, http://www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls

[45] All of the requirements to offer or commit an energy efficiency resource in the PJM capacity market are detailed in *PJM Manual for the PJM Capacity Market* (M-18): http://www.pjm.com/documents/manuals.aspx

Table 32. Scenario Carbon Dioxide Emissions Savings: Electricity and Natural Gas

Thousand Metric Tons of CO_2 emissions ($tMTCO_2$)			
Annual Electricity Sector Emissions Savings ($tMTCO_2$)	Cumulative Participation Rate 15.8%	Cumulative Participation Rate 30.5%	Green Target* (Cumulative Participation Rate=53.0%)
Marginal On-Peak - TI	368	708	
Marginal On-Peak - TI + GF	691	1,032	
Emissions Realized at Target Savings			1,543
Marginal Off-Peak - TI	389	732	
Marginal Off-Peak - TI + GF	732	1,092	
Emissions Realized at Target Savings			1,634
Grid Average Electricity - TI	236	444	
Grid Average Electricity - TI + GF	455	663	
Emissions Realized at Target Savings			992
Annual Natural Gas Sector Emissions Savings ($tMTCO_2$)	Cumulative Participation Rate 15.0%	Cumulative Participation Rate 30.8%	Green Target* (Cumulative Participation Rate=67.0%)
Natural Gas Savings - TI	39	80	
Natural Gas Savings - TI + GF	54	95	
Emissions Realized at Target Savings			189

* Green Target participation rates vary by sector.

8 PERFORMANCE COMPARISON WITH OTHER STATE EE PROGRAMS

Delaware's energy efficiency potential and the efficacy of implementation strategies offered in this report can be benchmarked by program performance in other states. Table 33 displays electricity savings from energy efficiency programs for 14 states during 2006 and 2007. Based on ACEEE rankings of state energy efficiency performance (ACEEE, 2009a and b and 2010), these 14 states are recognized as national leaders in promoting energy savings through efficiency improvements. During both of these years, average annual savings as a percent of total electricity sales is 0.7%, resulting in an average of 4.8 – 5.2 MWh per $1,000 spent, with an average levelized cost of electricity of 2.3 ¢/kWh. Among these states, Vermont lowered its energy consumption the most in 2007, resulting in 1.8% energy efficiency annual savings, whereas savings in Texas during 2006 and 2007 was lowest at 0.1%.

The range in savings from state to state is significant and can be explained by several factors. For example, California's programs have been implemented for more than 30 years and, therefore, the availability of "low-hanging fruit" by 2006-07 will be comparatively smaller than in those states that have recently entered the market. The EERS implementation strategies in Delaware should, therefore, consider options for least-cost initiatives balanced by the range of experience and capabilities in other states and Delaware's own commitment to the development of the savings market.

Table 33. Electricity Efficiency Program Savings and Spending in 14 Leading States

State	Annual Spending ($Million)		EE Annual Savings as of Total State Sales		Annual Savings per Spending (MWh per $1000)		EE LCOE * Cents per kWh	
	2006	2007	2006	2007	2006	2007	2006	2007
California	357	646	0.7%	0.9%	5.4	3.5	2.05	3.11
Massachusetts	125	120	0.8%	0.9%	3.6	4.1	3.01	2.69
Connecticut	71	98	1.2%	1.3%	4.6	3.6	2.37	3.04
Vermont	16	24	1.1%	1.8%	4.0	4.4	2.76	2.47
Wisconsin	78	81	0.6%	0.7%	5.8	5.8	1.89	1.89
New York	224	242	0.6%	NA	3.7	NA	2.98	NA
Oregon	63	69	0.8%	0.9%	5.8	6.3	1.88	1.73
Minnesota	82	91	0.6%	0.7%	5.0	5.1	2.19	2.16
New Jersey	83	96	0.3%	0.3%	2.7	2.5	4.00	4.34
Washington	113	127	0.7%	0.7%	5.6	5.0	1.97	2.19
Texas	58	80	0.1%	0.1%	6.9	5.8	1.60	1.90
Iowa	55	56	0.7%	0.7%	5.7	5.7	1.92	1.92
Rhode Island	17	17	1.2%	0.8%	5.6	3.7	1.96	2.94
Nevada	24	29	0.6%	0.6%	9.0	7.2	1.22	1.53
Mean			**0.7%**	**0.7%**	**5.2**	**4.8**	**2.27**	**2.45**

* Assumes a 5% real discount rate and 13 years for efficiency measure lifetimes.
Data Source: ACEEE, 2009b

Table 34 presents electricity efficiency program performance for 2007 and 2008 among 11 utility and 3 municipal/special authority initiatives. The range of utility experiences in levelized cost of electricity efficiency per kWh (EE LCOE/kWh) is considerable: from less than 1.0¢/kWh to 3.2¢/kWh, with an average for both years of 1.8¢. Pacific Gas & Electric (California) reported annual spending that was two orders of magnitude higher than the lowest spending level, (Sierra Pacific Power Company - $440 million in 2008 compared to $4 million in 2007). This wide range in spending reflects the different numbers of customers in each jurisdiction, the comparative maturity of the savings market, and other factors. Annual energy savings also varied from a high of 3.5% to a low of 0.3%, with an average in 2007 of 1%, increasing to 1.4% in 2008. The average energy savings for these investments was 7.0 MWh per $1,000 in 2007, and 7.1 MWh per $1,000 spent in 2008.

