2011 DRAFT ENERGY MASTER PLAN

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ACE	Atlantic City Electric Company
AES	Alternative Electric Supplier
ARRA	American Recovery and Reinvestment Act
BAU	Business As Usual
bbl	Barrel
BGS	Basic Generation Service
BGSS	Basic Gas Supply Service
BPU	Board of Public Utilities
BRA	Base Residual Auction
C&I	Commercial and Industrial
CC	Combined Cycle
CEEEP	Center for Energy, Economic, and Environmental Policy
CEP	Clean Energy Program
CHP	Combined Heat and Power
CIEP	Commercial Industrial Energy Price
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CORE	Customer On-Site Renewables
CSP	Curtailment Service Provider
DAM	Day-Ahead Market
dc	Direct Current
DCA	Department of Community Affairs
DEP	Department of Environmental Protection
DG	Distributed Generation
DOE	Department of Energy
DOT	Department of Transportation
DR	Demand Response
EDA	Economic Development Authority
EDECA	Electric Discount and Energy Competition Act
EE	Energy Efficiency
EMAAC	Eastern Mid-Atlantic Area Council
EMP	Energy Master Plan
EPA	Environmental Protection Agency
ESIP	Energy Savings Improvement Programs
FERC	Federal Energy Regulatory Commission
FTR	Financial Transmission Rights
GT	Gas Turbine
GW	Gigawatt
GWh	Gigawatt Hour
HTP	Hudson Transmission Project
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
IDER	Integrated Distributed Energy Resources
IECC 2009	International Energy Conservation Code
ILR	Interruptible Load for Reliability
JCP&L	Jersey Central Power & Light Company
kW	Kilowatt
LCAPP	Long-Term Capacity Agreement Pilot Program
LDC	Local Distribution Company
LFG	Landfill Gas
LMP	Locational Marginal Price
LNG	Liquefied Natural Gas
LSE	Load Serving Entity
MAAC	Mid-Atlantic Area Council

MMBtu	Million British thermal units
MOPR	Minimum Offer Price Rule
MW	Megawatt
MWh	Megawatt Hour
NGV	Natural Gas Vehicle
NJAES	New Jersey Agricultural Experiment Station
NJ-RAGP	New Jersey Regional Anemometer Grant Program
NO_x	Nitrogen Oxides
NREL	National Renewable Energy Laboratory
OCE	Office of Clean Energy
OREC	Offshore Wind Renewable Energy Certificate
OWEDA	Offshore Wind Economic Development Act
PJM	Pennsylvania-New Jersey-Maryland Interconnection, LLC
PPL	PPL Electricity Utilities Corp.
PRD	Price Responsive Demand
PSE&G	Public Service Electric and Gas Company
PSEG	PSE&G Zone
PV	Photovoltaic
R/ECON	Rutgers Economic Advisory Service
RCRA	Resource Conservation and Recovery Act
RECO	Rockland Electric Company
REIP	Renewable Energy Initiative Program
REMI	Renewable Energy Manufacturing Incentive
RGGI	Regional Greenhouse Gas Initiative
RPM	Reliability Pricing Model
RPS	Renewable Portfolio Standard
RTEP	Regional Transmission Expansion Plan
RTM	Real-Time Market
RTO	Regional Transmission Organization
SACP	Solar Alternative Compliance Payment
SEAFCA	Solar Energy Advancement and Fair Competition Act
SO_2	Sulfur Dioxide
SOCA	Standard Offer Capacity Agreement
SREC	Solar Renewable Energy Certificate
Tetco M3	Texas Eastern Market Zone 3
TO	Transmission Owner
Transco	Transcontinental Gas Pipe Line
TRC	Total Resource Cost
UCAP	Unforced Capacity
USF	Universal Services Fund
WTE	Waste to Energy
WTI	West Texas Intermediate

GLOSSARY AND DEFINITIONS

Basic Generation Service (BGS)
The EDCs obtain wholesale power supplies to serve customers who do not shop for their own power through annual BGS auctions.

Board of Public Utilities (BPU or Board)
The BPU regulates the EDCs, participates in the PJM planning process, and advocates for New Jersey's interests before FERC. The BPU administers the BGS auctions; administers the Clean Energy Program, and approves ratepayer-supported utility programs.

Base Residual Auction (BRA)
Under the RPM construct, PJM conducts annual BRAs to set capacity prices on a locational basis.

British Thermal Unit (Btu)
A BTU is a standard measure of energy and provides a basis to compare energy sources and uses.

Capacity
Power plant size or capacity is measured in megawatts (MW).

Capacity Factor
Capacity factor is the ratio of the actual output of a power plant divided by the theoretical output of the plant if it had operated at full nameplate capacity the entire time.

Clean Energy Program (CEP)
New Jersey's Clean Energy Program is a statewide program that offers financial incentives, programs and services for New Jersey residents, business owners and local governments.

Clearing Price
The market price determined by a PJM-administered auction.

Combined Cycle (CC)
CC plants consist of one or more GTs generating electricity where exhaust is captured in a heat recovery steam generator to produce steam that generates additional electricity without the need for additional fuel.

Combined Heat and Power (CHP)
CHP plants, also referred to as cogeneration, provide electric and thermal energy, thus obtaining high overall efficiency from the fuel.

Compressed Natural Gas (CNG)
Natural gas can be stored under pressure in specialized tanks to substitute for gasoline or other fuels. Although its combustion does produce greenhouse gases, it is a more environmentally clean alternative to diesel fuel or gasoline and much less expensive.

Delivery Year
PJM defines a Delivery Year as the twelve month period from June 1 through May 31.

Demand Response
Measures consumers take to minimize their demand for energy. It includes curtailment of energy or the use of on-site generation of electricity at critical times

Department of Environmental Protection (DEP)
The DEP issues permits for air pollution control, water pollution control, land use, and the management of other environmental impacts. DEP administers New Jersey's auction and compliance program.

Dispatch
New Jersey's generating units are economically dispatched along with virtually all other plants in the PJM system by PJM operators according to plants' energy bids that are a function of the plant's efficiency, fuel price, and other operating costs.

Distributed Generation
Small-scale electricity production that is on-site or close to the primary users and is interconnected to the utility distribution system

District Energy System
Systems that provide energy from a centralized location rather than multiple localized facilities. District energy systems tend to be more efficient and less polluting than multiple local energy generation systems

Electric Discount and Energy Competition Act (EDECA)
New Jersey's Electric Discount and Energy Competition Act deregulated the State's electricity industry.

Electric Distribution Company (EDC)
Atlantic City Electric (ACE), Jersey Central Power & Light (JCP&L), Public Service Electric & Gas Company (PSE&G), and Rockland Electric Company (RECO).

Eastern Mid-Atlantic Area Council (EMAAC)
EMAAC is part of PJM that includes all of New Jersey, Philadelphia Electric, and Delmarva Power & Light. PJM evaluates reliability, sets capacity prices, and plans transmission upgrades for this region.

Federal Energy Regulatory Commission (FERC)
FERC has jurisdiction over the interstate sale and transmission of electricity and natural gas, and regulates PJM.

Gas Turbine (GT)
GTs operate in simple-cycle mode and typically operate as peaking plants with low capacity factors.

Gigawatt
A Gigawatt (GW) is a unit of electrical capacity equal to 1,000,000,000 watts.

Gigawatt-day
A unit of energy, especially electrical energy, equal to the work done by one Gigawatt acting for one day.

Gigawatt-hour (GWh)
1 GWh is a unit of electrical energy equal to 1,000 MWh or 1 million kWh.

High Voltage (HV)
HV transmission normally refers to lines rated 110 kV and above. PJM's highest voltages for its backbone transmission system serving New Jersey are 345 kV and 500 kV.

kilowatt (kW)
A kW is a unit of electrical capacity equal to 1,000 watts. It is estimated that a typical residential home (without electric heating) can have a peak load as high as 8 kW.

kilowatt-hour (kWh)
A kWh is a unit of electrical energy equal to 1,000 watt-hours. According to the DOE, the average New Jersey residential home consumes almost 700 kWh/month.

Long-Term Capacity Agreement Pilot Program (LCAPP)
New Jersey enacted the LCAPP legislation to facilitate the development of 2,000 MW of baseload and mid-merit generation facilities for the benefit of in-State electric customers.

Local Distribution Company (LDC)
Elizabethtown Natural Gas, New Jersey Natural Gas, Public Service Electric and Gas, and South Jersey Gas.

Locational Marginal Price (LMP)
LMPs are wholesale energy prices set by PJM at each node throughout its system based on generator and demand-side energy bids and the expected load. PJM operates a Day-Ahead energy market and a Real-Time balancing energy market. In the predominant Day-Ahead market, all dispatched plants receive the same LMP (with adjustments for losses and congestion) equal to the bid of the last, most expensive dispatched plant, regardless of their own bid prices.

Load-Serving Entity (LSE)
An LSE provides electric services to customers that do not elect BGS service. LSEs may include regulated EDCs, municipal electric companies and cooperatives, and competitive energy suppliers.

Mid-Merit
Among conventional generation technologies, mid-merit generation, such as a CC plant, is moderately expensive to construct, moderately expensive to operate, and has considerable flexibility. Mid-merit plants are most often dispatched to meet on-peak loads, generally weekday days.

Minimum Offer Price Rule (MOPR)
MOPR, an RPM price mitigation mechanism to prevent subsidized capacity resources from submitting uneconomic bids and artificially lowering market capacity prices.

Megawatt (MW)
A MW is a unit of electrical capacity equal to 1,000 kilowatts or 1,000,000 watts.

Megawatt-day
A unit of energy, especially electrical energy, equal to the work done by one Megawatt acting for one day.

Megawatt-hour (MWh)
A MWh is a unit of electrical energy equal to 1,000 kWh.

Nameplate Capacity
Nameplate capacity is the intended technical full–load sustained output of a power plant as indicated on a nameplate that is physically attached to the plant and is expressed in MW or kW.

Office of Clean Energy (OCE)
The New Jersey Office of Clean Energy oversees the CEP.

Oil-to-Gas Price Ratio
The ratio between crude oil ($/barrel) and natural gas ($/MMBtu) prices.

Offshore Wind Renewable Energy Certificate (OREC)
ORECs are a specific type of REC created in New Jersey for offshore wind.

Peakers
Among conventional generation technologies, peaking plants, such as GTs, are the least expensive to construct, the most expensive to operate, and can run for just a few hours per day.

Pennsylvania-New Jersey-Maryland Interconnection, LLC (PJM)
Pennsylvania-New Jersey-Maryland Interconnection, LLC is the RTO responsible for planning and operating the electric transmission grid across thirteen Mid-Atlantic and Midwestern states and the District of Columbia. PJM is also the independent system operator that administers the wholesale power markets in its territory to assure bulk system reliability.

Reliability Must Run
Generators operating under Reliability Must Run Agreements receive payments to generate power as needed to ensure system / grid reliability.

Reliability Pricing Model (RPM)
RPM is PJM's competitive capacity pricing mechanism that sets market-based capacity prices for different regions based supply-side and demand-side capacity bids submitted in annual auctions.

Renewable Portfolio Standard (RPS)
An RPS is a state regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal, to meet a specified goal for that state's EDCs. Twenty-nine states and the District of Columbia have RPS requirements.

Regional Transmission Organization (RTO)
A Regional Transmission Organization, *e.g.* PJM, is an entity responsible for planning and operating regional electric transmission grids.

Regional Transmission Expansion Plan (RTEP)
The RTEP identifies transmission system upgrades and enhancements to meet operational, economic and reliability requirements.

Secondary General Service
Refers to PSE&G general lighting and power, ACE monthly secondary general service, and JCP&L and RECO secondary general service.

Solar Alternative Compliance Payment (SACP)
The SACP is an alternative compliance payment specifically for SRECs.

Solar Renewable Energy Certificate (SREC)
Each unit of energy produced by a solar energy system is tagged with an SREC. Annual SREC quantities are established by New Jersey's RPS and SREC prices are set by the competitive market up to the Solar Alternative Compliance Payment ceiling.

Total Resource Cost (TRC)
TRC is a test to gauge the cost-effectiveness of energy policy programs based on the expected costs and benefits for both participating and non-participating customers.

Unforced Capacity (UCAP)
UCAP is a capacity rating that accounts for the availability of a capacity resource. For example, a 100 MW resource with 90% availability provides 90 MW of UCAP.

1 Introduction

The purpose of the 2011 Energy Master Plan is to document the Christie Administration's strategic vision for the use, management, and development of energy in New Jersey over the next decade. As required by law, the EMP includes long-term objectives and interim measures consistent with and necessary to achieving those objectives.

The Administration will manage energy in a manner which saves money, stimulates the economy, creates jobs, protects the environment, and mitigates long-term cumulative impacts. Thus, the specific recommendations in this 2011 EMP focus on both initiatives and mechanisms which set forth energy policy to drive the State's economy forward, but do not lose sight of environmental protection imperatives. Efforts to promote economic development will include increasing in-state energy production, improving grid reliability, and recognizing the economic, environmental, and social benefits of energy efficiency, energy conservation, and the creation of clean energy jobs.

To that end, the Administration has formulated five overarching goals that the State should pursue:

1. **Drive down the cost of energy for all customers** – New Jersey's energy prices are among the highest in the nation. For New Jersey's economy to grow, energy costs must be comparable to costs throughout the region; ideally these costs should be much closer to U.S. averages.

2. **Promote a diverse portfolio of new, clean, in-State generation** – Developing efficient in-State generation while leveraging New Jersey's infrastructure will lessen dependence on imported oil, protect the State's environment, help grow the State's economy, and lower energy rates. Energy diversity is essential. Concentrating New Jersey's energy future on any one form of energy is ill-advised. Picking "winners" and "losers" should not be the State of New Jersey's job, but formulating incentives to foster the entry of both conventional and renewable technologies is required when market based incentives are insufficient.

3. **Reward energy efficiency and energy conservation and reduce peak demand –** The best way to lower individual energy bills and collective energy rates is to use less energy. Reducing energy costs through conservation, energy efficiency, and demand response programs lowers the cost of doing business in the State, enhances economic development, and advances the State's environmental goals.

4. **Capitalize on emerging technologies for transportation and power production –** New Jersey should continue to encourage the creation and expansion of clean energy solutions, while taking full advantage of New Jersey's vast energy and intellectual infrastructure to support these technologies.

5. **Maintain support for the renewable energy portfolio standard of 22.5% of energy from renewable sources by 2021–** New Jersey remains committed to meeting the legislated targets for renewable energy production. To achieve these

targets, New Jersey must utilize flexible and cost-effective mechanisms that exploit the State's indigenous renewable resources.

To advance these five overarching goals, this 2011 EMP has formulated an action plan consisting of a number of concrete policy options and recommendations. The majority of the individual recommendations will serve to advance more than one of the five EMP goals. For example, measures that reduce peak electric demand clearly are integral to Goal #3, but will also help drive down electricity prices (Goal #1) and contribute to achieving the State's greenhouse gas reduction targets (Goal #5). For this reason, the policy options and recommendations are grouped by subject area in four sections of this report, as follows:

- Section 7.1 covers challenges and opportunities associated with the State's portfolio of **conventional generation and other infrastructure resources**.
- Section 7.2 discusses the expansion of State's indigenous **renewable resources** while rationalizing the incentives for renewable project development.
- Section 7.3 covers **energy efficiency, conservation, and demand response**, and
- Section 7.4 discusses **innovative technology** opportunities.

By way of background, Section 3 of this 2011 EMP describes the EMP development process. Sections 4 and 5 provide broad background information regarding New Jersey's electricity and fuel sectors, respectively, discuss market and industry developments since the 2008 EMP, and identify the resources that are at the State's disposal to effectuate the EMP goals. Section 6 summarizes energy legislation enacted since the 2008 EMP and the progress to date of implementing these laws.

State law requires the EMP to be revised and updated at least once every three years. This provides policy makers with the opportunity to view the results achieved against stated objectives, and to adjust energy goals and the policy options to reach them in light of changed economic and environmental circumstances. While there are numerous policy options, none is without costs and risks. It is therefore the Christie Administration's intention that the long-term goals and implementation strategies set forth in this 2011 EMP be flexible enough to respond to market changes and new information about the relative merit of competing energy technologies and strategies.

2 Executive Summary

Over the past year, global events have reminded the world that there are no easy options on the subjects of our dependence on oil, nuclear power, and the mining of coal. BP's deadly explosion and oil spill at the deepwater Macondo platform in the Gulf of Mexico, the release of radiation at the stricken Fukushima Daiichi nuclear plants in Japan, and the tragic loss of life at the Upper Big Branch coal mine in West Virginia underscore the reality that technology choices present risks to society and the environment. Closer to home, the debate over extracting natural gas from Marcellus shale in Pennsylvania, West Virginia and New York requires that we deal with the environmental ramifications attributable to reliance on an abundant, indigenous fuel. The pros and cons of both supply-side and demand-side resource options must be examined as New Jersey develops a diverse and cost-effective portfolio of energy technologies that meet the State's economic, environmental and reliability objectives.

New Jersey has implemented policy initiatives that incorporate both supply-side and demand-side resources for electricity production. These policy initiatives have heightened New Jersey's reliance on natural gas as a less carbon-intensive fossil fuel, and expanded the amount of renewable resources in response to aggressive renewable portfolio standards (RPS). The Christie Administration is committed to continuing by example the Garden State's national leadership in furthering environmental objectives in a manner that saves money, stimulates the economy, and creates jobs. The emphasis going forward is placed upon increasing in-State energy production, improving grid reliability, and recognizing the significant economic and environmental benefits of energy efficiency, conservation, and renewable energy sources.

The high cost of electricity coupled with New Jersey's current fiscal challenges reminds policymakers that the method for achieving the RPS should be flexible, not rigid or absolute. The Administration is committed to the formulation of incentives that promote a renewable energy portfolio that is comprised of cost-effective energy alternatives. Mid-course corrections that foster RPS objectives should safeguard New Jersey's pocketbook, while encouraging the environmental, economic and reliability benefits associated with green technologies and demand-side initiatives. Supply-side resources that generate "bang for the buck" should not be left out of the public debate for innovation and carbon reduction because of concerns about risk. In the hunt for the optimum blend of supply-side and demand-side resources, the Christie Administration calls for rigorous testing of the net economic benefits to New Jersey. New Jersey needs to formulate a vision of what its energy infrastructure will consist of in the first half of the 21st century. Every step of the way, informed decision-making requires a rigorous assessment of the program options and goals set forth in the 2011 Energy Master Plan (EMP).

New Jersey's 22.5% RPS target in 2021 is a long stride in the march toward deep structural changes in New Jersey's energy infrastructure in the 21st century. The Christie Administration recognizes that New Jersey must take a far longer view than ten years in order to pour the energy foundation for a clean and secure energy future for decades to come. The goal of fulfilling 70% of the State's electric needs from "clean" energy sources by 2050 may be an aspiration, but it is one that is achievable if the definition of clean energy is broadened beyond renewables to include nuclear, natural gas, and hydroelectric facilities. At the same time, coal is a major source of CO_2 emissions and will no longer be accepted as a new source of power in the State. New

Jersey will work to shut down older, dirtier peaker and intermediate plants with high greenhouse gas emissions.

In the alternative, if 70% of the State's electric needs are to be derived from carbon-free energy sources by 2050, then the technology bandwidth narrows. Tension will be created among the environmental, reliability and economic criteria that protect ratepayer interests. Simply put, something has to give. The only carbon-free technologies are renewables and nuclear power. Solar photovoltaic (PV) power is expensive and intermittent. While New Jersey has high quality, harvestable offshore wind, it too is intermittent and expensive. In addition, there are practical limits to the heavy concentration of offshore wind in one location. The potential for importing wind from other PJM states raises additional concerns about reliability, the siting of new high voltage (HV) transmission lines, PJM's ability to integrate intermittent generation, and the export of green industry jobs out of New Jersey. Hence, solar and wind require the addition of other conventional or innovative technologies to ensure grid security.

The Christie Administration's overarching goals for the EMP are as follows:

1. Drive down the cost of energy for all customers;

2. Promote a diverse portfolio of new, clean, in-State generation;

3. Reward energy efficiency and energy conservation and reduce peak demand;

4. Capitalize on emerging technologies for transportation and power production; and

5. Maintain support for the renewable energy portfolio standard of 22.5% of energy from renewable sources by 2021.

To that end, specific highlights of New Jersey's program initiatives formulated to achieve these goals are set forth below.

Expand In-State Electricity Resources

New Jersey needs to expand electricity generation resources to improve reliability and to lower costs, consistent with environmental and economic development objectives. New Jersey's policy initiatives are centered on balancing these objectives in a cost-effective manner with respect to economic and political realities. Renewable energy resources, distributed generation (DG), and clean conventional generation projects can help New Jersey flourish while protecting the environment.

- *Construct New Generation and Improve PJM Rules and Processes*

New Jersey's Long-Term Capacity Agreement Pilot Program (LCAPP) has resulted in contract awards for three new in-State combined-cycle (CC) generation projects that use clean-burning natural gas. These high-efficiency projects total 1,949 MW, insignificantly less than the procurement target set forth by the Legislature. The expected net savings of $1.8 billion in wholesale energy costs over the 15-year contract period constitute a much needed economic shot-in-the-arm for ratepayers in New Jersey. This number is stated *before* counting the income benefits ascribable to job creation, especially during the manpower-intensive construction phase. In addition to the reduction in wholesale energy costs, the addition of LCAPP capacity will yield valuable environmental benefits by helping to modernize the resource mix in New Jersey, thereby reducing the State's reliance on older, less efficient generation that burns coal, oil and natural gas, as well as imports by wire from resources elsewhere in PJM. The Federal Energy Regulatory Commission (FERC) recently implemented rule changes aimed at the LCAPP resources. These rule changes may undercut New Jersey's realization of LCAPP's economic and environmental benefits. Therefore, the Board of Public Utilities (BPU or Board) should pursue remedies to preserve New Jersey's sovereign right to plan its energy future in the 21st century.

- *Assess the Implications of Lost Nuclear Capacity*

The retirement of the 654-MW Oyster Creek facility in 2019 will result in the removal of a carbon-free baseload resource. Nuclear power, if constructed and operated safely, can be a long-term cost-effective hedge against fossil fuel price volatility, while providing thousands of jobs. The events in Japan represent a siren for redoubled vigilance and federal regulatory oversight regarding the safety of all nuclear reactors in the U.S. While the prospect of new nuclear generation to replace Oyster Creek is not achievable by the end of the decade, New Jersey should remain committed to the objective assessment of how nuclear power fits into the diversified resource mix to meet economic, reliability and environmental goals. To that end, New Jersey should continue its coordination with the U.S. Department of Energy (DOE) regarding the steps needed to accelerate a federal solution to the problem of storing radioactive waste.

- *Expand Distributed Generation and Combined Heat and Power*

Both DG and combined heat and power (CHP) resources improve system reliability and utilize fuel more efficiently, especially for commercial and industrial (C&I) customers. The Christie Administration is committed to developing 1,500 MW of new DG and CHP resources where net economic and environmental benefits can be demonstrated.

- *Support Behind-the-Meter Renewables*

Behind-the-meter solar PV customer installations achieve carbon reduction, while supporting the potential growth of the State's solar manufacturing industry. However, these behind-the-meter solar programs are costly for non-participants, *i.e.*, ratepayers who do not host a solar installation, yet pay for the subsidies in their monthly electric bills. The Board must step up its regulatory review of solar PV to ensure that State-sponsored programs represent worthwhile initiatives that achieve a sensible balance among competing resource planning, economic, and environmental objectives from both a participant's and a non-participant's perspective.

- *Promote Effective Use of Biomass and Waste-to-Energy*

Agricultural and forest residues, along with municipal and industrial waste, are underutilized resources that can be used to fuel power plants. New Jersey should reassess the existing renewable energy incentives to utilize indigenous biomass resources more effectively. At the same time, fostering more complete use of the State's underutilized biomass resources cannot subvert the goal of preserving valuable farmland.

- *Promote the Safe Expansion of the Natural Gas Pipeline System*

Although the certification of expanded or new pipeline facilities is the responsibility of the FERC, not the BPU, the Christie Administration is committed to the expansion of the existing pipeline network that serves gas utilities and power plants throughout New Jersey if it is done safely and in compliance with environmental regulations. Therefore, expanding New Jersey's gas infrastructure must incorporate the most advanced construction design techniques in order to safeguard New Jersey's natural and cultural resources, while preventing any adverse impact on safety and homeland security. Adding pipeline deliverability is a necessary complement to New Jersey's reliance on natural gas for electricity generation. It will lower wholesale power costs while strengthening the foundation for economically and environmentally sound programs aimed at lessening the State's dependence on oil.

Likewise, New Jersey's gas utilities are encouraged to evaluate the economic and environmental merit of distribution system expansions. This is needed where natural gas is not available presently, or where there is a relatively high saturation of oil-fired heat. South Jersey, in particular, lacks adequate natural gas infrastructure to support new, gas-fired generation as well as substitution for other fuels in the residential and commercial sectors. Expansion of the natural gas pipeline system will strengthen New Jersey's ability to achieve innovations in transportation fuels, as well.

Cost Effective Renewable Resources

New Jersey's electric ratepayers have some of the highest retail rates in the U.S. Rates may decline if the price of Basic Generation Service (BGS) is reduced, and as new HV transmission upgrades alleviate congestion in New Jersey. This would temper the run-up in capacity prices in PJM. However, much more needs to be done to ease the economic burden borne by electric ratepayers throughout New Jersey. Solar and offshore wind have great commercial potential, but implementation of solar and offshore wind technologies must not create an undue economic burden for retail customers. Therefore, solar and offshore wind project development must provide net economic benefits. Solar and offshore wind applicants must demonstrate that the net economic benefits of their projects are of sufficient "quality" to offset the costs.

- *Solar Alternative Compliance Payments*

Solar installations in New Jersey have grown steadily, ranking second only to California. There are about 9,000 solar PV projects totaling 330.5 MW statewide, the majority of which have been added in the last three years. New Jersey's aggressive solar development program has been enabled by the State's subsidy programs, such as Customer On-Site Renewables (CORE), the Renewable Energy Initiative Program (REIP), and the Renewable Energy Manufacturing Incentive (REMI) Program, among others. Central to these solar incentive programs is the requirement that New Jersey's electric distribution companies (EDCs) and load-serving entities (LSEs) purchase or produce solar renewable energy certificates (SRECs) to meet their respective solar energy obligations.

New Jersey's solar target is one of the most aggressive in the U.S. In light of the target objective, New Jersey has been chronically SREC short. Hence, the SREC clearing price has been at or close to the Solar Alternative Compliance Payment (SACP), the ceiling price set by the Board to help incubate solar technology in New Jersey. The goal of incubating solar technology has been met. New Jersey's SACP is, by far, the most generous in the nation. The solar industry is no longer fledgling – it has grown in leaps and bounds across the U.S., Europe and Asia. As the all-in capital costs for diverse solar technologies continue to decline, the Board should take action to reduce the SACP through 2025. Doing so will not undermine new solar projects that are worthwhile, but will reasonably minimize the cost burden borne by non-participants throughout the Garden State.

- *Cost Benefit Test for Solar Renewable Incentives*

Solar PV is subsidized through New Jersey's SREC program, thus spreading program costs to retail customers throughout the State. The Christie Administration does not support the unreasonable transference of wealth from ratepayers at large to solar developers as well as residential, commercial and industrial participants. To avoid the creation of a financial albatross, the Board needs to re-evaluate the costs and benefits of existing solar policies to ensure that New Jersey's residents, particularly non-participants, are receiving economic and environmental benefits in return for the financial support that has fueled rapid solar penetration in New Jersey.

- *Promote Solar Installations that Provide Economic and Environmental Benefits*

Brownfield sites and landfills are well-suited for the development of large solar generation projects. Large-scale solar development can offset the costs to cap or remediate these sites and should be encouraged. Other innovative, large-scale solar installations are on the horizon and should be considered in addition to, not in lieu of, smaller-scale, grid-connected applications.

- *Maintain Support for Offshore Wind*

Although New Jersey's onshore wind potential is resource constrained, the Garden State has great offshore wind potential. New Jersey may be one of the first states to support the construction of one or more offshore wind facilities, but it must not rush headlong into long-term contracts between offshore wind developers and EDCs until the State has determined there are net economic benefits realizable through this promising technology. The Christie Administration supports the Board's due diligence process to safeguard the economic interests of ratepayers throughout the State while promoting job creation and environmental benefits associated with this promising technology.

Codification of the statutory requirements of the Offshore Wind Economic Development Act (OWEDA) provides a framework for approving applications and setting offshore wind renewable energy certificate (OREC) prices to promote the financeability of offshore wind projects. The Christie Administration remains supportive of offshore wind development. The Board has sole jurisdiction to approve an OREC price that will allow the applicant to satisfy the cost-benefit standard set forth in OWEDA, including adjusting the OREC price as required. In reaching a determination of net economic benefits, the Board must consider the resultant benefits to wholesale energy and capacity prices attributable to wind, income effects ascribable to construction and operation of offshore wind projects, and consequent environmental benefits. In the years ahead, New Jersey should monitor technology and operating developments in Europe and China, as larger wind turbines yield potential cost and performance advantages over existing technology.

Promote Cost-Effective Conservation and Energy Efficiency

The State has had a variety of energy efficiency (EE) and conservation programs, as well as CHP programs. The array of conservation and CHP programs are a cost-effective way to reduce energy costs and carbon emissions. However meritorious EE and CHP programs may be, the Administration is committed to a top-down reassessment of program efficacy. Changes since the 2008 EMP require that the 20% energy reduction goal be modified, but cost-effective programs can still reduce the State's energy use, thereby fostering economic development and promoting the State's environmental goals. Some of these programs may *increase,* not decrease the State's use of natural gas.

- *Promote Energy Efficiency and Demand Reduction in State Government Buildings*

New Jersey will lead by example and continue to improve the EE of State owned and operated buildings. In addition to existing programs, the State will take advantage of recent legislation that allows State agencies to contract with third parties with "know-how" and financial resources to implement and fund EE measures in government owned and/or operated buildings without upfront capital investment. Operating costs will be lowered by using performance-based contracting for capital improvements to energy equipment such as lighting upgrades, heating, ventilation and air conditioning (HVAC) replacement, and the installation of building automation systems.

- *Incorporate Aggressive Energy Efficiency in Building Codes*

The State has a number of measures to encourage EE in new and existing buildings. Incorporating more aggressive EE requirements within the New Jersey Building Code will assist in reducing energy use without jeopardizing economic development or environmental goals.

- *Redesign the Delivery of State Energy Efficiency Programs*

There are several innovative alternatives to optimize existing EE programs that should be evaluated, such as a revolving loan program or the creation of an "energy efficiency utility" that would generate revenue out of energy savings. These alternative delivery mechanisms should be implemented if they are cost-effective and benefit all ratepayers.

- *Monitor PJM's Demand Response Initiatives*

PJM is in the process of implementing many incentives and resources to support demand response (DR) to make it easier for those resources to participate and be rewarded through PJM's energy and capacity markets. New Jersey should monitor actively how new incentives inspired by FERC's recent rulemaking affect incremental DR in order to maximize the State's participation in these programs.

- *Improve Natural Gas Energy Efficiency*

We encourage increased natural gas use for power generation as well as for residential and commercial applications, in lieu of oil. The use of high efficiency natural gas appliances is encouraged, including the substitution of natural gas furnaces and hot water heaters for distillate oil use.

- *Expand Education and Outreach*

Implementation of any of these measures will require educating all consumers about energy conservation measures and EE tools by State agencies, utilities, non-profits, and membership organizations.

<u>Support the Development of Innovative Energy Technologies</u>

New Jersey has many options to develop new, clean, cost-effective sources of electricity, utilize fuels more efficiently, and lessen reliance on gasoline and diesel fuel as the primary transportation fuel. These energy technologies would reduce emissions of air pollutants and greenhouse gases. Active support of innovative energy technologies will create jobs as well as help businesses throughout the State.

- *Improve Transportation Efficiency and Emissions Reductions*

The disparity between oil and natural gas prices warrants technology substitution for diesel engines, particularly for dedicated fleet vehicles that start and return to the same depots each day and have a limited driving radius. Similarly, plug-in electric and electric hybrids have enormous potential to increase mileage efficiency and drastically reduce emissions from the transportation sector if our base load energy comes from cleaner and renewable sources. Although NGVs have been commercialized around the globe for decades, NGVs have not established significant market share in New Jersey. The auto industry, worldwide, has made strides in the development of electric-hybrid and electric vehicles. In New Jersey, we face challenges related to our aging grid infrastructure, and the need to reduce reliance on high emission sources of energy. The Christie Administration is committed to change by promoting the infrastructure needed throughout the State to induce heavy vehicle class conversion from expensive and polluting diesel fuel to less costly and clean CNG and for new and cleaner in-state power generation and the improvement of our electric grid which will be needed if and when the electric vehicle industry develops a market on a state and national scale.

- *Future Use of Fuel Cell Technology*

Fuel cells hold promise for emission-free DG and transportation applications, but they are expensive. Fuel cells can reduce the need for new transmission and distribution investments. Technology progress may improve the economic performance of fuel cells. New Jersey should continue to monitor fuel cell performance benchmarks.

- *Future Use of Energy Storage Technologies*

Energy storage has a promising future, especially when coupled with intermittent resources like solar and wind. The new technologies include compressed air energy storage, flywheels, advanced battery systems and plug-in hybrid electric vehicles. New Jersey should continue to monitor the evolving development and improvement of energy storage technologies.

- *Evaluation of Smart Grid Demonstrations*

New Jersey expects that smart grid technology will be an integral part of the energy balance throughout the State. An ongoing demonstration project will allow parties to evaluate its cost effectiveness before we make any policy decisions.

- *Dynamic Pricing and Smart Metering*

New Jersey will expand implementation of smart meters and gradually expose customers with lower energy demands who wish to take advantage of dynamic pricing to encourage wiser energy use and reduce retail prices for all residents.

3 Energy Master Plan Background

New Jersey's Energy Master Plan Statute, N.J.S.A. 52:27F-14, was enacted in 1977 as a response to the energy crisis of the mid-1970s.[1] The statute called for a 10-year "master plan" for the "production, distribution, and conservation of energy in New Jersey." Although the statute calls for the creation of a new EMP every ten years, and an update every three years, after the initial EMP was published, revisions were issued only sporadically, most recently in 1995 and then in October of 2008. This 2011 EMP serves as the three-year update to the 2008 EMP.

The Statute further requires the EMP to include long-term objectives and the implementation of interim measures consistent with those objectives, and to give due consideration to the energy needs and supplies in the "several geographic" areas of New Jersey. Finally, the Statute calls for consultation and cooperation among the various federal and State agencies with an interest in the production, distribution, consumption, or conservation of energy.

3.1 The 2011 Update Process

In April of 2010, during the BPU's Sustainable Energy and Economic Policy Forum at the State Theatre in New Brunswick, Governor Christie outlined an energy policy that emphasizes in-state production of both renewable and traditional energy sources to create a stronger economy and jobs. He directed the BPU to revisit the 2008 EMP in light of current economic realities, thereby initiating the current EMP revision process.[2]

Immediately following the April conference, the BPU convened an internal task force to review the 2008 EMP goals and the State's ability to achieve those goals in light of current economic conditions and policies. The BPU worked with the Rutgers Center for Energy, Economic, and Environmental Policy (CEEEP) and the Rutgers Economic Advisory Service (R/ECON) of the Center for Urban Policy Research at the Edward J. Bloustein School of Planning & Public Policy, who used the R/ECON statewide economic model to evaluate EMP goals.[3]

On June 24, 2010, the BPU held an Electric Generation Capacity conference (also referred to as the "Technical Conference") to discuss and address concerns related to the construction and operation of new generation in New Jersey. Over the summer of 2010, BPU staff worked with CEEEP to collect and analyze energy data, and to develop models that would help frame the current situation with regard to energy pricing, use, and development. As part of this process, BPU and Rutgers convened a series of meetings organized by CEEEP to discuss the relative successes of current programs with interested parties and to consider policy changes.

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[1] The EMP Statute can be found at: http://www.state.nj.us/emp/archives/empstatute.html.

[2] This revised 2011 EMP is intended to be reviewed and revised again in three years.

[3] From its inception in 2003, CEEEP in conjunction with R/ECON has and continues to emphasize transparency in its analysis and has third parties review and critique data, analysis, and findings. The R/ECON model provides policymakers with a tool for analyzing New Jersey's economy, including the energy sector. Many charts and data used in this 2011 EMP rely on the R/ECON model.

In August, CEEEP released the 2010 EMP Assumptions document that provided updated data (from the 2008 EMP) for current electric and gas rates, fuel prices, generation technology costs, and projections for New Jersey customers. This document was updated again on February 14, 2011. In August and September of 2010, the BPU hosted three stakeholder meetings around the state on the EMP assumptions, issues, and potential new directions.[4] Comments were received from over fifty organizations, companies, and individuals during these meetings and in follow-up communications.

3.2 CEEEP Analysis

CEEEP began the analysis for the 2011 EMP understanding that, in this context, planning should be a continuous process that articulates fundamental objectives, establishes measurable targets, assigns resources and responsibilities for meeting those targets, and reevaluates and adjusts the EMP's strategies over time. CEEEP developed and analyzed a considerable amount of energy data to inform the EMP process, and not to be dispositive. The engineering, economic, and policy issues in the energy field are so complex and intertwined that there is not a single "right" solution that the modeling is supposed to calculate. The data collection and analysis provides a means to test and understand the EMP's themes and strategies, narrow areas of disagreement, identify uncertainties that matter, identify key tradeoffs, and establish the conditions under which certain outcomes can occur. CEEEP's analysis is intended to support the EMP planning process, not to determine specific policy design.

The EMP process must account for future uncertainties, determine when conditions depart substantially from what past assumptions, and make changes as appropriate. As CEEEP noted in 2008, a cursory review of energy events over the last several decades reveals that the unexpected is the norm, not the exception. In the 1970s and early 1980s, there were oil shortages and concerns about oil prices reaching $100/bbl.[5] Natural gas was not permitted to be used to generate electricity, and the price was administratively controlled. In 1979, the meltdown at Three Mile Island precipitated a halt in the construction of new nuclear power plants.

Oil prices came back down by the late 1980s, the Clean Air Act was considerably expanded in 1990, and wellhead natural gas price controls were removed in 1985. After a period of relative calm, natural gas prices spiked in the winter of 2000 and have been volatile ever since. Even so, natural gas became the dominant fuel for new CC generation plants.[6] While there had been increasing consideration for new nuclear plants, high capital costs and renewed safety issues have dampened any enthusiasm for the time being. More recently, there is concern about emissions of greenhouse gases like carbon dioxide (CO_2) and methane, leading to the development and improvement of new technologies, including hybrid vehicles, fuel cells, carbon sequestration, biomass and municipal solid waste plants, wind turbines, and solar power.

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[4] Stakeholder meeting transcripts and other EMP documents can be found at: http://www.state.nj.us/emp/.

[5] The average price of domestic crude oil increased from $19/bbl in 1970 to $99/bbl in 1980. See Section 5 for historical oil and natural gas prices.

[6] Relative to other plant technologies, CC plants are inexpensive to build and operate, are efficient, and have flexible operating characteristics. The BPU's 2011 LCAPP resulted in the selection of three in-state gas-fired CC plants.

3.3 Implementation of the EMP

Implementation of New Jersey's energy goals will require the support and cooperation of all State agencies, together with energy developers and suppliers, power plant owners, PJM, FERC, all levels of government, and ratepayers. Governor Christie has directed all State agencies to work together as we begin the implementation process.

The BPU will continue to serve as the lead implementing agency for the EMP. In doing so, the BPU will, among other things: coordinate with appropriate state agencies, energy providers and other stakeholders as needed; track and report on progress through annual reporting to the Governor and posts to the BPU web site; and work with the legislature to develop or modify existing and future programs that support these energy goals.

4 New Jersey's Electric Industry

The EMP is centered on New Jersey's electricity industry. The State of New Jersey through the BPU has the regulatory authority to compel or incentivize the four EDCs to take actions that foster the environmental, economic, and reliability goals of the State. These goals include job creation and employment. As of October 2010, New Jersey's retail electric rates remain among the most expensive in the nation.[7] Residential rates are the fourth most expensive, industrial rates are seventh most expensive, and commercial rates are ninth most expensive. For New Jersey's economy to grow, electricity costs must be comparable to costs throughout the region, and ideally to the U.S. as a whole. Electric energy costs have a significant effect on the economic well being of C&I customers. High electricity prices discourage new manufacturing and commercial entry and may cause electricity-intensive industry to relocate. Against the backdrop of the recent recession, businesses hesitate to expand in part due to high electricity prices. Moreover, high residential rates not only affect the cost of living in New Jersey, but deplete disposable income, thus reducing money spent on goods and services throughout the State.