Table 34. Electricity Efficiency Program Savings by 14 Leading Utilities

	Annual Spending ($Million)		EE Annual Savings as of Total Sales		Annual Savings per Spending (MWh per $1000)		EE LCOE * Cents per kWh	
	2007	2008	2007	2008	2007	2008	2007	2008
Pacific Gas & Electric Co	294	440	2.1%	3.5%	5.6	6.5	1.9	1.7
Southern California Edison Co	299	301	2.0%	2.0%	5.2	5.4	2.1	2.0
Connecticut Light & Power Co	68	83	1.8%	2.0%	4.1	3.4	2.6	3.2
United Illuminating Co	21	16	1.5%	2.2%	4.0	4.3	2.7	2.5
Long Island Power Authority	33	32	0.8%	0.8%	4.8	4.6	2.3	2.4
PacifiCorp	29	37	0.3%	0.4%	5.9	6.4	1.9	1.7
Northern States Power Co	31	38	0.7%	0.9%	8.3	8.2	1.3	1.3
Puget Sound Energy Inc	37	53	1.0%	1.2%	6.1	5.1	1.8	2.1
City of Seattle	15	20	0.6%	1.0%	4.0	4.5	2.7	2.4
Austin Energy	12	12	1.0%	1.1%	10.1	11.0	1.1	1.0
MidAmerican Energy Co	17	19	0.5%	0.6%	9.8	9.0	1.1	1.2
Interstate Power and Light Co	23	22	0.8%	0.8%	5.8	5.8	1.9	1.9
Nevada Power Company	17	28	0.8%	1.4%	10.4	11.0	1.1	1.0
Sierra Pacific Power Co	4	8	0.6%	1.2%	13.4	13.7	0.8	0.8
Mean			**1.0%**	**1.4%**	**7.0**	**7.1**	**1.8**	**1.8**

* Assuming 5% real discount rate and 13 years for efficiency measure lifetime
** For details, see: EIA-861, 2008

Variations in levels of energy savings and associated costs will reflect differences in market maturity and the history of commitments by different implementing organizations. In considering the process of implementing an energy efficiency strategy relative to the technologies available, utilities and statewide programs have tended to focus on those measures with the quickest paybacks and lowest administration costs. Hence, Table 35 shows how energy efficient lighting garners the majority of program electricity savings – representing, for example, 92% of PG&E's reduction in electricity consumption. One technology, the compact fluorescent lamp, accounts for the majority of these savings. In the commercial and industrial sectors, Table 36 displays a similar trend where lighting accounted for more than half and in some cases two-thirds of electricity savings.

Table 35. Share of Residential Electricity Savings by Principal End-use Technology

	Southern California Edison	Pacific Gas & Electric	Efficiency Vermont	New Jersey Clean Energy Program	Wisconsin Focus on Energy
Lighting	76.9%	92.0%	89.3%	82.6%	62.5%
Refrigeration	19.6%	5.3%	NA	NA	NA
Appliances	NA	1.6%	NA	NA	5.2%
HVAC	2.7%	NA	NA	8.8%	9.4%
Other	0.8%	1.1%	10.7%	8.6%	22.9%

Source: ACEEE, 2009b

Table 36. Share of C&I Electricity Savings by Principal End-use Technology

	Southern California Edison	Pacific Gas & Electric	Efficiency Vermont	Wisconsin Focus on Energy
Lighting	61.3%	69.3%	59.5%	54.8%
Process Heat	17.9%	12.7%	14.5%	NA
Refrigeration & Compressed Air	NA	8.9%	NA	9.3%
HVAC & Motors	NA	NA	7.3%	8.4%
Other	20.8%	9.1%	18.7%	27.5%

Source: ACEEE, 2009b

The comparison of program savings potential for natural gas has proven to be more difficult to obtain. Kushler, et al (2009) found that "there was much less policy and program activity, and much less data available, regarding natural gas utility energy efficiency spending and savings" (ACEEE, 2009b: 2).

Table 37 reports spending and percent savings for ten states, and Table 38 compares natural gas savings potential by sector with CEEP's estimates.