Available to New Jersey policymakers are a number of policy initiatives that can influence the cost of electricity. Many components of the cost are part of the legacy of building out the State's energy infrastructure over the years. Other components reflect regional and global market dynamics underlying the availability and price of fossil fuels over which the State has little control. For example, the price of oil is largely beyond the State's control. Likewise, developments affecting the production of natural gas in shale formations are outside the purview of the BPU. Similarly, the certification of new interstate pipelines is a FERC jurisdictional matter, but there are actions the State of New Jersey and municipalities throughout the State can take to ensure that safety and environmental goals are protected. Finally, the approval of new transmission lines is also a FERC jurisdictional matter, largely outside the regulatory purview of the BPU and other state agencies. These commodity and infrastructure developments affect New Jersey's electric industry, and must therefore be monitored closely by New Jersey stakeholders in order to maintain a good balance among infrastructure options available to meet environmental, economic and reliability objectives.

4.1 The New Jersey Power System

Retail electric service in New Jersey is provided by the four EDCs:[8]

- Atlantic City Electric Company (ACE)
- Jersey Central Power and Light (JCP&L)
- Public Service Electric and Gas Company (PSE&G)

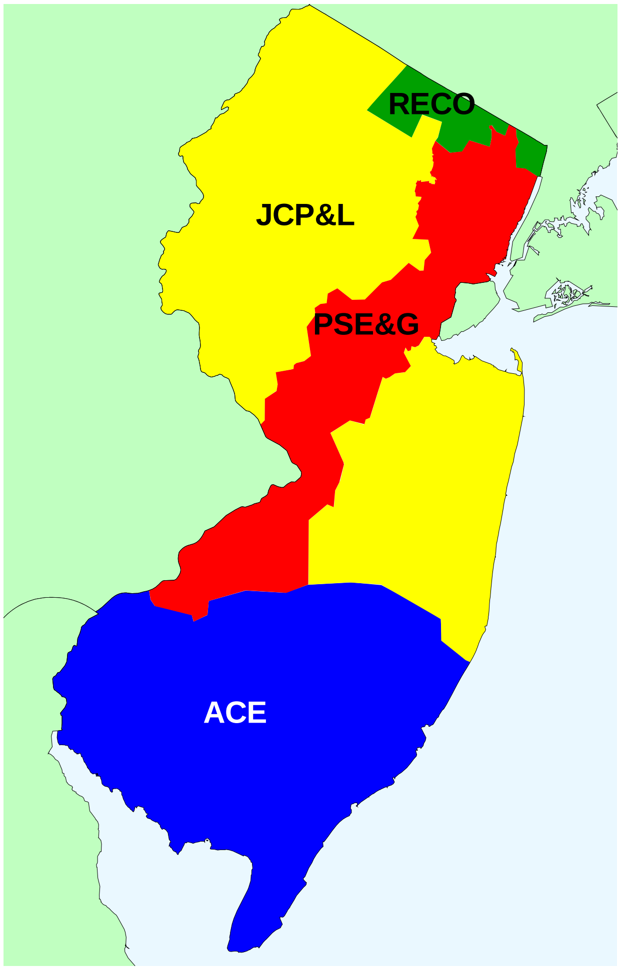
[7] EIA. Table 5.6.B. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date through October 2010 and 2009. www.eia.doe.gov/cneaf/electricity/epm/epmxlfile5_6_b.xls.

[8] In addition to the four EDCs, there are electric municipal utilities that serve load for their customers that are not regulated by the BPU.

- Rockland Electric Company (RECO)

The service territories of the four EDCs are shown in Figure 1.

Figure 1. EDC Service Territories



The New Jersey transmission system, shown in Figure 2, is owned by the EDCs and controlled by Pennsylvania-New Jersey-Maryland Interconnection, LLC (PJM)[9], the federally-approved Regional Transmission Organization (RTO) that ensures the reliability and security of the bulk electric power system.[10] PJM also coordinates the flow of electricity power to and from adjoining power systems, including New York. The transmission system allows power to be delivered to customers from in-state and out-of-state generation resources. New Jersey's high degree of electrical connectivity with contiguous states in PJM is illustrated in the transmission

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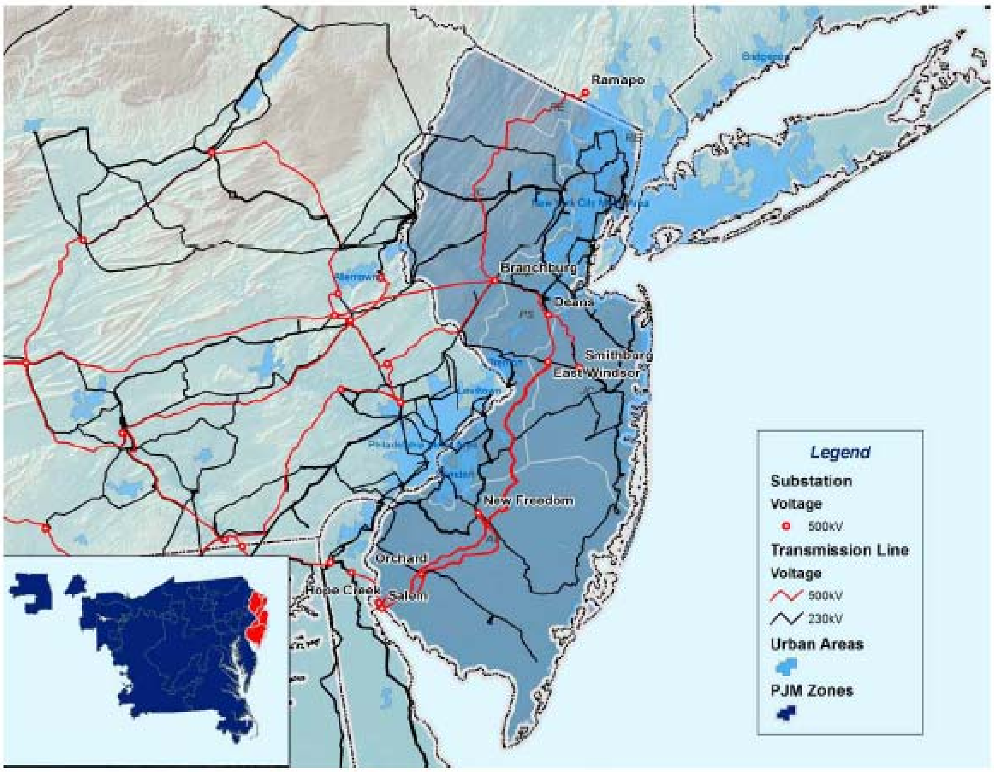
[9] The Members' Committee of PJM, which elects the PJM Board, establishes the schedules and by-laws, and votes on PJM policies, is dominated by suppliers, generation owners and transmission owners. Of the 439 voting members, only 17 are end-use customers, and only nine are consumer advocates.

[10] As an RTO, PJM is regulated by FERC rather than the state public utility commissions.

map below. As discussed in Section 4.2.1, New Jersey also has a number of HV transmission links with New York.

Figure 2. Transmission System in New Jersey



The long-term adequacy of New Jersey's electric resources must consider the forecasted demand, new resources, power plant retirements, and a broad array of other factors that bear upon reliability. While it is PJM's responsibility to assure there are enough generation, transmission and demand-side resources to meet customer demand in the face of many uncertainties affecting grid security, the State of New Jersey can affect the timing and location of many supply and demand-side resources that bear on reliability and security of supply.

4.2 The PJM Market

New Jersey's four EDCs are participants in PJM, the largest regional electricity market in the U.S. PJM encompasses all or part of thirteen states and the District of Columbia.[11] PJM is a non-profit organization charged with the operation of the wholesale competitive market across the aforementioned market area, management of the electric grid, and long-term planning and resource coordination. PJM has a broad array of management responsibilities to ensure security of electricity supply. Meeting customer supply can be accomplished by proximate generation or transmission from remote generation outside of New Jersey. PJM plans years in advance for

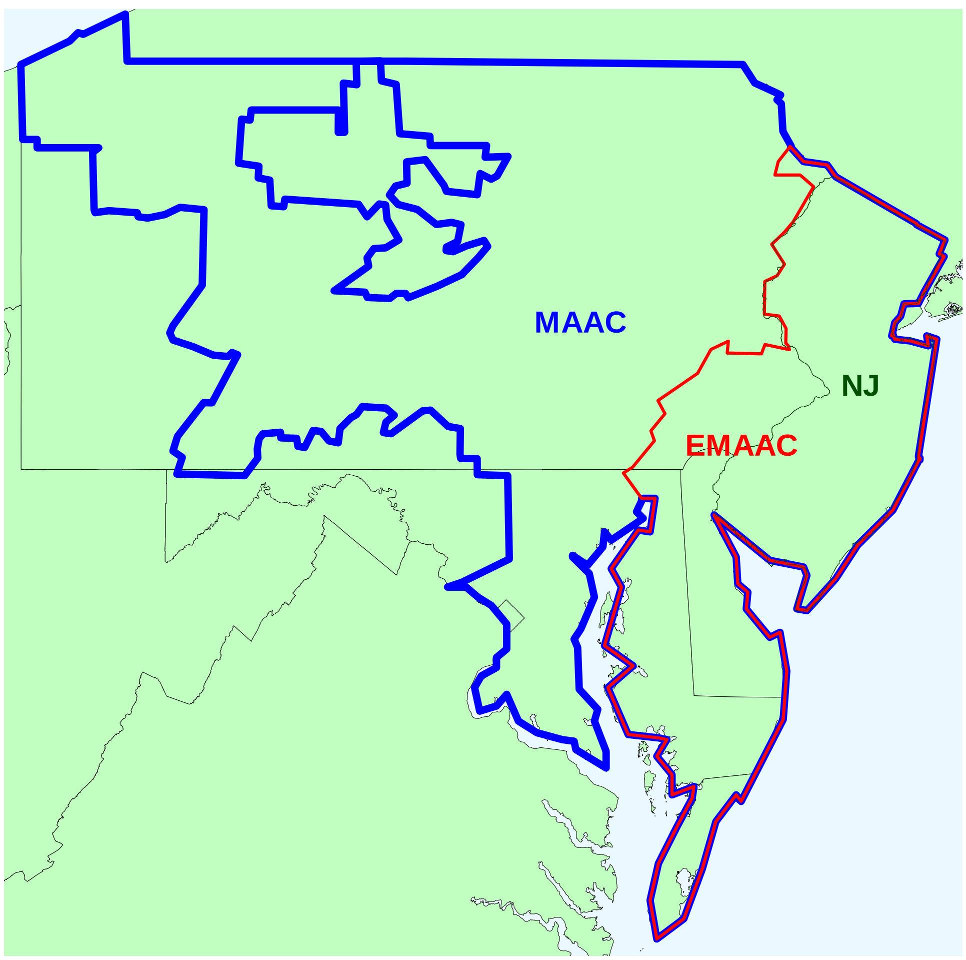
[11] The PJM Region includes all or parts of Delaware, District of Columbia, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia, Illinois, Indiana, Kentucky, Michigan, North Carolina and Tennessee.

transmission needs and guarantees rich returns to transmission developers. Significant economic and reliability benefits accrue to PJM members and their customers through the centralized security-constrained economic dispatch of power plants as well as the ongoing long-term planning process coordinated by PJM.

New Jersey makes up a relatively small portion of PJM. According to PJM's 2009 411 Report, which provides data on each of the over 1,000 generating units located within the region, PJM's total installed nameplate generating capacity is 177,942 MW. Less than 10% of the total installed generation capability is located in New Jersey, *i.e*., 17,394 MW.

Within PJM, New Jersey is located within the Mid Atlantic Area Council (MAAC) service area, a region that includes New Jersey and Delaware as well as parts of Pennsylvania and Maryland. MAAC is viewed as a separate region because of transmission constraints between it and the rest of PJM. Additionally, transmission constraints within MAAC make subdivision of the region into smaller areas useful. New Jersey is located in Eastern MAAC (EMAAC). Figure 3 shows the nested structure of New Jersey, EMAAC and MAAC.

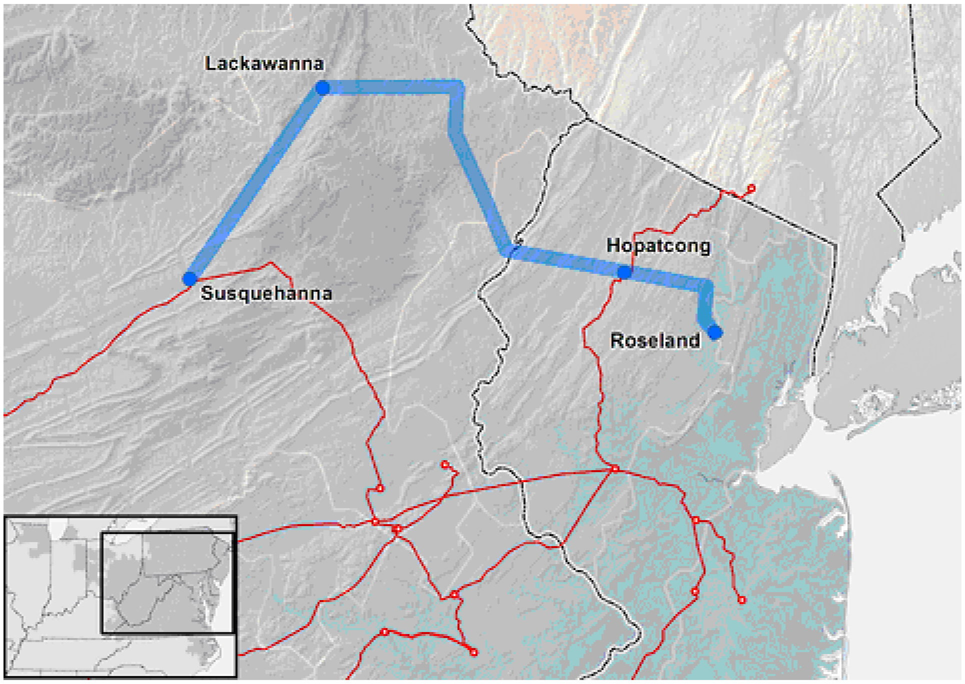
Figure 3. New Jersey, EMAAC, and MAAC



4.2.1 Transmission System

PJM operates the HV transmission system that gives EDCs and other LSEs access to cost-effective energy resources and assures them of adequate reliability. PJM is responsible for grid reliability and implements transmission projects when regions are forecasted to have inadequate capacity supplies relative to their peak load requirements.[12] For example, PJM determined through its reliability review process that new transmission was required to serve northern New Jersey. Toward that end, PSE&G, in conjunction with PPL Electricity Utilities Corp. (PPL), developed the Susquehanna-Roseland 500kV transmission project. This line is designed to bring electricity east from Pennsylvania, and to relieve a number of reliability planning violations identified by PJM starting in the summer of 2012.

Figure 4. Susquehanna-Roseland Transmission Project



Both the BPU and the Pennsylvania Public Utility Commission approved the line in February 2010. However, PSE&G and PPL, the transmission owners (TOs) responsible for construction, indicated that the line will not be in service until June 1, 2014, and perhaps later due to permit delays related to a 1.65 mile line segment requiring National Park Service approval.[13] The National Park Service has indicated that the review will be completed no earlier than January 2013. At this juncture, the best estimate for the in-service date of the New Jersey portion of Susquehanna-Roseland project is June 2014 for the eastern portion between Roseland and

[12] PJM's development of its annual Regional Transmission Expansion Plan (RTEP) is a public, stakeholder process.

[13] That segment traverses parts of the Delaware Water Gap National Recreation Area, the Appalachian National Scenic Trail and the Middle Delaware National Scenic and Recreational River.

Hopatcong, and June 2015 for the western portion between Hopatcong and the State border. PPL is now targeting an in service date of April 2015 for the Pennsylvania portion of the line.

The delay of the Susquehanna-Roseland line will create reliability problems in the State. PJM claims to be addressing this delay.[14] The federal permitting process must be accelerated. To hedge against uncertainty about the timing of new transmission, uncertainty about load growth and generator retirements, New Jersey should encourage the development of new generation that meets the economic, environmental and reliability goals set forth in this EMP.

PJM has planning criteria and study mechanisms to ensure that power exports to New York do not degrade reliability in New Jersey. The 660-MW Neptune HVDC project, which links New Jersey and Long Island, has been in operation since 2007 and required the construction of transmission upgrades to assure system reliability in New Jersey. The 300-MW Linden Variable Frequency Transformer project, which links New Jersey and Staten Island, is also commercial and also required transmission upgrades. The 660 MW Hudson Transmission Project (HTP), which has encountered market-related delays, has an uncertain completion date. If constructed, HTP would link New Jersey with mid-town Manhattan, and will require $172 million in PJM transmission upgrades to support HTP's firm withdrawal rights in the amount of 320 MW.[15] The transmission upgrades to ensure grid security and stability objectives in New Jersey are not designed to protect New Jersey ratepayers from economic consequences, however.

FERC has promulgated policies that it claims are sufficient to motivate transmission owners to develop new transmission projects. FERC attempts to encourage investment in transmission infrastructure through financial incentives – a mark-up to the customarily set equity rate of return. Other incentive-based rate treatment can include (i) 100% of prudently incurred Construction Work in Progress in rate base, (ii) recovery of prudently incurred pre-commercial operations costs, (iii) use of a hypothetical capital structure, (iv) accelerated depreciation for rate recovery, (v) recovery of prudently incurred costs that are cancelled or abandoned, (vi) deferred cost recovery, and (vii) any other incentives determined to be just and reasonable and not unduly discriminatory or preferential. FERC's transmission rate design policy has resulted in a number of proposed "backbone" transmission projects in PJM that are designed to alleviate congestion, hopefully rendering more efficient the generation and use of energy resources throughout the market area.

The BPU has evaluated the provision of additional incentives to EDCs for capital improvements to electric distribution systems. Parenthetically, the BPU has also considered the provision of additional incentives for gas distribution systems. These incentives include: (i) a surcharge mechanism that enables the EDCs to receive full recovery of and on investments without filing a base rate case, (ii) an after-the-fact prudency review and true-up to reconcile estimates with actual costs, (iii) other recovery surcharge mechanisms favorable to the EDCs. Annual

[14] In its 2010 RTEP, PJM reported that they have developed an operational solution to address the reliability criteria violations that would be expected to occur in 2012 without the line, including extending the Reliability Must Run agreement of the Hudson Unit # 1 into 2012.

[15] Any additional withdrawals above the 320 MW firm withdrawal level would be scheduled on an interruptible basis.

adjustments would continue until the EDC's next base rate case, at which time unrecovered costs would be rolled into rate base and collected through base rates.

4.2.2 Energy Market

PJM is responsible for the administration of the energy and ancillary services market as well as the capacity market. Wholesale energy markets are cleared on an hourly basis by PJM, thus setting energy prices on a locational basis across the market area. Wholesale energy prices are commonly referred to as Locational Marginal Prices (LMPs). Auction clearing prices are the result of PJM's matching bids received by generators to supply energy for a given hour, to demand for energy (system load), in that hour.

LMPs are generated in two separate but inextricably linked markets – the Day-Ahead Market (DAM) and the Real-Time Market (RTM). The DAM is conducted one day prior to the delivery. Thus, bids for supply are received from generators on Thursday for delivery on Friday. Prices are set based on the bids received and PJM's *expectation* of the following day's demand, which is based primarily on a one-day-ahead weather forecast. On the day of delivery, deviations in the amounts of supply and demand cleared in the DAM can occur. Weather may change unexpectedly, causing demand to increase or decrease. Suppliers may not be able to meet their obligations due to unscheduled outages. These and other factors mean that the system requires a reconciliation market to deal with variances between expected conditions and actual delivery day conditions. This is the role of the RTM.

The RTM is held on the day of delivery and works similarly to the DAM in that bids are received from suppliers and demand is calculated by PJM. In the RTM, the only quantities participating are those that are required to offset variances between expected and actual conditions. For example, if weather on the day of delivery is hotter than had been expected the day before, demand will be greater than the amount that cleared in the DAM. Thus, the RTM will be utilized to procure energy required to meet the excess demand. Only resources that did not clear in the DAM are allowed to participate in the RTM. Hence, prices in the RTM tend to be more volatile than those in the DAM. Over time, however, price differences between the two markets converge. Most energy is transacted in the DAM rather than the RTM, which is in part why RTM prices tend toward greater volatility.

In PJM, energy prices for load are set at 16 different localities. Four of the highest-priced of the 16 PJM localities are located in New Jersey, and are the franchised service areas of PSE&G, JCP&L, ACE, and RECO. Transmission constraints across the region limit the extent to which energy can flow from one area to another. These transmission limitations coupled with PJM operating criteria result in energy price separation – prices are typically higher in New Jersey than in adjoining areas due to the State's high demand and higher cost generation available to serve load. Prices are generally lower in other areas such as western and central Pennsylvania where demand is comparatively low and there are many more inexpensive generating assets to serve load. LMPs, by design, assign the highest value to energy delivered to constrained areas. The theory of LMP is to send economic signals to market participants to add new generation where it is needed most; in other words, the higher the energy price, the greater the need, and *vice versa*. While there is much public debate about the theory of LMP, New Jersey maintains that it does not provide effective market signals that result in new resources when and where they are needed most.

4.2.3 Capacity Market

The other key market administered by PJM is the capacity market, for which prices are set by the Reliability Pricing Model (RPM). Capacity is the ability to generate electricity when needed. Resources that are paid for capacity obligations commit to being available to PJM to generate or to reduce load when called on. For some resources, such as inefficient peaking units, they will only be required to generate during the few hours a year when demand is highest. The market needs those resources to ensure reliability during high-load hours, but since peakers do not run many hours there must be another revenue stream available to peakers to ensure that the resources are available when needed. PJM's RPM is designed to produce the other revenue stream in addition to profits from energy and ancillary sales. All generation resources that participate in the RPM and clear the auction receive these capacity revenues. According to the theory of RPM, price outcomes by capacity zone in PJM are designed to produce market signals that result in new resources where and when they are needed most.

Under RPM, capacity prices are set for each Delivery Year by auctions held three years in advance.[16] Prices are set by the intersection of bids received from generators and demand-side resources and an administratively-determined demand curve designed to procure enough capacity to maintain reliability standards, based on the then-prevailing PJM load forecast. There are actually multiple auctions. Most capacity is transacted in the Base Residual Auction (BRA), which is held every May three years preceding the Delivery Year. Following the BRA, additional auctions are held before the Delivery Year to account for changes in the demand forecast, changes in the amount of supply available, and other factors that would cause a variance from conditions expected in the BRA. For each auction, suppliers submit offers to sell capacity to PJM and bids are stacked to form an upward sloping supply curve. Clearing prices are determined by the intersection of that supply curve and the demand curve.[17] Like the energy market, RPM is locational. New Jersey is located in EMAAC, which is itself located within MAAC, as indicated in Figure 3. Depending on market conditions and local and regional transmission constraints, New Jersey ratepayers may pay a capacity price for EMAAC, MAAC, or PJM as a whole.

A key goal of the capacity market is to induce the entry of new generation when needed. To date, RPM's success is a subject of much controversy. In PJM's report of the results of the 2013/14 BRA, held in May 2010, PJM noted that since the first BRA for the 2007/08 Delivery Year, the system has seen about 18,000 MW of new capacity, about two thirds of which is DR.

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[16] A Delivery Year runs from June to the following May of each year. For example, April 2011 is near the end of the 2010/11 Delivery Year.

[17] PJM refers to the demand curve as a Variable Resource Requirement curve. It is established so that if the system requires resources in the delivery year to meet reliability standards based on the then-prevailing load forecast, clearing prices will be high to induce entry. If the market has an excess, prices will be low. Price signals are designed to induce entry as well as cause retirements.

The remainder is comprised of new generation assets.[18,19] However, many market participants argue that RPM has not brought enough generation into the markets where and when needed. A key finding of the June 2010 BPU conference was that generators proposing new projects are not able to obtain financing at reasonable rates to develop new assets due to uncertain capacity revenues. Under existing rules, PJM does not allow new resources to lock-in capacity prices for more than one year, at a time. Most generation assets must be developed under a long term contract to ensure that revenue streams will be sufficient to attract financing. New Jersey's recent LCAPP proceeding was an attempt to address the problem that BRA capacity price outcomes are not bankable and do not support new generation entry in and around New Jersey.

In response to New Jersey's LCAPP initiative, PJM sought FERC approval to make a rule change affecting capacity markets.[20] The rule change was focused on modifications to the Modified Offer Price Rule (MOPR). Previously, as a result of a settlement approved by FERC, many new generators had been allowed to submit bids of $0/MW-day, ensuring that the corresponding capacity would clear an auction, thus receiving capacity revenues at the prevailing clearing price. This also ensured that the inclusion of new resources in the supply mix would put downward pressure on BRA clearing prices, all other things being the same. PJM's proposed revisions to the MOPR would make it more difficult for new entrants to submit low bids into the RPM if the market already has an excess of capacity. On April 12, 2011, FERC accepted PJM's proposed changes to MOPR, effective immediately. Although the decision left open the possibility of a Section 206 filing, and PJM's addressing the issue via a stakeholder proceeding at some later time, FERC's Order accepting PJM's proposed changes to MOPR imperils New Jersey's ability to realize the economic, environmental and reliability benefits intended under LCAPP. The selection process culminated in the award of three contracts covering 1,945 MW of state-of-the-art CC plants.[21]

In addition to energy and capacity, PJM also administers other markets, such as ancillary services and Financial Transmission Rights, which establish rates for charges associated with market operation.[22] These markets, however, make up a relatively small portion of all-in costs for ratepayers.

4.3 EDECA and Deregulation

Prior to deregulation in the mid-1990s, New Jersey's electric utilities were responsible for the generation, transmission, and delivery of electricity under the regulation and oversight of the BPU. Vertically-integrated electric utilities built, operated, and maintained power plants with the expectation that the BPU would allow them to recover prudently incurred costs, including a

[18] Values are net of generator retirements

[19] Source: PJM 2013/14 RPM Base Residual Auction Results, p. 15

[20] Docket Nos. EL11-20-000 and ER11-2875-000.

[21] According to Levitan & Associates, Inc. the LCAPP Agent, the present value of the benefits under the SOCAs amount to $1.8 billion. See Agent's Report, March 21, 2011, p. 69.

[22] Ancillary services are services provided by generators that support grid operation, such as voltage support or the ability to provide reserves for the system in the event other resources suddenly go offline. FTRs are rights purchased at auction to move electricity across congested transmission lines.

return on investment. Once plants were constructed, the electric utilities were largely insulated from the risk that their respective investments were imprudent, thereby causing the utility's investors to bear cost responsibility. By the mid to late 1990's, many states throughout the U.S, including New Jersey, embraced a new regulatory structure centered on deregulation of the generation segment of the business, but a continuation of the traditional cost of service regulation approach for the wires segment of the business, *i.e.*, transmission and distribution. Today, the BPU has limited or no regulatory authority over the owners of power plants in New Jersey. Transmission owners are regulated by FERC. The BPU's regulatory authority is limited to the EDCs that are responsible for the distribution of electricity throughout New Jersey, including the array of social programs and renewable technologies required to meet New Jersey's RPS.

Passage of the Electric Discount and Energy Competition Act (EDECA) has its origins in the Energy Master Plan Committee's Phase I Report that was published in March 1995. The report "presented a vision for the state that was based on energy markets guided by market based principles and competition." The report "provided a policy framework for the transition from power industry monopolies to competitive markets." The BPU was asked to assess possible long-term changes to the structure of the electric power industry in order to lower electricity costs. The Board then initiated a Phase II proceeding that concluded with the Final Report issued in April 1997.[23]

New Jersey enacted EDECA in 1999, the fourteenth state to restructure its electricity industry.[24] Under EDECA the electric utilities divested their electric generation assets. Electric services were unbundled and retail choice was implemented allowing ratepayers to select their suppliers. EDECA also required that electricity rates be reduced for four years. Since then, the wholesale price of electricity (including the energy, capacity, and ancillary service components) has been set through competitive market mechanisms administered by PJM. PJM's competitive market mechanisms are subject to FERC jurisdiction. Since divestiture New Jersey's ratepayers no longer bear the risks of power plant construction and operation – those risks and responsibilities have been assumed by generators in PJM.[25] In theory, but not in fact, new generation resources are developed when and where there is need based on capacity and energy market signals administered by PJM.

4.4 New Jersey Market Dynamics

The generation fleet in New Jersey operates on a relatively diverse mix of fuels. As of 2008, the New Jersey fleet was 55% gas-fired, based on generation capacity, 22% nuclear, and 11% coal fired. New Jersey's increased dependence on natural gas fired generation is a relatively recent development, but one that is consistent with trends in New England and the downstate New York market as well. Figure 5, below, shows how the composition of New Jersey's generation fleet

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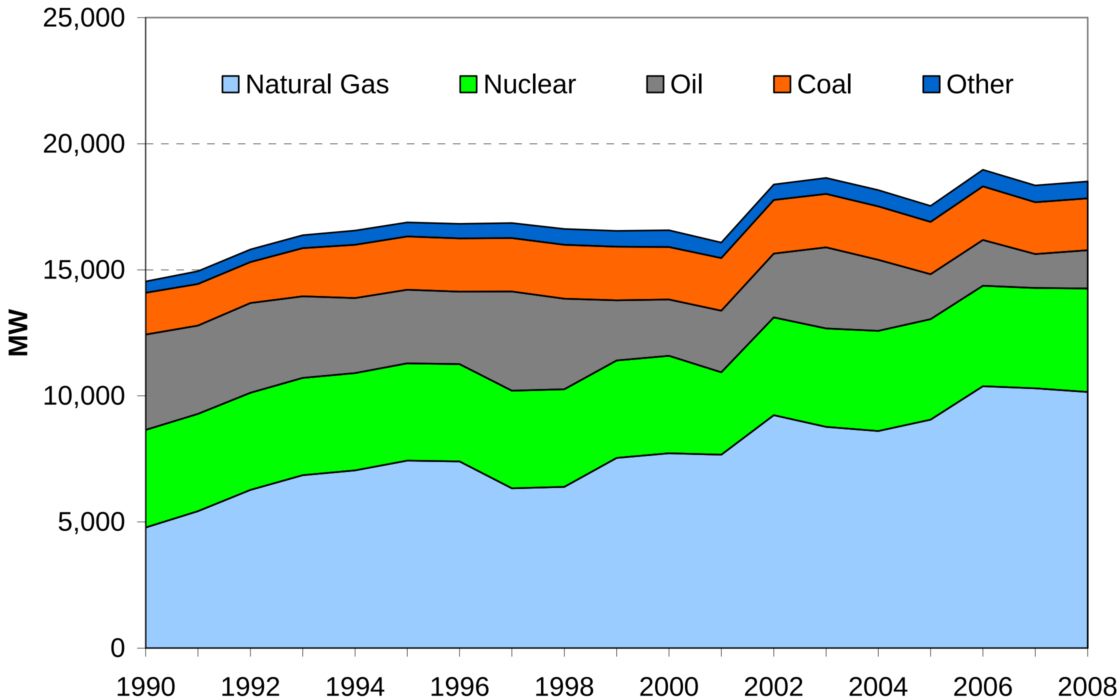
[23] The Board directed the State's electric utilities to submit restructuring proposals that were the subject of wide-ranging, contested adversarial proceedings before the Office of Administrative Law and the Board.

[24] Many other states have deregulated the generation of electricity, including Pennsylvania, Maryland, Delaware, and New York.

[25] Generators may be independent or affiliated with EDCs.

has changed since 1990[26]. In the last twenty years, natural gas generation capacity has increased from about one-third to over one-half the State's generation capacity. This rapid growth in gas-fired generation is similar to other states in the Northeast and elsewhere in the U.S. in response to the performance of CC plants, the availability and pricing of natural gas, and the comparatively low capital cost of building CC plants or quick start peakers.

Figure 5. New Jersey Generating Capacity (1990-2008)



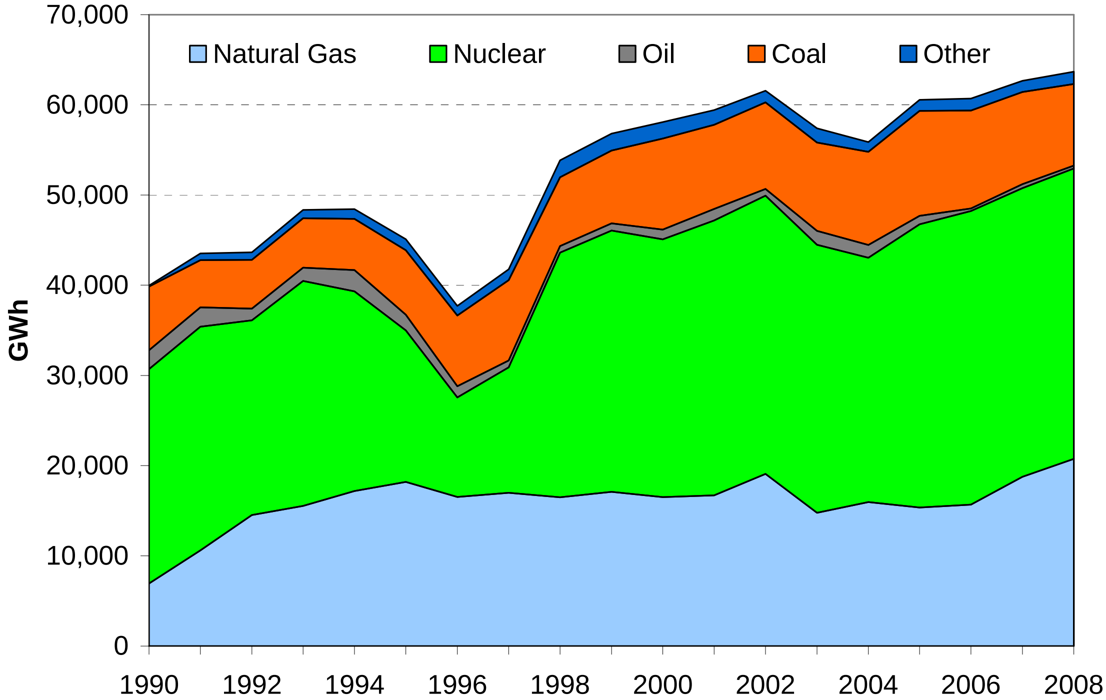
Over this period, the amount of oil fired generation has declined significantly, reflecting the weak economics and comparatively poor environmental performance associated with oil-fired generation. Oil fired generation is, nevertheless, an integral part of New Jersey's state-wide reliability requirements. Oil-fired generation is available during cold snaps when limitations on the availability of natural gas can reduce or preclude gas-fired generation in the DAM or RTM. Over the last two decades, the amount of coal and nuclear generation has remained about constant. Since 1990 New Jersey has relied largely on new gas-fired generation to meet load growth and maintain reliability, but the recent addition of renewables coupled with other demand side technologies portends greater supply and demand diversity on a going forward basis.

While natural gas fired capacity accounts for over one-half the State's generating capacity, only 33% of total energy produced was derived from gas-fired plants in 2008. As shown in Figure 6, more than one-half of the State's total energy generation was derived from nuclear plants, a carbon free resource. The State's coal plants accounted for 14% of total generation.

[26] Source: EIA

The relative amount of energy produced by fuel type is shown in Figure 6, below.[27]

Figure 6. New Jersey Electric Generation (1990-2008)

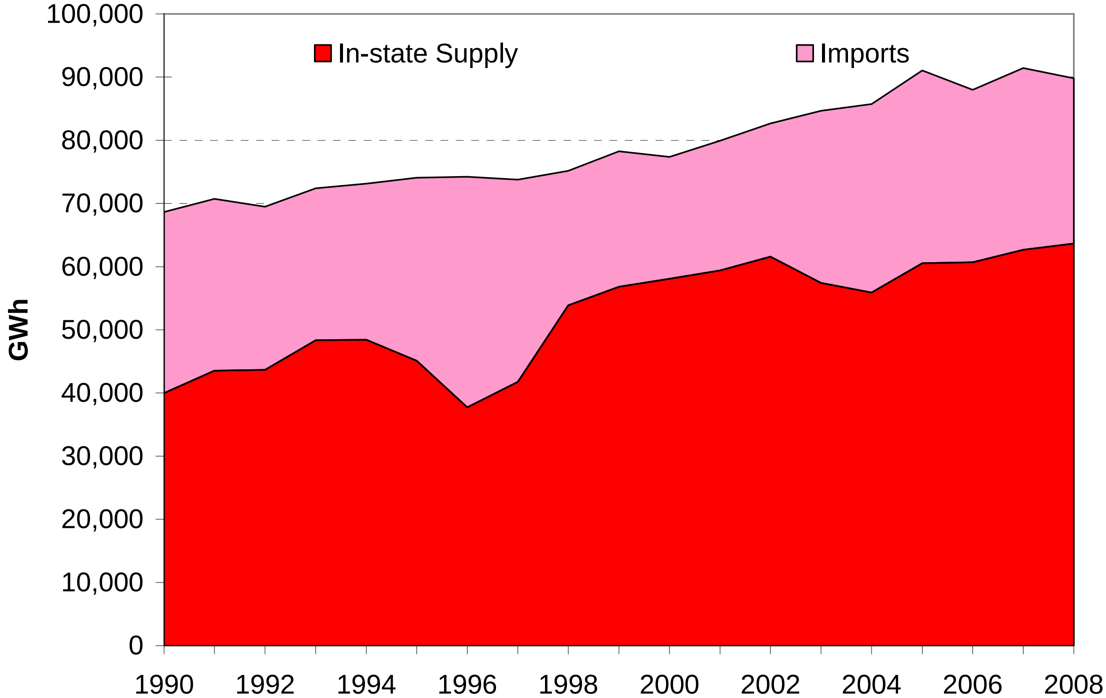


The generation indicated in Figure 6 includes only generation from assets located in New Jersey. This amount is not enough to satisfy total electricity demand throughout the State. Total electricity demand is approximately 40% higher than indigenous generation capability. To fill that gap, electricity is imported from neighboring states. In 2008, New Jersey imported 26,148 GWh, about 30% of total use. Figure 7, below, compares the contributions of imports to in-state generation for the period 1990-2008[28]:

[27] *Ibid*

[28] *Ibid*

Figure 7. New Jersey Electric Imports (1990-2008)



The degree to which New Jersey has relied on imports has varied over this period. While 30% of State-wide use was via imports in 2008, one decade earlier total imports were about one-half of the State's needs.[29] Imports have remained and are expected to remain a substantial portion of New Jersey's energy balance, at least 25%. New Jersey's ability to import more or less energy from elsewhere in PJM is a valuable option that helps maintain the State's ability to meet its total electricity requirements in a cost efficient manner. To the extent new efficient generation is added in New Jersey, reliance on imports by wire from other PJM states will likely be reduced, and *vice versa*.

Gas fired generators submit bids into the DAM and RTM that reflect the total marginal cost to generate the delivered cost of natural gas, plus an adder to account for variable O&M, among other things. If a generator is not selected in the DAM or RTM, the unit does not run. If the unit is selected, the unit runs and may then set the LMP paid to all generation. The highest cost generator in any hour sets the marginal price that is paid to all generation that participates in the DAM or RTM.