Table 37. Natural Gas Efficiency Program Savings and Spending in Ten States

State	EE Annual Program Spending (million$)	EE Annual Savings as a % of total sales to end-use customers	EE LCOE $ per MCF
California	94.1	0.25%	3.3
Massachusetts	25.6	NA	NA
Vermont	1.3	0.73%	NA
Wisconsin	42.8	0.54%	3.2
Minnesota	16.3	0.64%	NA
New York	NA	0.10%	NA
Oregon	12.1	0.17%	3.5
New Jersey	32.7	0.15%	4.6
Washington	8.2	NA	NA
Iowa	31.1	0.89%	2.8

Sources: ACEEE, 2009a; ACEEE, 2009b

Table 38. Natural Gas Cost Saved & Savings Potential Comparison

	Administrative Adder	Cost Saved: CEEP ($/MCF)	Cost Saved: ACEEE* ($/MCF)	Savings Potential: CEEP (%)	Savings Potential: ACEEE, for DE* (%)
Residential	25%	3.4	3.0	3.3-7.0%	5.2%
Commercial	20%	1.7	1.0	2.9-5.6%	4.5%
Industrial	15%	1.0	0.7	1.6-3.5%	3.6%

* Source: ACEEE, 2003

9 SUMMARY OF PROGRAM POTENTIAL: ELECTRICITY & NATURAL GAS

Delaware's EERS implementation potential is summarized below for electricity in Table 39, for natural gas in Table 40, their estimated program costs, savings and job creation potential in Table 41, and the program levelized cost of saved energy in Table 42. As indicated in the tables, at likely participation rates Delaware can achieve energy savings levels approaching the Green target through performance contacted sustainable energy services financing by the SEU's green bonding programs. Evaluation of Delaware's EE opportunities is considered in detail subsequently below.

Table 39. Summary of Electricity Savings, Demand Savings, and CO_2 Emissions Reductions

2015 Scenario Energy Savings by Sector (GWh), Demand Savings (MW), and CO_2 Reduction Potential (thousand $MTCO_2$)			
Estimated Annual Savings at 2015 EERS Target-Year*	Leading State Cumulative Participation Rate 15.8%**	Most Aggressive State Cumulative Participation Rate 30.5%**	Green Target*** (Cumulative Participation Rate=52.6%)
Residential ***TI*** Savings (GWh)	208	401	
Sector Savings Required (GWh)			670
Commercial ***TI*** Savings (GWh)	137	265	
Commercial ***GF*** Savings (GWh)	342	342	
Sector Savings Required (GWh)			648
Industrial ***TI*** Savings (GWh)	79	151	
Industrial ***GF*** Savings (GWh)	31	31	
Sector Savings Required (GWh)			462
Total Annual ***TI*** Savings (GWh)	424	817	
Total Annual ***GF*** Savings (GWh)	+ 373	+ 373	
Total Annual ***TI*** + ***GF*** Savings (GWh)	= 797	= 1,190	
Total Annual Savings Required (GWh)			1,780
Green Target-Year % Savings ***TI***	3.6%	6.9%	
Green Target-Year % Savings ***TI*** +***GF***	6.7%	10.0%	**15.0%**
Annual Demand Savings ***TI*** +***GF*** (MW)	175 MW	262 MW	
Demand Realized at Target-Savings (MW)			392 MW
Annual Emissions Reductions ***TI*** + ***GF*** ($tMTCO_2$)			
Marginal Power Gen. On-Peak Emissions Reduced	691 732	1,032	
Marginal Power Gen. Off-Peak Emissions Reduced		1,092	
Emissions Reductions at Target-Savings: On-Peak			1,543
Emissions Reductions at Target-Savings: Off-Peak			1,634
Cumulative Energy Savings: 15-Year Measure Life			
Lifetime Energy Savings ***TI*** (GWh)	6,360	12,255	
Lifetime Energy Savings ***GF*** (GWh)	5,595	5,595	
Lifetime Energy Savings ***TI*** + ***GF*** (GWh)	11,955	17,850	

* Savings include T&D savings of 7%

** These participation rates are based upon the methodology described in section 4.4 using 14 leading states in electricity efficiency programming and the most aggressive state of Vermont (see ACEEE, 2009a and b).

*** Green Target participation rates vary by sector. The parenthetical rates are based on total GWh savings required to meet these scenario targets.

Table 40. Summary of Natural Gas Savings and Associated CO_2 Emissions Reductions

2015 Scenario Energy Savings by Sector (MMCF), and CO_2 Reduction Potential (thousand $MTCO_2$)			
Estimated Annual Savings at 2015 EERS Target-Year	Leading State Cumulative Participation Rate 15.0%	Most Aggressive State Cumulative Participation Rate 30.8%	Green Target* (Cumulative Participation Rate=66.7%)
Residential ***TI*** Savings (MMCF)	277	570	
Sector Savings Required (GWh)			1,000
Commercial ***TI*** Savings (MMCF)	163	335	
Commercial ***GF*** Savings (MMCF)	259	259	
Sector Savings Required (MMCF)			863
Industrial ***TI*** Savings (MMCF)	274	563	
Industrial ***GF*** Savings (MMCF)	23	23	
Sector Savings Required (MMCF)			1,601
Total Annual ***TI*** Savings (MMCF)	715	1,468	
Additional Annual ***GF*** Savings (MMCF)	+ 282	+ 282	
Total Annual ***TI*** + ***GF*** Savings (MMCF)	= 997	= 1,750	
Total Annual Savings Required (MMCF)			3,464
Green Target-Year % Savings ***TI***	2.1%	4.2%	
Green Target-Year % Savings ***TI*** + ***GF***	2.9%	5.1%	
			10.0%
Annual CO_2 Emissions Reduced ***TI*** ($tMTCO_2$)	39	80	
Annual CO_2 Emissions Reduced ***GF*** ($tMTCO_2$)	15	15	
Annual CO2 Emissions Reduced ***TI*** + ***GF***(tMTCO2)	54	95	
Emissions Reductions at Target-Savings ($tMTCO_2$)			189
Cumulative Energy Savings: 15-Year Measures Life			
Lifetime Energy Savings ***TI*** (MMCF)	10,725	22,020	
Lifetime Energy Savings ***GF*** (MMCF)	4,230	4,230	
Lifetime Energy Savings ***TI*** +***GF*** (MMCF)	14,955	26,250	

* These participation rates are based upon the methodology described in section 4.4 using 10 leading states in natural gas efficiency programming and the most aggressive state of Iowa (see section 8, based on 2007-08 performance – see ACEEE, 2009a and b).

** Green Target participation rates vary by sector. The parenthetical rates are based on total MMCF savings required to meet these scenario targets.

To reach the statute's goal of a reduction of the equivalent of 15% in 2007 electricity sales, CEEP estimates that compliance can be reached between 2018 and 2021 (depending upon whether the participation rate of Vermont or the 14 most aggressive states in the country is used). For natural gas, CEEP's estimate of the compliance period is between 2020 and 2027 for a 10% reduction of sales based on 2007 consumption.

Table 41. Summary of Electricity & Natural Gas Program Costs, Economic Savings, and Jobs Created

2015 Scenario Program Cost by Sector ($million), Program Savings over Lifetime ($million), Jobs Creation			
Electricity Savings and Incremental Costs by Sector ($million)	Leading State Cumulative Participation Rate*	Most Aggressive State Cumulative Participation Rate*	Green Target Cumulative Participation Rate*
Elec. Residential Sector Cost ***TI*** ($m)	$83.6-$87.5	$161.4-$168.8	$267.9-$280.3
Elec. Commercial Sector Cost ***TI*** ($m)	$19.2-$20.1	$37.1-$38.9	$42.4-$44.4
Elec. Commercial Sector Cost ***GF*** ($m)	$28.9	$28.9	$28.9
Elec. Industrial Sector Cost ***TI*** ($m)	$22.8-$23.4	$44.1-$45.1	$124.3-$127.2
Elec. Industrial Sector Costs ***GF*** ($m)	$5.4	$5.4	$5.4
Elec. All Sector Costs ***TI*** ($m)	$125.7-$131.0	$242.6-$252.8	$434.5-$451.9
Elec. All Sector Costs ***GF*** ($m)	$34.3	$34.3	$34.3
Elec. Cumulative Savings ***TI*** ($m) **	$592.4	$1,141.9	$1,442.0
Elec. Cumulative Savings ***GF*** ($m) **	$488.1	$488.1	$488.1
Elec. Cumulative Savings ***TI*** +***GF*** ($m)	$1,080.5	$1,630.0	$1930.2
Natural Gas Savings and Incremental Costs by Sector ($million)			
NG Residential Sector Cost ***TI*** ($m)	$22.9-$23.9	$46.9-$49.1	$81.6-$85.4
NG Commercial Sector Cost ***TI***, ($m)	$4.8-$5.0	$9.9-$10.4	$17.6-$18.4
NG Commercial Sector Costs ***GF*** ($m)	$4.5	$4.5	$4.5
NG Industrial Sector Cost ***TI*** ($m)	$5.1-$5.3	$10.6-$10.8	$29.3-$30.0
NG Industrial Sector Costs ***GF*** ($m)	$0.3	$0.3	$0.3
NG All Sector Total Costs ***TI*** ($m)	$32.8-$34.2	$67.4-$70.3	$128.4-$133.8
NG All Sector Total Costs ***GF*** ($m)	$4.8	$4.8	$4.8
NG Cumulative Savings ***TI*** ($m) **	$125.5	$258.1	$497.2
NG Cumulative Savings ***GF*** ($m) **	$48.9	$48.9	$48.9
NG Cumulative Savings ***TI*** + ***GF*** ($m)	$174.5	$307.0	$546.2
Job Creation (Elec. + NG) ***TI*** ***	1,843	3,565	6,605
Job Creation (Elec. + NG) ***GF*****	479	479	479
Job Creation (Elec. + NG) ***TI*** + ***GF*** ***	2,323	4,045	7,084
Elec. + NG Sector ***TI*** Total Costs ($m)	$158.5-$165.2	$310.0-$323.1	$562.9-$585.7
Elec. + NG Sector ***GF*** Total Costs ($m)	$39.1	$39.1	$39.1
Elec. + NG Cumulative Savings ***TI***+***GF*** ($m)**	$1,255.0	$1,937.0	$2476.3

* Participation rates vary for electricity and natural gas, likewise for all sectors. Estimated participation rates utilized are shown in ES-2 & ES-3 based on energy savings, whose methodology is described in Section 4.4.