Nuclear and coal plants, on the other hand, bid into the LMP markets differently. Nuclear units have very low marginal costs, and typically bid zero as a price taker in any hour.[30] Generally,

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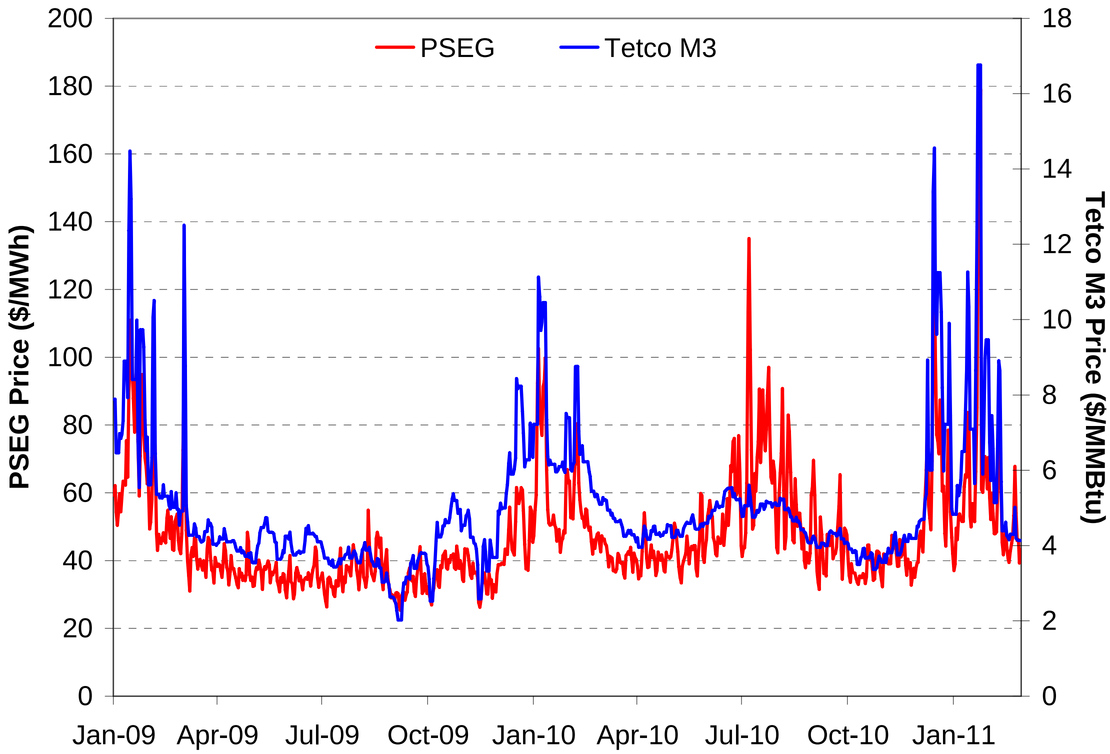
[29] The heavy reliance on imports in 1996 coincides with the state's nuclear fleet generating at levels well below normal, as indicated in Figure 6.

[30] Gas turbines (GTs) and, to a lesser extent, CCs have high variable costs and low fixed costs, i.e. the cost of owning the plant (primarily capital costs). Nuclear and coal plants, on the other hand, have low variable costs reflecting their low cost of fuel, but much higher fixed costs. As such, nuclear and coal plants can rationalize

coal plants are also price takers depending upon limitations on the dispatch regime of the plant. Unlike nuclear, coal plants do not have a very low marginal cost of producing energy. In some hours coal plants in PJM and New Jersey may set the LMP.

In New Jersey, the marginal bid is usually one submitted by a gas-fired plant. As a result, the state's electricity prices are highly correlated to natural gas prices. Sometimes more expensive oil-fired generation sets the energy price. Since gas is more expensive than other fuels except oil, New Jersey's wholesale rates are higher than other states in PJM where there is greater fuel diversity and excess generation relative to state-wide load. Figure 8, below, compares average daily LMPs in the franchise territory of PSEG to daily gas prices for Texas Eastern Market Zone 3 (Tetco M3), a key regional gas index since the beginning of 2009[31]:

Figure 8. PSEG and Tetco M3 (Jan 09-Feb 11)



Capacity costs in New Jersey are also high when compared to the rest of PJM. Because of constraints on transmission into MAAC and further constraints into EMAAC, prices for those two regions can be high. Ratepayers in New Jersey pay the higher of the MAAC, EMAAC, or unconstrained PJM price. Figure 9, below, shows the history of prices for New Jersey since RPM was put into place (note that since RPM is a forward market, capacity prices are known

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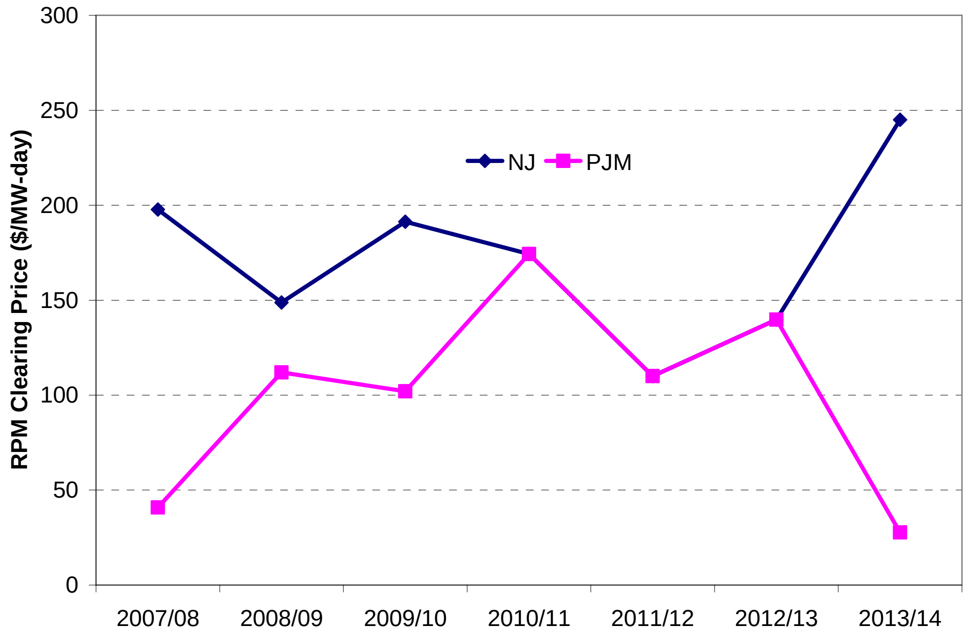
operating at very low margins due to their low variable costs and have a strong incentive to run in as many hours as possible as they need to maximize revenues to cover their fixed costs.

[31] Source: PJM, Bloomberg LP

through 2013/14). For purposes of comparison, the price paid by unconstrained regions of PJM is also indicated.

Figure 9. RPM Clearing Prices for New Jersey and PJM[32]



In most years, clearing prices for New Jersey are significantly higher than those for the unconstrained areas of PJM, *i.e.*, the majority of the market area. In some years where there are significantly different market conditions in New Jersey compared to PJM as a whole, the difference can be large. In 2013/14, the difference was nearly 800%, with PJM clearing at $27.73/MW-day and EMAAC / NJ clearing at $245/MW-day. In other years, such as 2010/11, when there are few transmission constraints in EMAAC, MAAC, and the rest of the system, New Jersey paid the same price as the rest of PJM.

4.5 Load Growth

Native New Jersey load is served over PJM's HV transmission systems owned by the four EDCs and interconnected to the overall PJM system. The PJM market is designed to set wholesale energy and capacity prices to encourage new supply-side and demand-side capacity resources where and when needed. If capacity is forecasted to be insufficient, PJM's ongoing transmission planning process may support new transmission projects to meet load growth requirements. If capacity is forecasted to be sufficient, New Jersey may not require new capacity for reliability.

Forecasting peak load and energy demand always presents challenges. Since the 2008 EMP, the State economy has suffered a major recession which has lowered the peak load and energy demand forecasts for New Jersey. Figure 10 shows PJM's peak load projections for the four New Jersey EDCs prepared in 2008 and 2011. Between these two forecasts, PJM revised its

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[32] Source: PJM

annual growth rate from 1.7% to 1.1%, respectively, a significant decrease. For comparative purposes, Figure 10 presents the actual historic peak load for the 2002 through 2010 period.[33]

The 2008 EMP estimated that a 5,700 MW peak load reduction relative to Business as Usual (BAU) could be accomplished by 2020 through specific initiatives taken by consumers to reduce or shift load during hours of highest consumption.[34] The result of a 5,700 MW reduction from the 2008 projected peak load in 2020 of 25,557 MW would be a peak load of 19,857 MW; both points from 2008 are shown in Figure 10. The targets that were set forth in the 2008 EMP have been revised to reflect PJM's most recent peak demand forecasts. The State's peak demand reduction goal in 2020 is 3,634 MW, or a reduction of 17% relative to PJM's 2011 demand forecast.

Figure 10. New Jersey Peak Load Forecasts and Goals

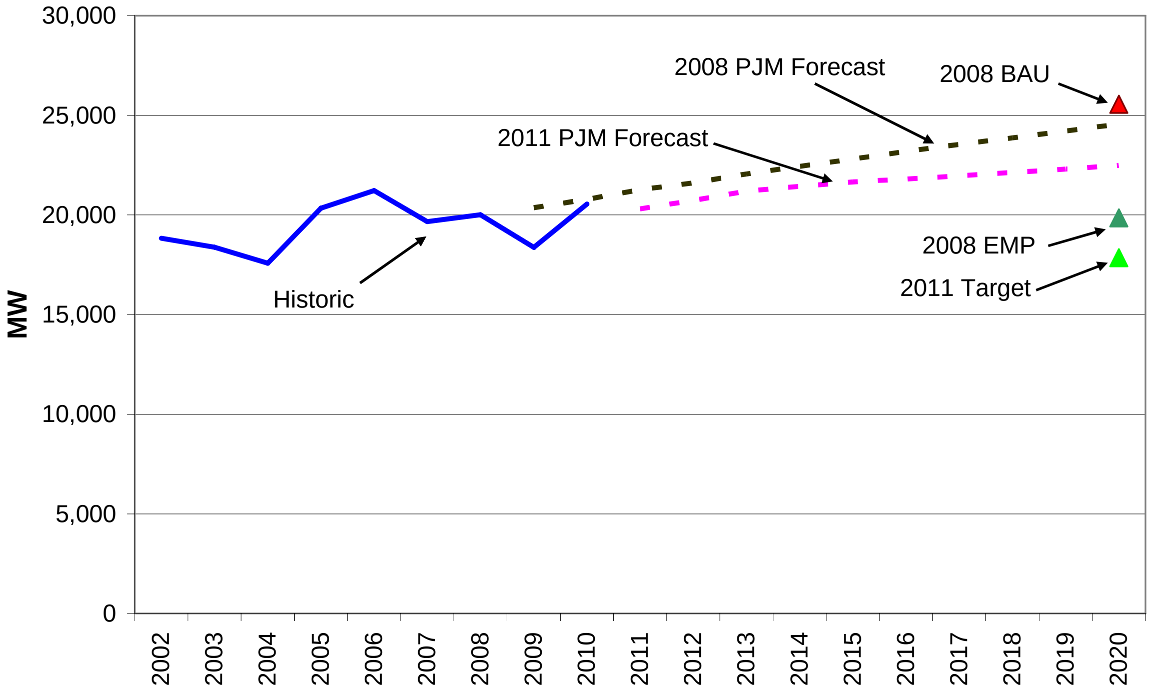

Figure 11 shows New Jersey's historical energy consumption since 2002 and PJM's energy forecasts prepared in 2008, 2010, and 2011.[35] Due to changes in underlying factors, PJM's energy forecasts have declined over time: PJM's 2008 and 2010 forecasts had a 1.7% average annual energy growth rate while the 2011 forecast had a 1.6% average annual energy demand

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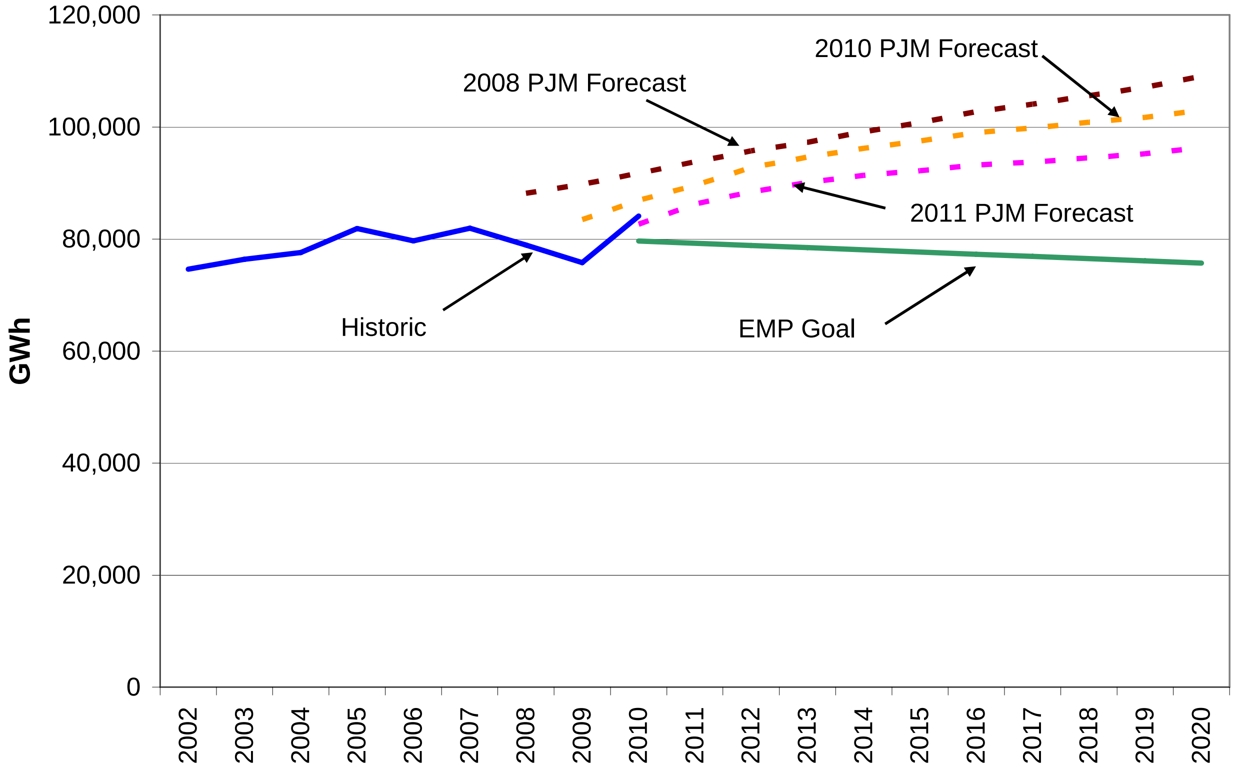
[33] 2010 shows two values: the CEEEP-R/ECON Model data value which is based on PJM weather normalized data and the metered load value which is based on the four EDCs actual peak loads as sourced from the PJM website at http://www.pjm.com/markets-and-operations/compliance/nerc-standards/historical-load-data.aspx

[34] Analysis for the 2011 Draft New Jersey Energy Master Plan Update – February 28, 2011

[35] 2010 shows two values: the estimate from the CEEEP-R/ECON Model data and the metered value which is based on the four EDCs actual energy demands as sourced from the PJM website at http://www.pjm.com/markets-and-operations/compliance/nerc-standards/historical-load-data.aspx

growth rate. Figure 11 also shows the CEEEP analysis of the 2008 EMP projections that assumed a number of EE and DR programs. Based on the 2008 EMP projections, the targeted average annual energy demand growth rate was -0.8% for the 2010-2020 period after accounting for reductions in New Jersey energy use from these programs. The State's energy use goal remains the same as the 2008 EMP, but the 2020 target now represents a smaller percentage reduction relative to the most recent PJM forecast.

Figure 11. New Jersey Energy Demand Forecasts



Notwithstanding the reduction in PJM's load forecasts, New Jersey's energy and peak demand reduction targets remain aggressive. It is important to note that the short-term reduction in peak demand due to the economic recession is not expected to continue. Larger homes and advances in technology, including an increase in the number of computers, plasma televisions, and similar devices, as well as the needs of a recovering business sector, will increase the State's overall growth in demand in the long term.

4.6 Existing In-State Capacity

As previously discussed, the current in-state installed capacity by fuel type is shown in greater detail in Figure 12.[36] In this figure, the composition of "other" technology types, including renewables is shown. New Jersey generating capacity totals 17,227 MW, about 84% of New

[36] Source: 2010 PJM Regional Transmission Expansion Plan, Figure 14.17

Jersey's peak load of 20,548 MW in 2010.[37] The energy generated by these plants in 2010 is shown in Figure 13.[38] Nuclear plants generated the most energy, almost 50% of the State's total generation. Natural gas-fired plants provide about 37%, and coal-fired plants provide almost 10% of the state's generation. New Jersey's in-state generation was equivalent to 78% of the State's 2010 total energy requirements.[39] About one-half of that generation was produced from carbon-free sources, predominantly nuclear; it includes a very small but growing solar component and wind.

Figure 12. Existing Capacity in New Jersey by Fuel Type (MW and %)

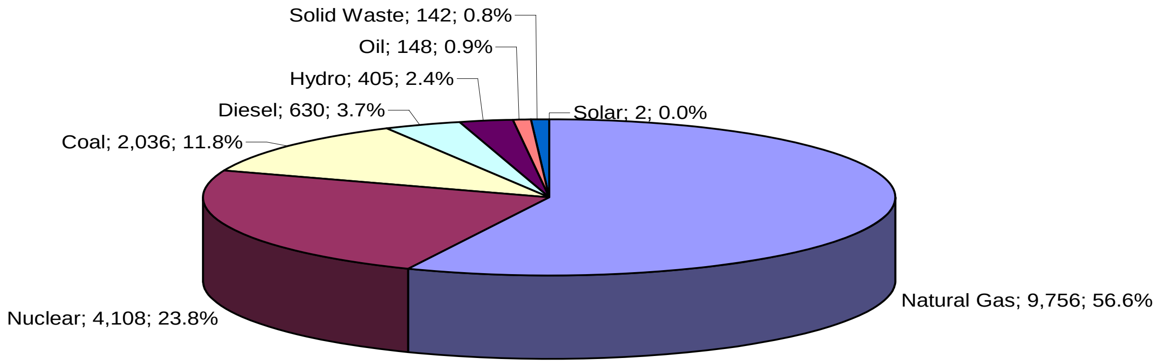
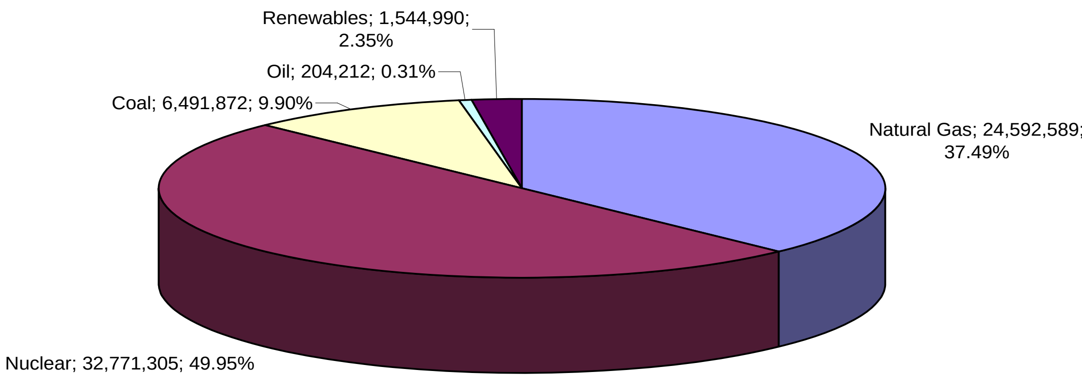


Figure 13. 2010 New Jersey Energy Generation by Fuel Type (MWh and %)



New Jersey has four operational nuclear plants as listed in Table 1.[40] Applications for 20 year license extensions for the Hope Creek and Salem nuclear plants were filed with NRC in August 2009. A decision by the NRC is pending. Oyster Creek, an older nuclear plant design, had its

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[37] Based on the peak load as reported at http://www.pjm.com/markets-and-operations/compliance/nerc-standards/historical-load-data.aspx (See Demand Forecast Section). It is difficult to draw conclusions about New Jersey's ability to satisfy its in-state demand due to the dynamic power flows into and out of the state.

[38] Source: EIA: http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html

[39] Based on in-state generation of 65,604.968 GWh and Energy Demand of 84,087.946 GWh as reported at http://www.pjm.com/markets-and-operations/compliance/nerc-standards/historical-load-data.aspx (See Demand Forecast Section)

[40] Source: Nuclear Energy Institute Fact Sheet

license renewed in April 2009, but is scheduled to retire in eight years. The possible replacement of Oyster Creek capacity is addressed in Section 7.1.2 of this report.