** Present value dollar savings ($million) includes total return to participants & program as applicable to a TI/GF implementation, assumes 5% discount rate, 1% retail price escalation and average measure life of 15 years.

*** Estimated jobs created include combined electricity & natural gas programs. All values are estimates for a five-year continuous investment effort.

Table 42. Levelized Cost of Saved Energy

	(All Sectors)	
Program LCOE	Saved Electricity ($/kWh)	Saved Natural Gas ($/MCF)
TI	$0.03/kWh	$4.51/MCF
GF	$0.01/kWh	$1.63/MCF

Note: Typical measure lives for TI and GF electricity and natural gas programs are assumed to be 15 years. LCOSE for TI are based on data reported in ACEEE 2008a and 2009. LCOSE for GF are based on data from Citigroup (2009), LBNL (2010), and personal communications with selected ESCOs.

10 CONCLUSION

Delaware's enactment of an EERS places it among a growing number of states seeking to aggressively capture energy efficiency opportunities in their electricity and natural gas markets. Recently, John Holdren, White House Science and Technology Advisor, observed (Holdren, 2008: 18):

> [T]he cheapest, fastest, cleanest, surest leverage against CO_2 emissions is to increase the efficiency of energy use, and the potential for doing a lot of this is large.

California continues to lead the way among American states, with its adoption of a $3 billion initiative as part of its Long Term Energy Efficiency Strategic Plan (CPUC, 2009).[46] At cumulative participation rates for a five-year period of nearly 16% to 30%, investments could range between $197 million and $362 million through combined Traditional-Incentive (TI) and Green Finance (GF) approach, achieving cumulative financial savings between$1.2 billion and 1.9 billion (Tables 39-41). While a targeted Green Financing (GF) program was modeled for only a small portion of the state's building stock, its investment volume rivals TI approaches and could surpass this program approach by attracting new and significant investment streams from private markets.

With a statewide pursuit of these pathways, Delaware will rival California's commitment on a per capita basis.[47] It is important to recognize that as a state, California has one the longest experiences with energy efficiency promotion. Thus, the comparison can help Delaware decision makers and researchers to understand the magnitude of impact of SB 106 on energy policy.

While the implementation pathways modeled for this report are aggressive given a history of relative inaction in Delaware,[48] the state has a special advantage in meeting an ambitious EERS – its Sustainable Energy Utility (SEU). The SEU is an innovative public-private partnership

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[46] After adopting California's first Long Term Energy Efficiency Strategic Plan in 2008, the Public Utilities Commission has now authorized over $3 billion towards energy efficiency as of September 2009. Available at: http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DETISION/107378.htm

[47] In 2007 California, under its energy efficiency programs spent approximately $20 per each resident (ACEEE, 2009b). If Delaware spends on average $20 million or $40 million per year, then it will achieve $22 to $44 per capita spending.

[48] In 2008, before the SEU was implemented, ACEEE ranked Delaware as tied for last place among 50 states in energy efficiency (ACEEE, 2008b).

focused exclusively on delivering sustainable energy services and offers novel financing strategies such as the Green Energy Savings Bond (see Byrne and Allen, 2009 & 2010). Delaware's SEU is characterized by a number of distinct features: comprehensive programs, flexible incentives combined with a long-term policy framework, bonding authority, and competitively bidded projects based on guaranteed energy savings.

The comprehensive nature of Delaware's SEU fosters leveraging of private and institutional resources necessary to establish long-term market signals for citizens and business to access the most cost-effective options. The SEU's long-term energy efficiency policy framework reduces investment risk and can generate net positive employment effects to reverse the recent trend in Delaware's high unemployment rate. Capitalizing on SEU Green Financing programs and ESCO performance-based contacting, Delaware could achieve ambitious EERS savings goals.

EERS implementation is estimated to potentially create 2,323-4,045 jobs if participation matches the experience of leading states (Table 31). Efficiency policies and programs can accordingly be a core component of Delaware's economic development strategy. Statewide energy efficiency demand establishes the need for a qualified supply of local well-trained workers. EERS implementation should therefore consider processes for a sustained and coordinated workforce development strategy.

The economic development strategy is complemented by measurable environmental benefits of more efficient electricity and natural gas consumption. SEU programming by achieving leading state participation can avoid 745 $tMTCO_2$ to 1,187 $tMTCO_2$ emissions annually (Table 32). This represents a reduction in forecasted emissions of 10.3% - 16.4%, an impressive start.

As these economic development and environmental benefits exemplify, implementation of the SB 106 targets further establishes Delaware in the forefront of states building a green economy for a sustainable future.

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APPENDIX A: RESIDENTIAL ELECTRICAL & NATURAL GAS SAVINGS MEASURES

The research for this report included the following energy efficiency measures for calculating the technical savings potential for the residential, commercial, and industrial sectors.