Table 1. Nuclear Plants in New Jersey

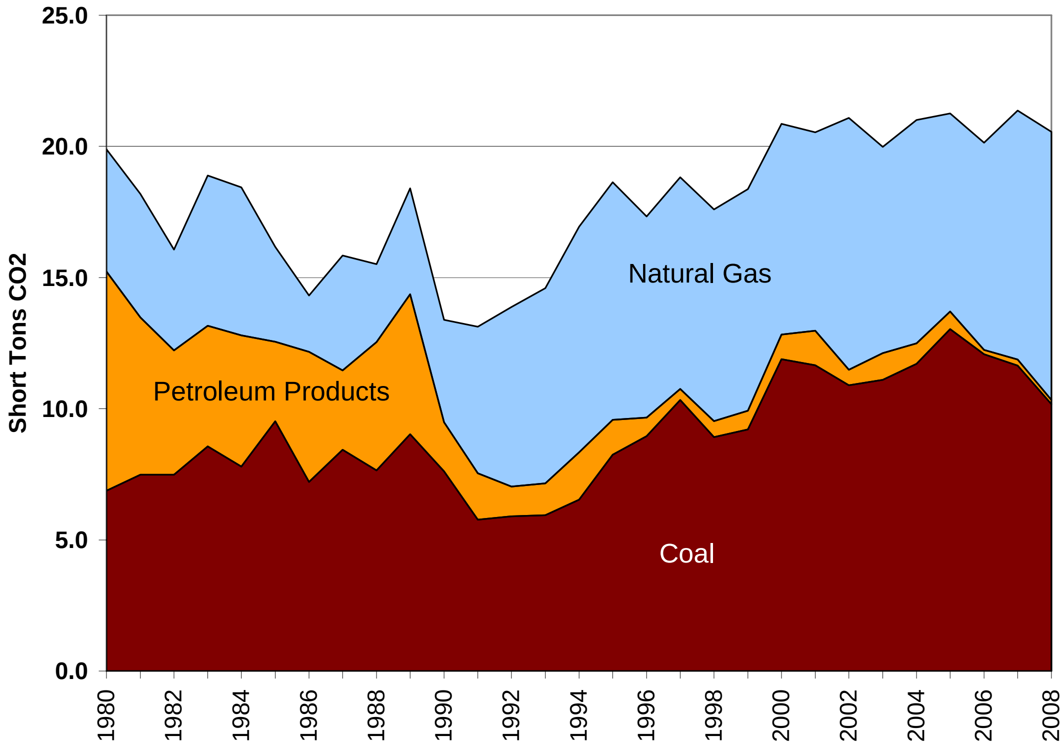
	Capacity	Average Capacity Factor (2007-2009)
Hope Creek	1,161 MW	96.6%
Oyster Creek	615 MW	90.6%
Salem 1	1,174 MW	93.0%
Salem 2	1,158 MW	91.1%

As shown in Figure 14, in-state generation facilities produced about 20.6 million tons of CO_2 in 2008.[41] This equates to about 700 lb/MWh, which is one of the country's lowest overall average CO_2 emissions rates and reflects the state's generation mix. Compared to the U.S. as a whole, New Jersey has a relatively low proportion of coal-fired generation, and a relatively high proportion of carbon-free and low carbon sources. However, when accounting for the total electric energy use in New Jersey, total CO_2 emissions associated with New Jersey's electric load has been estimated to be around 30 million tons. This is because energy imports from elsewhere in PJM are associated with more carbon-intensive sources, in particular, coal. This is consistent with the transport of air pollutants from central and western PJM, such as nitrogen oxides (NO_x) and sulfur dioxide (SO_2), downwind to New Jersey.[42]

[41] Source: EIA http://www.eia.gov/oiaf/1605/state/state_emissions.html

[42] See, for example, information provided by DEP at: http://www.state.nj.us/dep/baqp/model.html and Ozone Transport Commission, "The Nature of Ozone Air Quality Problem in the Ozone Transport Region: A Conceptual Description," October 2006, revised August 2010.

Figure 14. New Jersey's in-State Annual Power Plant CO_2 Emissions



4.7 Generation Addition and Retirement

4.7.1 Development of New Generation Facilities

Development of new generation in New Jersey and the rest of EMAAC has been slow. Since 1999 PJM has received interconnection requests for 504 new generating resources or incremental additions to existing resources in New Jersey.[43] Of these requests, only 9% are in-service and 1% are under construction. 67% of the requests have been withdrawn from the interconnection queue.

[43] Source: PJM 2010 Regional Transmission Expansion Plan, Section 14.7.2

Table 2. Status of Generation Interconnection Requests in New Jersey[44]

	Capacity (MW)	Percent	Number
Active	11,888	23%	258
In Service	4,590	9%	52
Under Construction	590	1%	34
Withdrawn	35,338	67%	160
Total	52,407	100%	504

New Jersey has questioned the effectiveness of the PJM market structure because there has been a lack of new generation in EMAAC. Even though capacity prices in EMAAC have been high, developers have not been willing to add new generation plants in New Jersey without a guarantee of realizing a higher return on investment.

At a technical conference of industry experts conducted by the Board on June 24, 2010, many participants agreed that the current wholesale market construct was not providing adequate revenues for new generation development. Profits from energy sales in the wholesale energy market coupled with capacity based operating revenue from the BRA have not been stable, secure, and of sufficient term to attract investment in new generation. Other stakeholders have questioned the need for new capacity in EMAAC voicing skepticism over the need for capacity claiming EMAAC prices have been lower than that required to support new entry. Finally, the expected addition of the Susquehanna-Roseland HV transmission project in 2015 will reduce congestion in the region, thereby lessening the need for new generation.

Capacity revenues to existing generation make it easier for incumbent generation to remain in the resource mix. However, many stakeholders have asserted that RPM is not providing incentives to develop new generation. Even PJM acknowledged that RPM should provide a better long-term price signal. In fact, PJM indicated that it had petitioned FERC with a long-term price signal as part of RPM, a proposal that the BPU supported. FERC, however, did not approve this feature of PJM's proposal.

In order to overcome the financial impediments associated with the BRA, in January 2011 the New Jersey legislature created LCAPP "to ensure sufficient generation is available to the region, and thus the users in the State, in a timely and orderly manner." On March 29, 2011, the Board awarded SOCAs to three in-state CC generators: Hess Newark Energy Center, NRG Old Bridge Clean Energy Center, and CPV Woodbridge Energy Center. If these new CCs are commercialized, the Board anticipates that the three projects will produce significant energy price savings throughout New Jersey as well as provide reliability, and economic development and employment benefits during the construction and operating periods, respectively. The potential for other economic benefits exists as well. The PJM IMM conducted an analysis of

[44] This data includes solar and conventional electricity requests to PJM. It does not include connection requests to export power to New York.

adding 1,000 MW or 2,000 MW of capacity in New Jersey and requiring it to offer at $0/MW-day in the BRA.[45]

In addition to LCAPP, New Jersey has a long history of supporting solar and wind energy development. OWEDA was designed to support at least 1,100 MW of offshore wind generation through the OREC program. Offshore wind is renewable, has no carbon output, and it has the potential to develop a manufacturing and support industry in New Jersey. Under OWEDA, all three of these elements are important in the review of any proposed project. The BPU has released rules to implement the OWEDA that balance the cost-benefit and the overall impact upon the State. These impacts must include economic and environmental costs and benefits, and job creation, among other things.

4.7.2 Generator Retirements

Generator retirements can reduce system reliability. When power plants retire, usually there is an increase in wholesale energy and capacity prices. Since 2003, approximately 1,150 MW of capacity have been retired in New Jersey, with an additional 654 MW of capacity expected to retire by 2013, according to the PJM 2010 Regional Transmission Expansion Plan Report. Oyster Creek is scheduled to retire in 2019.[46]

Older fossil-fuel plants in New Jersey, and PJM as a whole are coming under increasing economic pressure due to age, energy prices, and stricter environmental regulations. This group of plants consists almost entirely of small units (less than 200 MW) that are more than 40 years old and face a combination of environmental capital expenditures and/or tighter margins on energy sales. Energy and capacity revenues may be barely sufficient to cover ongoing operation and maintenance costs for aging plants.

Across PJM the retirement of older fossil-fired plants is likely to accelerate over the next decade due to environmental regulations proposed by the U.S. Environmental Protection Agency (EPA) that could require expensive retrofits.[47] Regulations may require some plants to install

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[45] Source: The Independent Market Monitor for PJM, "Impact of New Jersey Assembly Bill 3442 on the PJM Capacity Market," January 6, 2011.

"An analysis of the impact of adding 1,000 MW of capacity in New Jersey, paying it through an out of market subsidy, and requiring it to offer at zero shows that the result would be a reduction in capacity market revenues to PJM suppliers of more than [$1 billion] per year, including about [$600 million] in EMAAC and about [$400 million] in rest of MAAC. The reduction in capacity payments to suppliers in New Jersey would be about [$280 million]."

"An analysis of the impact of adding 2,000 MW of capacity in New Jersey, paying it through an out of market subsidy, and requiring it to offer at zero shows that the result would be a reduction in capacity market revenues to PJM suppliers of more than [$2 billion] per year, including about [$1 billion] in EMAAC, about [$700 million] in rest of MAAC and about [$125 million] in rest of RTO. The reduction in capacity payments to suppliers in New Jersey would be about [$560 million]."

[46] Events at the Fukushima Daiichi Nuclear Power Station in Japan may have repercussions with respect to the relicensing or early retirement of other nuclear units in New Jersey and elsewhere in the U.S.

[47] Under the federal Clean Air Act, Clean Water Act, and the Resource Conservation and Recovery Act (RCRA), EPA has promulgated regulations applicable to the permitting and performance requirements for operation of

expensive retrofits, and may also materially increase operating costs. In many cases, the capital investment and increased operating costs cannot be justified on the basis of going-forward earnings by the plant owner, and a decision will be made to retire the plant instead of undertaking the required retrofits. Regulations that are expected to have the greatest impact on plant retirements over the next several years are as follows:

- Section 316(b) of the Clean Water Act – requires that the location, design, construction and capacity of cooling water intake structures reflect "best technology available" for minimizing adverse environmental impact. Following prolonged court challenges and rulemaking delays, draft regulations were released by EPA on March 28, 2011, and must be finalized by July 2012. EPA elected not to mandate cooling towers (other than for new units), and instead proposed a combination of national performance standards and a consideration of site-specific factors in determining best technology available.

- Title I of the Clean Air Act – This Title provides regulatory authority for EPA to mandate "Maximum Achievable Control Technology" standards for Hazardous Air Pollutants, including mercury. In a proposed rulemaking issued March 16, 2011, EPA established emission limits for existing coal-fired and oil-fired plants, which will require, at a minimum, SCR and flue gas desulfurization (scrubbers), and potentially activated carbon injection and upgrades to plant particulate control systems.

- Clean Air Transport Rule – The program proposed by EPA on July 6, 2010 would reduce emissions of SO_2 and NO_x across the eastern U.S. by 2014 with the goal of attaining National Ambient Air quality standards for ozone and fine particulates.

- Coal Combustion Residuals – Pending rules under RCRA would reduce available options for disposal or re-use of coal ash.

All of these regulations are pending, but are likely to be final by mid-2012, and fully implemented by 2018. Several recent studies have examined the potential impact of these rules. While the results vary widely, there is general consensus that plant de-rates and retirements will reduce significantly the total capacity of older oil and coal-fired plants in PJM; estimates range from roughly 5 to 19 GW.[48]

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existing electric generation facilities, as well as new plants. These federal regulations are intended to achieve federal standards with respect to ambient air quality, and to protect water quality and the diversity of aquatic life. New Jersey's environmental standards applicable to power plants have generally been more stringent than the federal rules. New Jersey has been in the vanguard with respect to state-led initiatives to achieve healthy air quality and protect its waters and other natural resources. For example, New Jersey was one of the first states in the U.S. to adopt rules requiring stringent mercury emission limits for coal-fired power plants. New Jersey's environmental programs have been effective in reducing State-wide emissions from power plants and modernizing the State's electric generation fleet.

[48] North American Electric Reliability Corporation, 2010 Special Reliability Assessment: Resource Adequacy Impacts of Potential U.S Environmental Regulations, October 2010; M. Celebi, F. Graves, G. Bathla and L. Bressan (Brattle Group), Potential Coal Plant Retirements Under Emerging Environmental Regulations, December 8, 2010; D. Eggers, K. Cole, Y. Y. Song and L. Sun (Credit Suisse), Growth from Subtraction, Impact of EPA Rules on Power Markets, September 23, 2010.

4.8 Pricing Dynamics

Figure 15 presents trends for New Jersey wholesale energy prices and retail rates over the last five years. Wholesale energy prices, presented in weighted average LMP terms, rose gradually from 2006 to 2008, dropped by almost 50% in 2009, and then rose again in 2010.[49] Average retail rates are presented for residential, commercial, and industrial customers. The makeup of these retail rates, and the differences among them, are discussed in Section 4.10 of this report.[50]

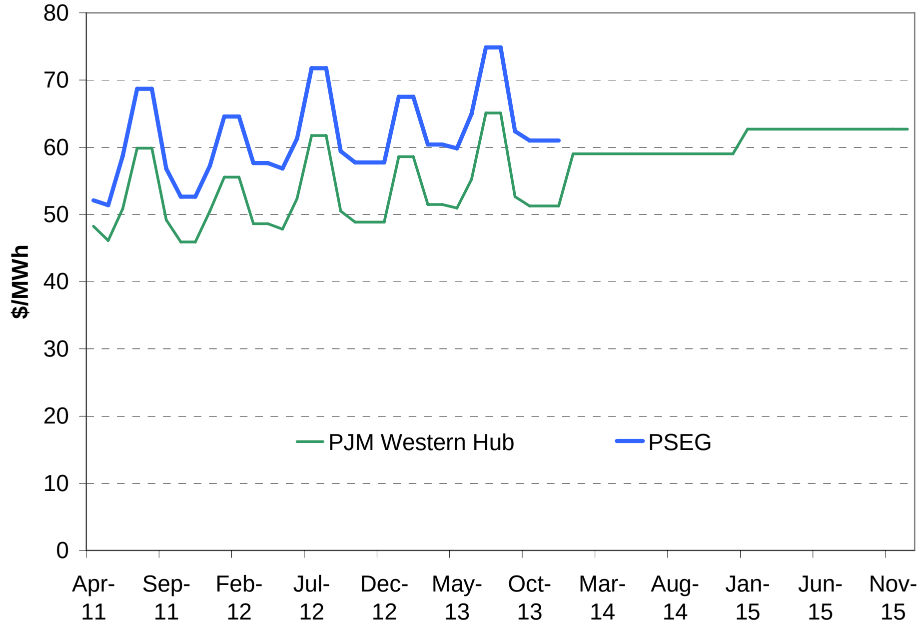
Figure 15. New Jersey Average Wholesale Prices and Average Retail Rates

Wholesale electricity prices in New Jersey are expected to increase somewhat over the next decade. This expectation reflects forward fuel prices of relevance in setting wholesale electric prices in New Jersey and, to a lesser extent, load growth. The benchmark trading index for electricity in PJM is the Western Hub, a collection of pricing nodes located in the Northwestern area of PJM's service territory. At present, forward contracts for Western Hub power are available on NYMEX through 2015. Additionally, contracts are available for PSEG power, though those are less liquid and, currently, only contracts through the end of 2013 are available. The forward price curves for on peak power at the Western Hub and PSEG from April 8, 2011, are indicated in Figure 16, below:

[49] Source: PJM 2006-2010 State of the Market Reports

[50] Source: EIA http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html

Figure 16. NYMEX Forward Curves for Western Hub and PSEG, April 8, 2011



The prices indicated exhibit strong seasonal patterns, with price spikes occurring in the summer. Prices are highest in the summer because demand is highest. During the peak heating season, December through February, delivered gas prices are highest, thereby putting upward pressure on energy prices even though electricity demand is much lower. Western Hub prices beginning in 2014 cease showing the seasonal pattern – this is because power products traded for settlement more than a few years into the future are generally transacted on a calendar year basis.

4.9 Retail Electricity Market and Customer Classes

Retail electric customers throughout New Jersey are served by the four EDCs that deliver electricity in their franchise service territories. The EDCs offer default supply service in the form of BGS. EDCs do not own generation other than some renewables. Unregulated affiliates of the EDCs are permitted to own and operate generation facilities in New Jersey, however. Customers are free to select a "third party" Alternative Electric Supplier (AES) instead of BGS. Either way, the retail rates generally consist of three components: (i) generation services under BGS or through an AES, (ii) distribution charges that cover the local distribution system and customer service, and (iii) other charges associated with state and federal programs. The generation services charge includes all of the components of full requirements electric supply, including the wholesale energy, capacity, and ancillary services costs procured through the PJM markets, as well as the supplier's cost to hedge and manage both price and quantity risks. Distribution and customer service costs are regulated by the BPU, which also supervises the process by which BGS is procured. Other charges associated with state and federal programs are administered by the BPU or embedded in the generation services charge.

Retail electric customers are broken into several classes, principally residential, small commercial/industrial, and large commercial/industrial.

- Residential customers generally pay a monthly service charge independent of energy use, with all other charges based on monthly energy usage. Virtually all residential customers are eligible for Fixed Price BGS, and most elect Fixed Price BGS, but a minority has selected competitive wholesale service from among more than a dozen approved AES serving the residential market. The Fixed Price BGS rate is set annually based on the auction process described below.
- Small C&I customers with peak loads of 750 kW or less are also eligible for Fixed Price BGS, but a significant number have taken advantage of the offerings from an AES in the C&I markets.[51] The rate structures for small C&I customers include customer, demand, energy-based distribution charges, and state and federal policy cost components.
- C&I customers with peak loads above 750 kW may elect BGS under the Commercial Industrial Energy Price (CIEP) which reflects a fixed price covering capacity, ancillary services, and transmission plus a pass-through of the PJM hourly real time energy price. Most large C&I customers have selected an AES. The distribution and state and federal policy components of large commercial/industrial rates generally reflect customer charges, demand-based charges, and energy-based charges.

4.9.1 Basic Generation Service Auction Process

BGS is a default service provided to any customer that does not choose an AES.[52] Each year, an auction is conducted under BPU rules to procure one third of the Fixed Price BGS requirement for the following three years for each EDC. The BGS auctions also procure the entire CIEP BGS obligation for the following year.

The simultaneous multi-product, multi-round descending clock auction is designed to fill the requirements of each product for each EDC at the lowest cost. The BGS auctions are referred to as descending clock auctions because the auctioneer sets a price for each product in each round, and bidders offer quantities for any or all products.[53] If there is excess product offered at a price, the auctioneer reduces the price by a "tick" and accepts another round of offered quantities. Bidders may reduce their total quantity offered and/or shift quantity from one product to another. A BGS auction ends when the required quantities are achieved for all products. All BGS suppliers are paid the final clearing price for each product.[54]

Each EDC sets its BGS rates for the year based on a pass-through of the costs of the winning bids, subject to BPU review and approval. For Fixed Rate BGS (less than 750 kW peak load) the

[51] The kW limitation for Fixed Price BGS has been periodically reduced. The limit was 1,000 kW through the 2010 BGS auction and was reduced to 750 kW for the 2011 BGS auction.