Residential Single-Family Electricity Measures

HVAC Load Reducing Measures

- Seal Ductwork
- Insulate Ductwork, R-8
- Infiltration reduction
- Insulation, ceiling, R-11 to R-38
- Insulation, ceiling, R-19 to R-38
- Blow-in wall insulation
- Cool Roof Shingles
- Estar Window, from single pane
- Estar Window, from double pane
- Programmable Thermostat

HVAC Equipment Measures

- Central HP (heating cycle); HSPF 9
- GSHP w/ desuperheater (14 EER)
- ENERGY STAR Central AC (cooling cycle) SEER 15
- ENERGY STAR Central AC early retirement
- ENERGY STAR Dehumidifier
- ENERGY STAR Room A/C (CEE Tier 2, 11.8 EER)
- Ceiling Fan (including light kit)

Water Heating Measures

- High Efficiency Showerheads (2GPM)
- Faucet Aerators (1.5 GPM)
- Water Heater Pipe Insulation
- ENERGY STAR H-axis Clothes Washer (2.0 MEF)
- ENERGY STAR Dishwasher (Electric WH; 0.75EF)
- Efficient Electric Water Heater (0.93 EF)
- Heat Pump Water Heater (COP =2.0)

Refrigeration Upgrades

- Refrigerator (20%)
- Refrigerator early retirement

Lighting Upgrades

- CFL, Advanced Incandescent Repl.

Appliance Measures

- H-Axis clothes washer (2.0 MEF)
- Dishwasher (Electric WH; 0.68 EF)

Furnace Fan Upgrades

- Efficient Furnace Fan (Heating Season)
- Efficient Furnace Fan (Cooling Season)

Total Plug Load Upgrades

- Energy Star Television Spec. v. 3.0
- Set-Top Box Power Reduction
- 1-Watt Standby Power
- In-home energy feedback monitor

Residential Multi-Family Electricity Measures

Total HVAC Measures

- Exhaust Fans, install timers
- Room A/C (CEE Tier 2, 10.8 EER)

Water Heating Upgrades

- Replace water heating system (0.95 EF)
- Dishwasher (Electric WH; 0.72EF)
- H-axis Clothes Washer (2.0 MEF)

Refrigeration Upgrades

- Refrigerator (20%)
- Refrigerator early retirement

Lighting Upgrades

- CFL Installation (apts)
- Occupancy Sensors

Appliance Upgrades

- Dishwasher (Electric WH; 0.72EF)
- H-axis Clothes Washer (2.0 MEF)

Plug Load Measures

- Energy Star Television Spec. v. 3.0
- Low Power Consumption on Set-Top Boxes
- 1-Watt Standby Power
- Electricity Use Feedback Monitor

Residential Single-Family Natural Gas Measures

Space Heating Load Reducing Measures

- Programmable Thermostat
- Seal Ductwork
- Insulate Ductwork (R-8)
- Infiltration Reduction
- Insulation, ceiling, R-11 to R-38
- Insulation, ceiling, R-19-R-38
- Space heating pipe insulation
- Blow-in wall insulation, R-13
- Estar window, from single pane
- Estar window, from double panes

Space Heating Equipment Upgrades

- Energy Star Boiler, Condensing, AFUE >=85
- Energy Star Furnace, Condensing, AFUE >=90

- Energy Star Furnace, Condensing, AFUE >=94

Water Heating Upgrades

- High Efficiency Natural Gas Water Heater (0.65 EF)
- Condensing Gas Storage Water Heater (0.86 EF)
- Demand/Instantaneous, Tankless water heater (0.80 EF)
- High efficiency showerheads
- Faucet Aerators
- Water heater pipe insulation
- H-axis clothes washer (2.0 MEF)(water heating)
- Dishwasher (Gas WH; 0.72 EF)

Appliance Upgrades

- Oven w/ electric ignition

Residential Multi-Family Natural Gas Measures

Space Heating Load Reducing Measures

- Air Sealing
- High Performance Windows, Double Pane, Low-E, low conductivity frame
- Improved Roof Insulation, R-11 to R-30
- Oxygen Trim
- Pipe Insulation
- Programmable Thermostat
- Steam Trap Maintenance
- Mainline Air Vents
- Thermostatic Steam Valves

Space Heating Equipment Measures

- Improved Heating System, High Efficiency Unit, Tier 1
- Front End Boiler
- Steam Boiler, 82% AFUE

Water Heating Total

- Condensing Gas Storage Water Heater (0.86 EF)
- Commercial Clothes Washer (2.0 MEF)
- Dishwasher (Electric WH; 0.72 EF)
- Low-flow Showerheads
- Faucet Aerators
- Water heater pipe insulation
- Pump/Demand Controller
- Graywater Heat Exchanger

Appliance Upgrades

- Oven w/ electric ignition

APPENDIX B: COMMERCIAL ELECTRICAL & NATURAL GAS SAVINGS MEASURES

Commercial Electricity Measures

Building Shell Improvements

- Cool roof
- Roof insulation
- Low-e windows

HVAC Improvements

- Duct testing and sealing
- Efficient ventilation fans & motors w VFD
- High-effic. Unitary AC&HP (65-135 kbtu)
- High-effic. Unitary AC&HP (135-240 kbtu)
- Packaged Terminal HP and AC
- Efficient room air conditioner
- High-efficiency chiller system

HVAC Equipment Upgrades

- Dual Enthalpy Control
- Demand-Controlled Ventilation
- HVAC tune-up (small buildings)
- Energy management system install
- Retro-commissioning

Water Heating Upgrades

- Commercial clothes washers
- Heat pump water heater

Refrigeration Upgrades

- Walk-in coolers & freezers
- Reach-in coolers & freezers
- Ice-makers
- Supermarket (built-up) refrigeration system
- Vending machines (to tier 2 Energy star level)
- Vending miser

Lighting Upgrades

- Florescent lighting improvements
- HID lighting improvements
- Replace incandescent lamps with CFLs
- Replace incandescent lamps with LEDs
- Occupancy sensor for lighting
- Daylight dimming system

Office Equipment Upgrades

- Office equipment
- Turn off office equipment after-hours

Appliances/Other Upgrades

- Hot Food Holding Cabinets
- Commercial clothes washers - 2.0 MEF

Commercial Natural Gas Measures

Building shell Improvements

- Roof Insulation
- Double-Pane Low-emissivity windows

HVAC Improvements

- Boiler Tune-up
- Duct Sealing
- Pipe Insulation
- HE Rooftop Furnace
- HE Standalone Furnace
- HE Main/Front-end Boiler
- Programmable Thermostat
- Energy Management Systen
- Demand-Controlled Ventilation
- Outdoor Temp. Boiler Reset

Water Hearting Upgrades

- Tank Insulation
- Pipe Insulation-water heating
- Circulation Pump Time Clock
- Condensing DHW Stand-alone Tank
- Indirect-fired DHW off space heating boiler
- Tankless high-modulating water heater
- Energy Star Washer

Cooking Upgrades

- Direct-fired convection range/oven
- HE Estar Fryer
- HE Estar Steam Cooker
- HE Griddle

Miscellaneous

- Retrocommissioning
- Refrigeration Heat Recovery

APPENDIX C: INDUSTRIAL ELECTRICAL & NATURAL GAS SAVINGS MEASURES

Industrial Electricity Measures

- Sensors and Controls Improvements
- EIS Upgrades
- Duct/Pipe insulation Improvements
- Electric Supply Improvements
- Lighting Upgrades
- Advanced efficient motor retrofits
- Motor Management Improvements
- Lubricants
- Motor system optimization
- Compressed air management
- Compressed air advanced management
- Pump Upgrades
- Fan Upgrades
- Refrigeration Upgrades

Industrial Natural Gas Measures

Boiler Measures

- Improved Process Control
- Maintain Boilers
- Flue Gas Heat Recover/Economizer
- Blowdown Steam Heat Recovery
- Upgrade burner efficiency
- Water Treatment
- Load Control
- Improved Insulation
- Steam Trap Maintenance
- Automatic Steam Trap Monitoring
- Leak Repair
- Condensate Return

HVAC measures

- Improve Ceiling Insulation
- Install HE (95%) condensing furnace/boilers
- Stack Heat Exchanger
- Duct Insulation
- EMS Install
- EMS Optimization

Process Heat Measures

- Process Controls and Management
- Heat Recovery
- Efficient Burners
- Process Integration

- Efficient Drying
- Closed Hood
- Extended Nip Press
- Improved Separation Processes
- Thermal Oxidizers
- Flare Gas Controls and Recovery
- Fouling Control
- Efficient Furnaces
- Oxyfuel
- Batch Cullet Preheating
- Preventative Maintenance
- Combustion Controls
- Optimize Furnace Operations
- Insulation/Reduce Heat Losses

APPENDIX D: EERS TARGET SCENARIOS EXCLUDING THIRD PARTY SUPPLY

Table D-1. 2007 Energy Use with and without Third Party Supply

	2007 Electricity Use with Third Party Supply, GWh	2007 Electricity Use without Third Party Supply, GWh	2007 NG Use with Third Party Supply, MMCF	2007 NG Use without Third Party Supply, MMCF
Residential	4,470	4,470	10,000	10,000
Commercial	4,321	2,209	8,628	6,449
Industrial	3,078	1,199	16,014	1,565
Power Generation	NA	NA	13,440	13,440
Total w/o Power	11,869	7,878	34,642	18,014
Total	11,869	7,878	48,082	31,454

Data Sources: EIA, 2010a; EIA, 2010b.