[52] Source: "Overview of the New Jersey Default Service Policy: Basic Generation Service", October 5, 2006, presented by Frank Perrotti, BPU

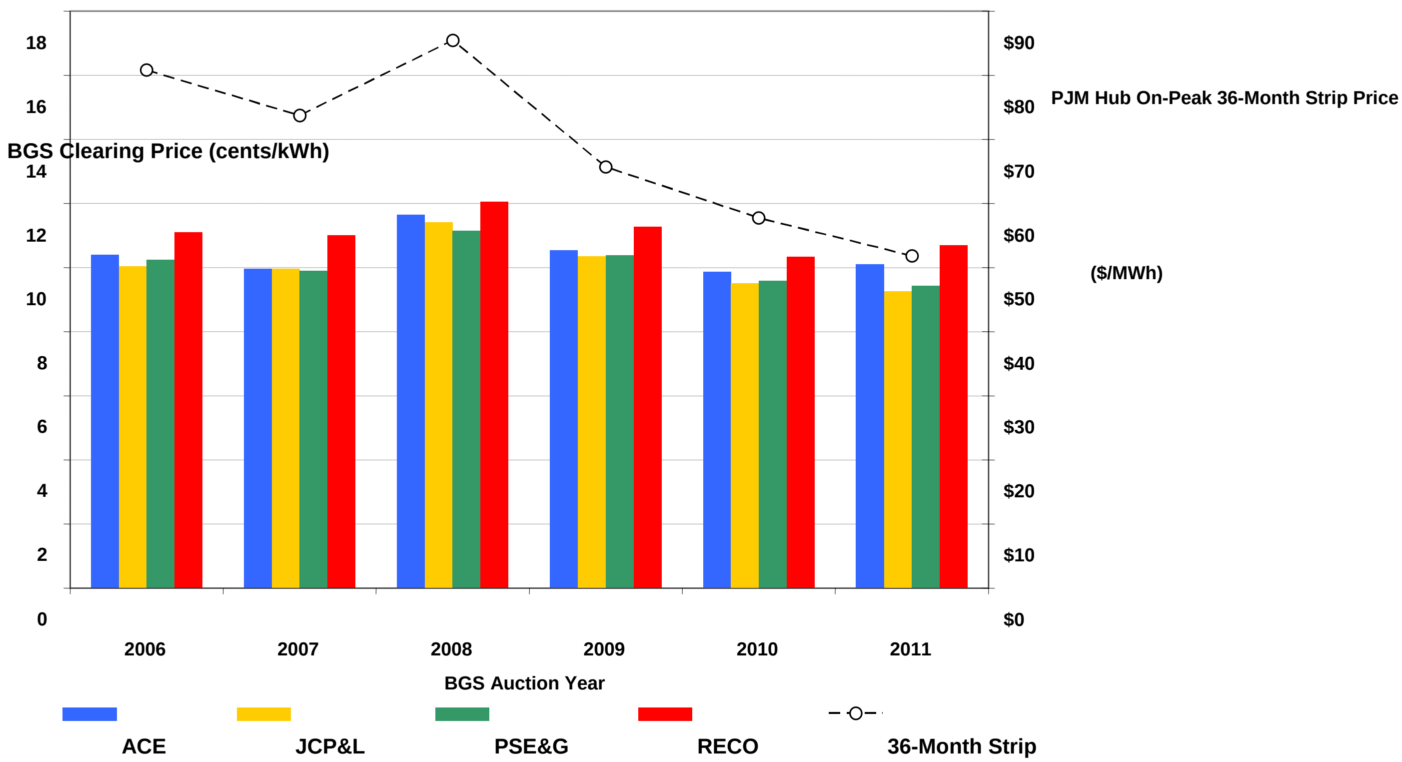
[53] Auction quantities are defined percentages of the actual total load for each product, not a firm quantity of energy or capacity. Thus winning bidders take the risk that actual product quantities could be higher or lower than expected due changes in load growth, migration to or from competitive supply, or other factors.

[54] Under some conditions, some bidders may be paid a price from the prior round.

rate is an average of the results of three previous BGS auctions conducted over a span of just over two years.

Results of the last six Fixed Price BGS auctions are summarized in Figure 17. Prices have dropped in each auction since 2008 (except for ACE and RECO in 2011, which rose slightly over prior year), consistent with the trend in wholesale energy prices, as illustrated by the 36 month forward strip of PJM Western Hub on-peak energy prices. Suppliers generally hedge their BGS commitments with forward on-peak and off-peak energy contracts, so bid pricing is heavily influenced by the forward energy market.

Figure 17. FP BGS Auction Results and Forward Energy Price



4.9.2 Competitive Retail Supply

As of March 2011, the BPU website listed 38 AES licensed by the BPU to operate in New Jersey. Virtually all of them offer commercial supply in at least one EDC territory, and some offer residential and/or industrial supply as well. Customers in PSE&G territory have the most choices in each service class, while those in RECO territory have significantly fewer options. Figure 18 shows the level of competitive supply penetration by year for all New Jersey load. Until 2010 there was virtually no residential load served by AES. The number of residential customers served by AES is shown as a percentage of total residential customers in Figure 19 for each EDC. Residential penetration has been higher in PSE&G and JCP&L than in other territories. As of February 28, 2011, about 6% of all residential customers were served by AES.

Figure 18. Total MW Load and Load Served by Competitive Supply

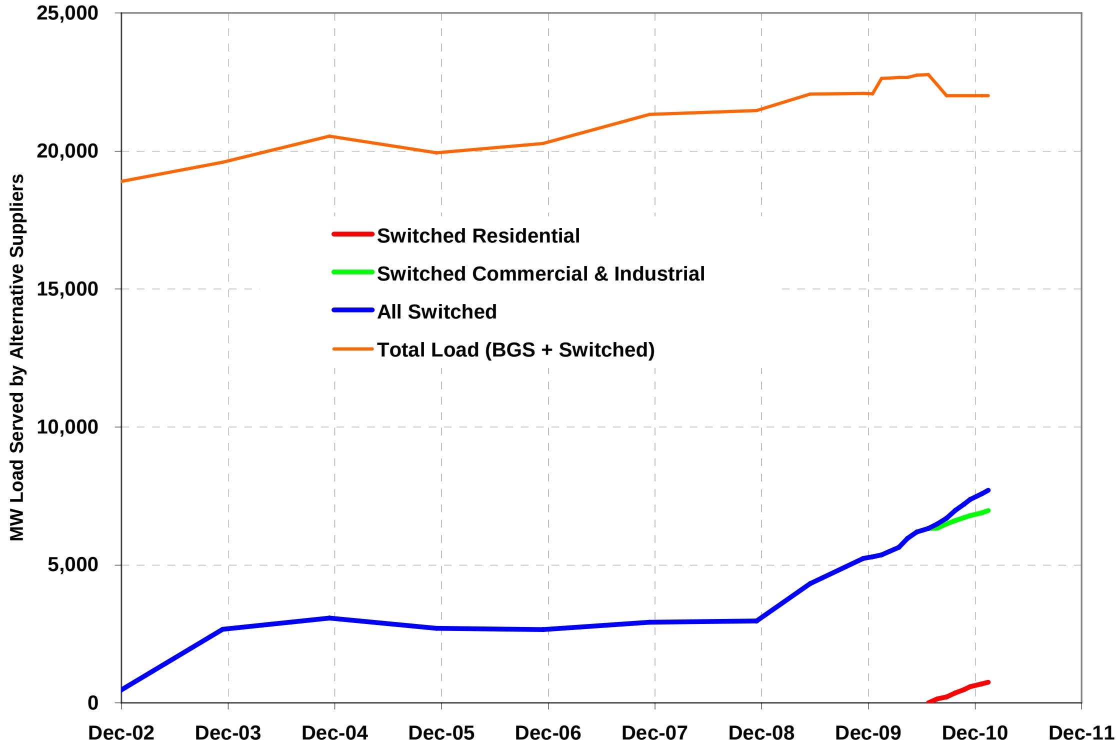
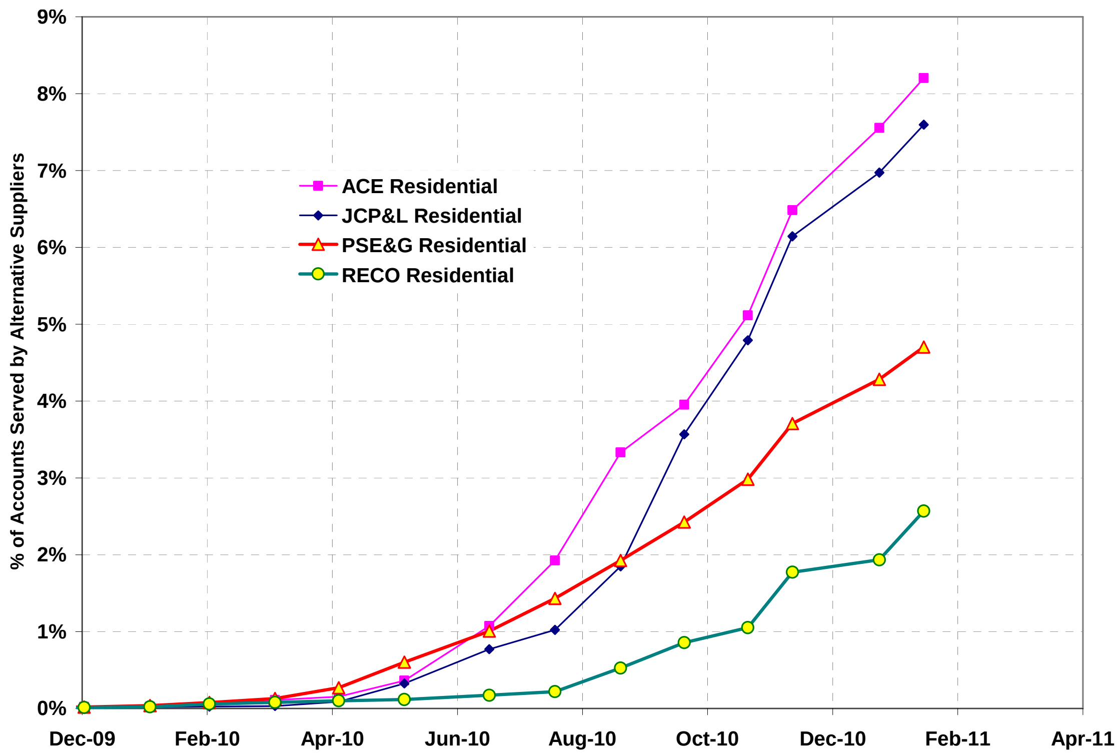
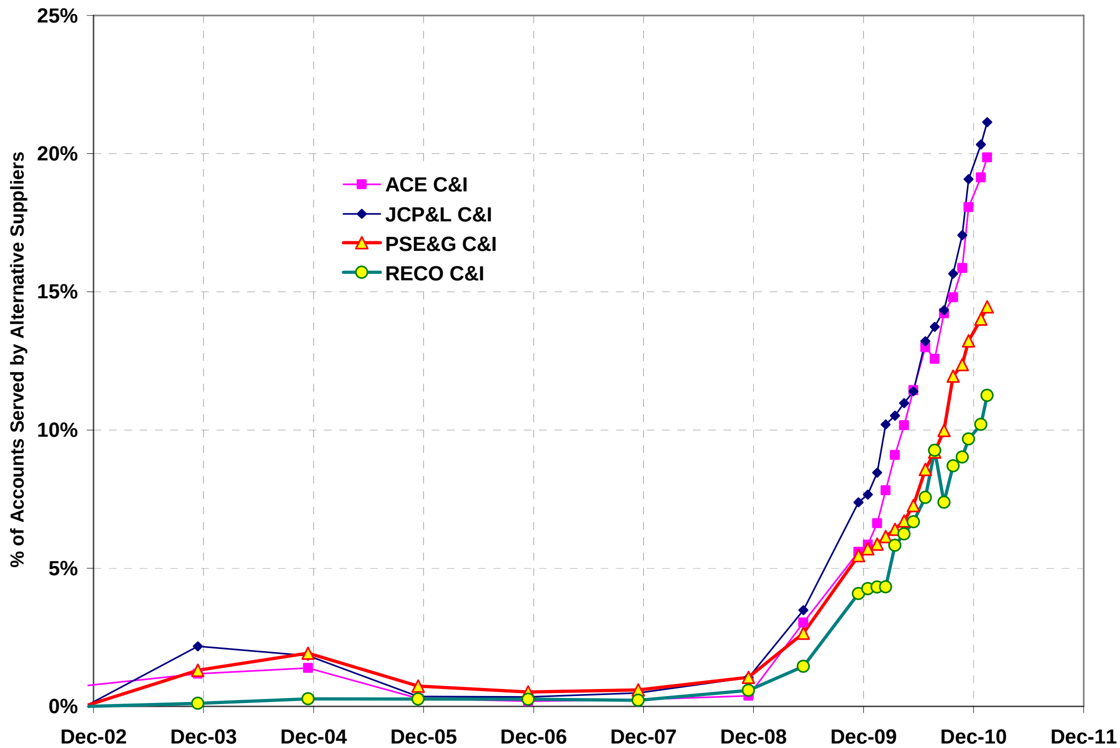


Figure 19. Percentage of Residential Customers Served by AES



While C&I customers have had more options and greater incentives to switch from BGS to an AES since the onset of deregulation, they too have waited until recently to switch, as indicated in Figure 20. While only about 17% of all C&I customers in New Jersey were supplied by an AES as of February 28, 2011, they represent about 60% of the total C&I MW load. Almost 75% of C&I customers subject to CIEP (demand greater than 750 kW) are supplied by an AES.

Figure 20. Percentage of C&I Customers Served by AES

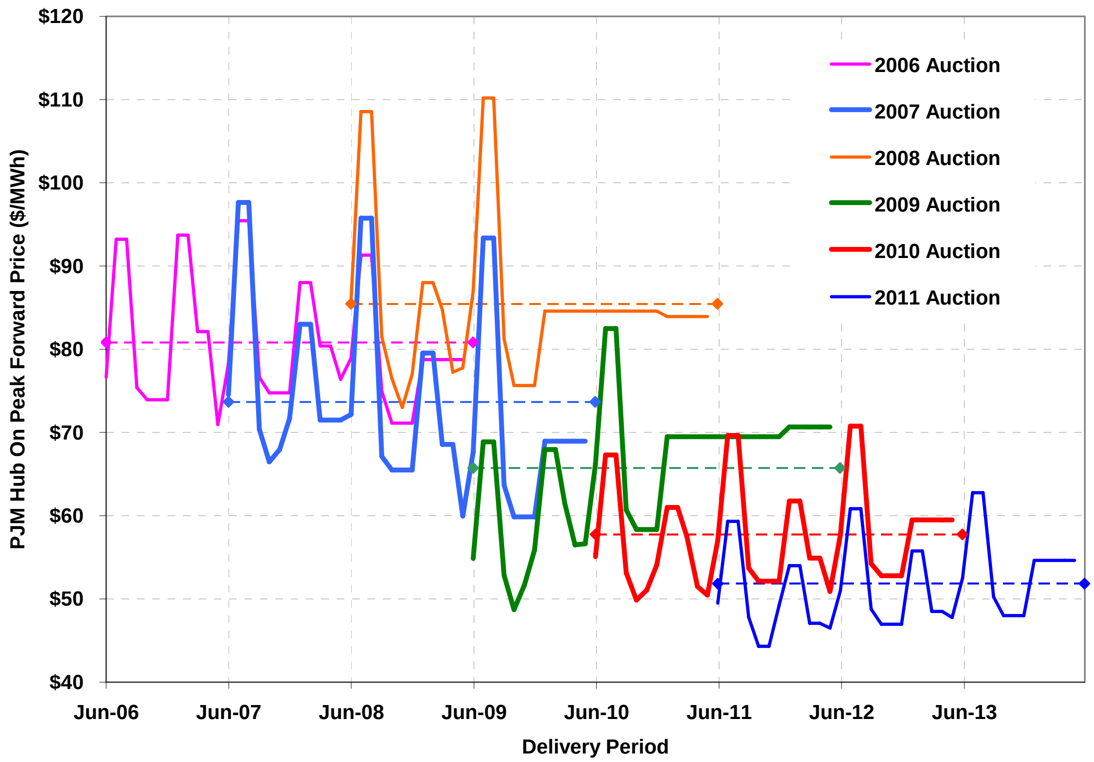


For large customers ineligible for Fixed Price BGS, suppliers compete with one another by offering "extras" such as price certainty (in which the generation service rate is fixed) or load management services (in which the supplier controls the customer's load shape to minimize consumption at times of peak real-time energy prices).

Competition for customers eligible for Fixed Price BGS is premised upon beating the announced BGS a year at a time. The BGS price is based on the average of the three previous procurements – customers are free to leave BGS or return to it at any time, unless bound by contract. Providers of both BGS supply and competitive supply hedge their price offers through the forward energy market, but the BGS price is derived from three auctions that blend prices over three year terms. Competitive supply prices are based on a single delivery year forward price. Hence, BGS represents a smoothed-out, long-term price of the wholesale electricity market while competitive supply is a shorter term one year outlook. When forward energy prices are declining, as they have been since the summer of 2008, competitive suppliers are in a position to beat the BGS price, and customers have an incentive to migrate to competitive supply. The rapid growth of both residential and commercial competitive supply share in 2009 and 2010, as shown in the charts above, explains this phenomenon, *i.e.*, steep slope upward reflecting increased customer choice. Should energy market forward prices begin to rise, the BGS price will tend to lag and moderate the increase. Under these circumstances, competitive suppliers may find it difficult to keep or attract customers.[55]

Figure 21 shows the forward prices for each month of the next three energy delivery years (June to May) for the PJM Western Hub (on-peak) on a trading day during each of the annual BGS auctions from February 2006 through February 2011. Also shown (as dashed lines in the same color) are the arithmetic averages of the 36 monthly prices. As also shown in Figure 21, the average prices rise from the 2006 though the 2008 auction dates, then decline in subsequent years. Figure 22 shows how three 36-month prices are averaged to represent the forward energy component of the BGS rate in each delivery year. Figure 23 shows how these longer-term average prices compare to the simple 12-month forward average which is representative of a competitive supply energy price.[56]

Figure 21. 36 Month Forward Energy Prices for PJM Western Hub (On-Peak)



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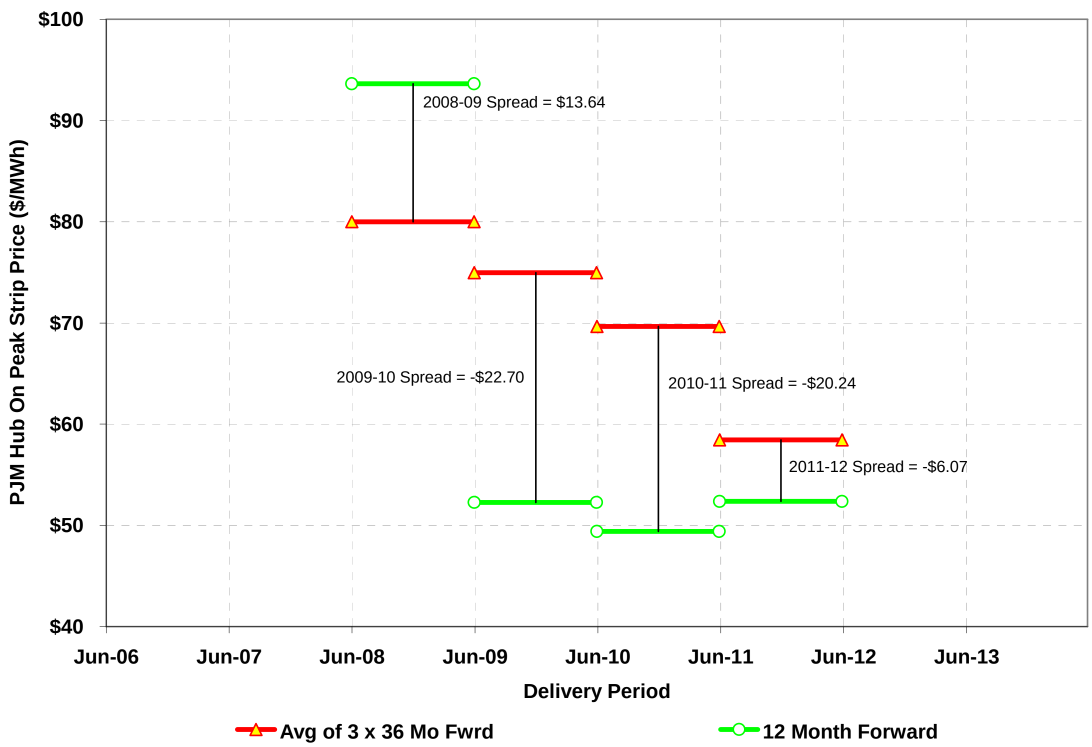
[55] Concern has been expressed about the ability of residential and small commercial customers in New Jersey to take advantage of cycles in energy prices. In times of declining prices, they elect competitive supplier offers, while in times of rising prices, they can return to BGS, creating migration challenges that are priced into the BGS.

[56] Competitive supply prices, like BGS prices, would also include components for load shape and quantity risk, capacity, ancillary services, and RPS costs. Forward on-peak energy prices are used here for illustrative purposes only.