Table D-2. Aggregate Energy Sales Projections with and without Third Party Supply

	Electricity Use Projections with Third Party Supply, GWh	Electricity Use Projections without Third Party Supply, GWh	NG Use Projections with Third Party Supply, MMCF	NG Use Projections without Third Party Supply, MMCF
2007	11,869	7,878	34,641	18,014
2008	11,749	7,812	34,117	17,324
2009	11,361	7,645	34,765	17,804
2010	11,713	7,899	36,075	18,945
2011	11,918	8,056	37,101	19,800
2012	12,155	8,231	37,968	20,493
2013	12,336	8,364	38,735	21,085
2014	12,509	8,498	39,442	21,616
2015	12,670	8,623	40,166	22,161

Table D-3. Aggregate Energy Efficiency Green Target Projections with and without Third Party Supply

	Electricity Target Projections with Third Party Supply, GWh	Electricity Target Projections without Third Party Supply, GWh	NG Target Projections with Third Party Supply, MMCF	NG Target Projections without Third Party Supply, MMCF
2011	237	158	346	180
2015	1,780	1,182	3,465	1,801

Table D-4. Aggregate Energy Efficiency Blue Target Projections with and without Third Party Supply

	Electricity Target Projections with Third Party Supply, GWh	Electricity Target Projections without Third Party Supply, GWh	NG Target Projections with Third Party Supply, MMCF	NG Target Projections without Third Party Supply, MMCF
2011	238	161	371	198
2015	1,901	1,293	4,017	2,216

APPENDIX E: CALCULATIONS OF EERS COMPLIANCE COSTS FOR GREEN TARGET SCENARIO

Admin Costs are assumed as follows:
Residential 15%-25% (see Table 4)
Commercial 10%-20% (see Table 7)
Industrial 10%-15% (see Table 10)

*CEEP assumes that EE programs are credited with 7% avoided T&D losses.

Ratio of Achieved Savings from TI vs. GF	
TI	GF
100%	0%
47%	53%
93%	7%

Electricity	Energy Saved per Traditional Incentive Paid with Low Admin Cost (MWh per $1000)	Energy Saved per Traditional Incentive Paid with High Admin Cost (MWh per $1000)		Energy Saved per Green Financed Payment (MWh per $1000)	
Residential	4.4	4.0	See Table 4, Page 13	NA	NA
Commercial	12.9	11.8	See Table 7, Page 20	11.0	See Table 25, Page 50
Industrial	6.2	5.9	See Table 10, Page 26	5.4	See Table 27, Page 52

	2007 Electricity Consumption (GWh)	Green Target Savings of 15% of 2007 Electricity Consumption (GWh)	Projected E-E Program Costs to Comply with the Green Target Scenario	
			Low Admin Cost*	High Admin Cost*
Residential	4,470	671	142	157
Commercial	4,321	648	51	53
Industrial	3,078	462	70	74
Total	11,869	1,780	**264**	**283**

Note: MWh per $1,000 cost for Traditional Incentive program is based on the payments of rebates and administrative costs. MWh per $1,000 cost for Green Financing programs is based on administrative costs and incremental cost, with the latter equal approximately twice the level of rebates coasts (due to the fact that customer costs are not covered in Traditional Incentive program but are covered in Green Financing programs – see p. vii of CEEP report. Importantly, Traditional Incentive programs raise rates for all customers. Green Financing programs pay incremental costs from the savings generated by energy efficiency investments. For comparability, MWh per $1,000 cost for GF programs in the above table should be multiplied by 2 (approximately)

Admin Costs are assumed as follows:
Residential 15%-25% (see Table 5)
Commercial 10%-20% (see Table 8)
Industrial 10%-15% (see table 12)

Ratio of Achieved Savings from TI vs. GF

TI	GF
100%	0%
70%	30%
99%	1%

Natural Gas

	Energy Saved per Incentive Paid with Low Admin Cost (MCF per $1000)	Energy Saved per Incentive Paid with High Admin Cost (MCF per $1000)		Energy Saved per Green Financed Payment (MCF per $1000)	
Residential					
Commercial	22.9	21.1	See Table 5, Page 16	NA	NA
Industrial	65.4	59.9	See Table 8, Page 22	57.6	See Table 26, Page 51
	102.8	98.4	See Table 12, Page 30	88.5	See Table 28, Page 53

	2007 NG Consumption (Billion CF)	Green Target Savings of 10% of 2007 NG Consumption (Billion CF)	Projected E-E Program Costs to Comply with the Green Target Scenario	
			Low Admin Cost	High Admin Cost
Residential	10.0	1.0	44	47
Commercial	8.6	0.9	14	15
Industrial	16.0	1.6	16	16
Total	34.6	3.5	**73**	**78**

Low Admin Cost.	High Admin Cost.
337	**362**

Note: MCF per $1,000 cost for Traditional Incentive program is based on the payments of rebates and administrative costs. MCF per $1,000 cost for Green Financing programs is based on administrative costs and incremental cost, with the latter equal approximately twice the level of rebates coasts (due to the fact that customer costs are not covered in Traditional Incentive program but are covered in Green Financing programs – see p. vii of CEEP report. Importantly, Traditional Incentive programs raise rates for all customers. Green Financing programs pay incremental costs from the savings generated by energy efficiency investments. For comparability, MWh per $1,000 cost for GF programs in the above table should be multiplied by 2 (approximately))

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