Figure 22. Average of 3 x 36 Month Forward Prices

Figure 23. Comparison of 3x36 Month Forward and 12 Month Forward Prices



4.9.3 Renewable Portfolio Standard

Established under EDECA, New Jersey's RPS is one of the most aggressive in the U.S. The RPS requires each electricity supplier serving retail electricity customers in the State to procure 22.5% of the electricity it sells in New Jersey from qualified renewable energy resources by 2021. New Jersey established the RPS to drive the market deployment of new clean energy technologies, recognizing that expansion of renewable energy generation would provide significant economic development and environmental benefits, thereby advancing New Jersey's greenhouse gas reduction goals.

U.S. energy policy has long subsidized conventional and non-conventional energy technologies, including tax breaks for oil and gas production from non-conventional or difficult to reach supply basins. The RPS mandate creates market demand that allows renewable energy technologies to achieve economies of scale in manufacturing and installation so that these technologies can compete better with conventional electric generation sources. The RPS has been complemented by programs administered by the BPU and the Economic Development Authority (EDA) that provide incentives for in-State renewable energy generation.

New Jersey's RPS establishes different requirements for different types of renewable energy resources:

- Class 1 renewable energy is defined as electricity derived from solar energy, wind energy, wave or tidal action, geothermal energy, landfill gas (LFG), anaerobic digestion, fuel cells using renewable fuels and, with written permission of the DEP, certain other forms of sustainable biomass. The RPS for Class 1 renewable energy resources increases over time, reaching 20% by 2021. The Class 1 requirement includes carve-outs for solar and offshore wind, discussed below. Deducting the solar carve-out, the Class1 requirement is equivalent to 17.88% in 2021. Qualifying Class 1 electric generators (with the exception of solar and offshore wind) do not need to be located in New Jersey, but must deliver electricity into the PJM wholesale grid, which serves New Jersey. Qualifying solar electric generation must be located in New Jersey (tied directly into the New Jersey electric distribution network).

  As of January 2010, the Solar Energy Advancement and Fair Competition Act (SEAFCA or the Solar Advancement Act) imposed a separate obligation for solar energy that requires electricity suppliers to procure an increasing amount of electricity from in-state solar electric generators, reaching at least 2,518 GWh by 2021, and at least 5,316 GWh of electricity by 2026 and each year thereafter.[57] Before the Solar Advancement Act took effect, the solar requirement was a percentage-based target that required suppliers to procure 2.12% of electricity sales from solar electric generators by 2021. Importantly, by establishing solar procurement targets in absolute GWh terms, the Solar Advancement Act insulates the solar

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[57] The annual requirement is based on an "energy year." Energy year 2021 runs from June 1, 2020 through May 31, 2021.

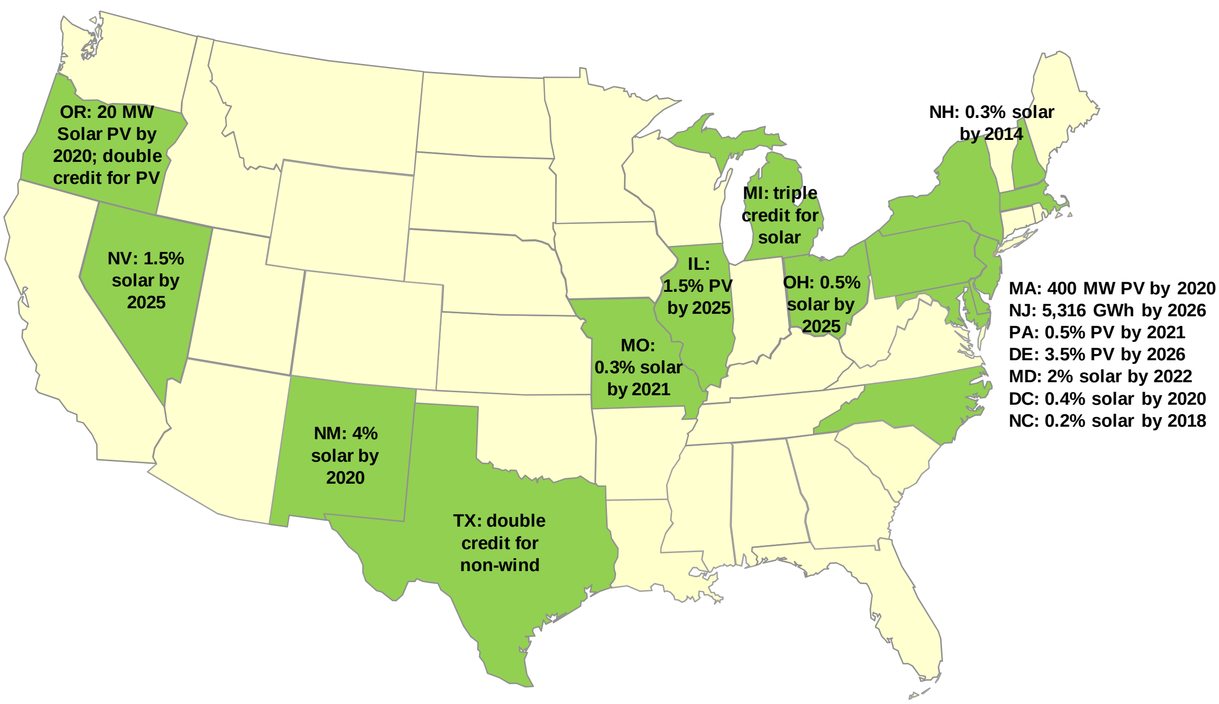
industry from loss of renewable market share due to economic downturn or the anticipated increased penetration of EE and conservation. The artificial demand created by SEAFCA guarantees high and expensive subsidies for solar in good and bad economic times. The implementation and costs associated with the Solar Advancement Act are discussed in Section 7.2.3.

OWEDA was enacted August 19, 2010. OWEDA calls for at least 1,100 MW (installed capacity) of offshore wind generation on the outer continental shelf in the Atlantic Ocean. Like solar, the offshore wind provision is also defined as a carve-out from the total Class I requirement. OWEDA and promulgated regulations are discussed in Section 6.2.

- Class 2 renewable energy is defined as electricity generated by hydropower facilities no greater than 30 MW, and resource-recovery facilities approved by the DEP and located in New Jersey. Electricity generated by a resource-recovery facility outside New Jersey qualifies as Class 2 renewable energy if the facility is located in a state with retail electric competition and the facility is approved by the DEP. The RPS for Class 2 renewable energy resources is constant at 2.5% through 2021.

New Jersey is not the only state attempting to promote solar energy. As of 2010, there were an additional 15 states that have some form of preferential solar energy policy (Figure 24).

Figure 24. U.S. States With Solar Provisions in Their RPS Policies[58]



[58] Source: DOE Database of State Incentives for Renewables and Efficiency

4.10 Understanding Retail Electric Costs

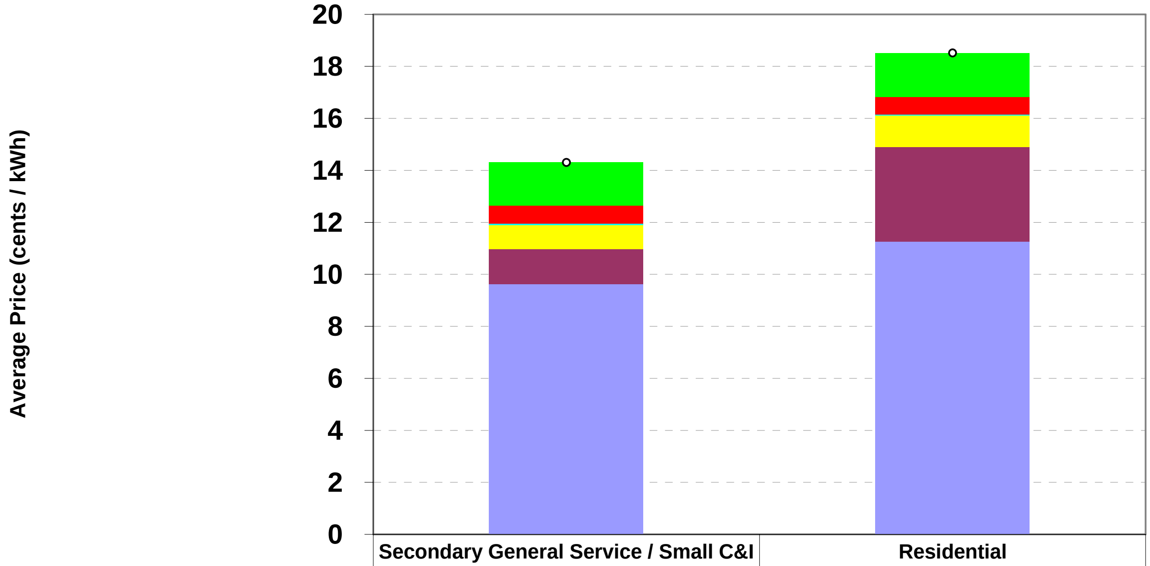
The basic electric utility bill includes numerous costs and charges that can be classified under three groups: state and federal policy, distribution charges, and the wholesale energy commodity cost. When the BPU released information in 2010 about the breakdown of charges on typical residential electric and gas bills, attention in the press focused on the "unknown charges" that contribute to high energy costs. Although most of these charges are identified on the EDC's bills, this was the "first time" information had been released about these "hidden taxes". Whether or not they are really "hidden" or are "taxes", customers and legislators must consider these charges when developing cost effective policies.

The major categories of residential and small commercial electric bill line items are summarized in Figure 25. Note that the numbers represent 2010 load-weighted averages for the four New Jersey EDCs.[59]

- Transition charges include the Non-Utility Generation Charge and securitization charges for transition bonds and associated income tax effects. These charges were created to recapture costs of the EDCs that would otherwise be unrecoverable after deregulation.
- Societal Benefits Charges recover the costs of State-mandated EE and RE programs, the Universal Service Fund, and Lifeline.
- Utility Administered EE and Renewable Energy Programs include the Energy Efficiency Stimulus Program and the Solar Generation Investment Program
- Sales and Use Tax is collected by the State on certain components of the retail tariff at a rate of 7%.
- Distribution charges recover EDC costs to own, operate and maintain their distribution systems.
- The BGS component represents all wholesale supply costs – energy, capacity, ancillary services, RECs, SRECs, and transmission.

[59] All rate component averages were compiled by CEEEP and presented in "Analysis for the 2011 Draft New Jersey Energy Master Plan Update," dated February 28, 2011.

Figure 25. Average EDC 2010 Electric Rate Components



	Secondary General Service / Small C&I	Residential
Transition Charges	1.663	1.691
Societal Benefits Charges	0.689	0.667
Utility Admin. EE and RE Programs	0.045	0.045
Sales and Use Tax	0.935	1.211
Distribution	1.339	3.638
BGS Subtotal	9.628	11.259
Total	14.299	18.511

Table 3 shows how the rate components illustrated in Figure 25 translate to an average residential home consumption of 700 kWh/month.

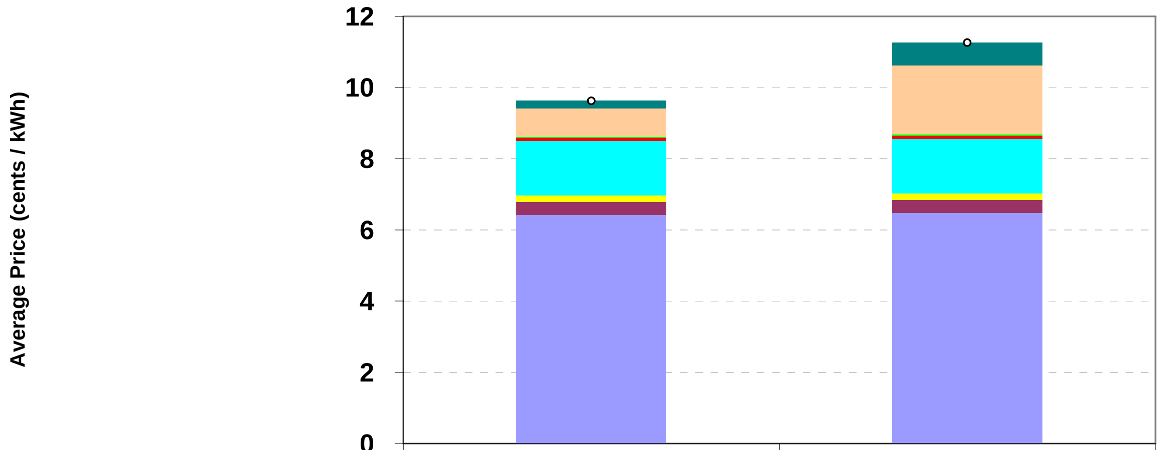
Table 3. Rate Components of an Average Residential Monthly Bill

Rate Component	Contribution to Monthly Bill
Transition Charges	$ 11.84
Societal Benefits Charges	$ 4.67
Utility Admin. EE and RE Programs	$ 0.32
Sales and Use Tax	$ 8.48
Distribution	$ 25.47
BGS Subtotal	$ 78.81
Total	$129.59

4.10.1 Basic Generation Service Components

The BGS component in Figure 25 is comprised principally of wholesale energy and capacity costs, as well as several elements attributable to State or federal policies. Figure 26 below shows the composition of the BGS contribution to total retail cost. Allowance costs for SO_2 and NO_x emissions are driven by Federal environmental policy. Allowance costs for CO_2 emissions are driven by New Jersey's participation in the Regional Greenhouse Gas Initiative (RGGI) and should no longer appear following New Jersey's orderly withdrawal from RGGI in 2012. They increase the marginal cost of generation for various types of electric generation and influence the wholesale LMP energy price. The New Jersey Solar REC Impact and New Jersey REC Impact items result from State policy initiatives but are not itemized in bills because they are internalized by BGS suppliers and form part of the BGS price determined at auction.

Figure 26. Breakdown of Basic Generation Service in Average 2010 Electric Rate



	Secondary General Service / Small C&I	Residential
PJM Transmission	0.218	0.636
Other BGS (Risk & Profit)	0.796	1.948
NJ REC Impact	0.024	0.024
NJ Solar REC Impact	0.090	0.090
PJM RPM Capacity	1.529	1.529
PJM Ancillary Services	0.184	0.184
SO2, NOx, & CO2 Allowance Cost	0.366	0.366
PJM LMP Energy (excl. allowances)	6.421	6.482
BGS Subtotal	9.628	11.259

Table 4 shows how the rate components illustrated in Figure 26 translate to an average residential home consumption of 700 kWh/month.

Table 4. BGS Components of an Average Residential Monthly Bill

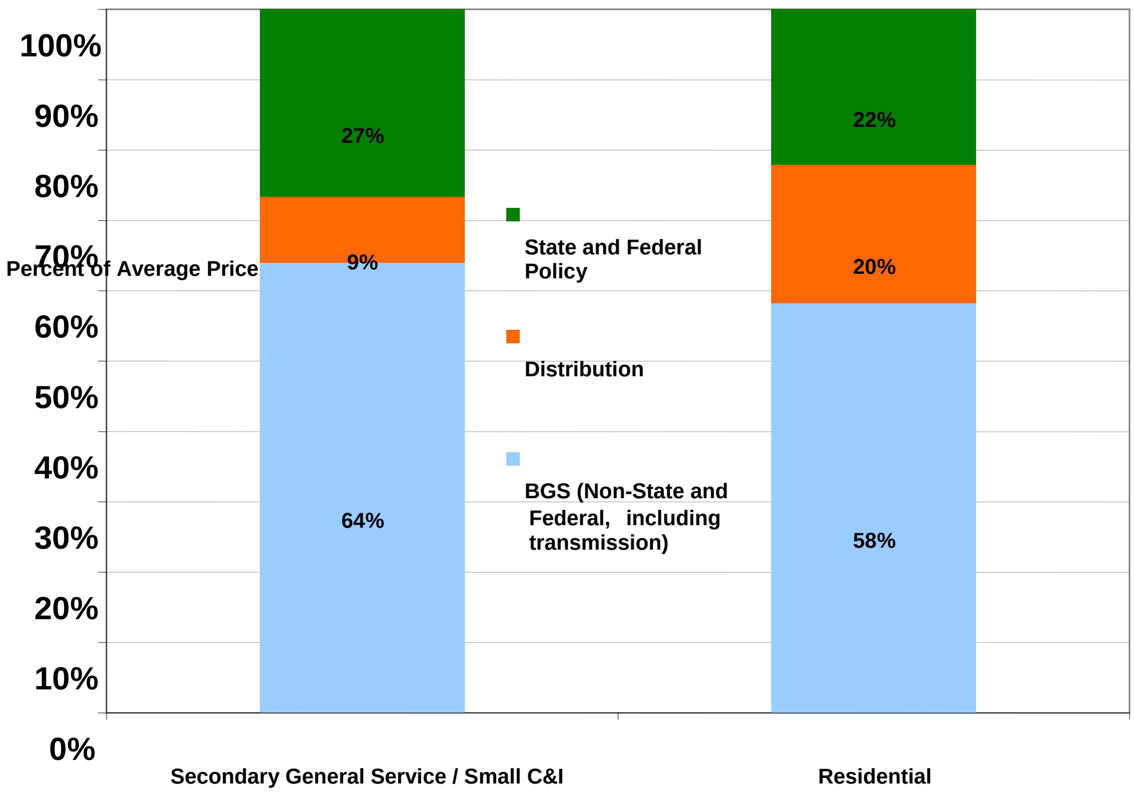
BGS Component	Contribution to Monthly Bill
PJM Transmission	$ 4.45
Other BGS (Risk and Profit)	$13.64
NJ REC Impact	$ 0.17
NJ Solar REC Impact	$ 0.63
PJM RPM Capacity	$10.70
PJM Ancillary Services	$ 1.29
SO2, NOx, & CO2, Allowance Cost	$ 2.56
PJM LMP Energy (excl. allowances)	$45.37
BGS Subtotal	$78.81

Emission costs and REC costs included in the BGS component, along with transition charges, societal benefits charges, utility administered program charges, and the sales and use tax, can be categorized as "state and federal policy" costs, and are discussed in greater detail below.

4.10.2 State and Federal Charges and Policies

Policy decisions, *e.g.*, deregulation and adoption of RPS, add charges to utility bills or indirectly impact wholesale energy commodity costs. The general components of typical retail electricity bills in New Jersey are shown in Figure 27.

Figure 27. Percentage Composition of Typical Electrical Bills



If the indirect BGS policy-related components were grouped with the direct policy components, they would total 27% of the typical Secondary General Service bill and 22% of the typical Residential bill, as shown in Figure 27.[60] Some policies, such as emission allowance programs to control SO_2, NO_x, and CO_2 emissions, result in costs to generators that are embedded in the wholesale market energy price and passed indirectly to customers. Others are collected by the EDCs as energy-based (cents/kWh) charges to all distribution customers. These charges disproportionately impact high-volume electricity users, the C&I ratepayers. Because distribution charges are much lower for most commercial-industrial customers than for residential customers, the distribution charges expressed as a percentage of the all-in retail rate constitute a larger percentage of the bill.

It is important to note that while the costs of State and federal policies may show up as a line item on the EDC's bill, the benefits are not revealed. Certain ratepayer charges fund State EE programs, which can lower prices to all ratepayers. These programs are subject to a Total Resource Cost (TRC) test to determine if they will generate positive economic benefits for all ratepayers.[61] Presumably, these programs would not be funded if they did not save money for

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[60] State policies are discussed in Section 6 of this 2011 EMP.

[61] The Clean Energy Program's (CEP's) energy efficiency elements use a TRC test, which measures the costs of a program as a resource option based on the total costs of the program, including both the participants' and the utility's

ratepayers and provide net economic benefits, but in the bill analysis below only EE costs are shown.[62] Direct benefits of such programs flow to the participants in terms of reduced energy bills due to lower usage. Indirect benefits, such as the reduction in wholesale electric prices due to lower demand, flow to all customers.

The CEEEP Report estimates, in cents/kWh, the average residential and small commercial rate impacts of various policy elements as shown in Table 5 below.

costs. This test represents the combination of the effects of a program on both the participating and non-participating customers. The benefits are the avoided supply costs, federal tax credits, and the reduction in generation and capacity costs valued at marginal cost for the periods when there is a load reduction. The costs are the program costs paid by the utility and participants plus the increase in supply costs for the periods in which load is increased.

[62] The Solar REC Program is not subject to a TRC test.

Table 5. State and Federal Policy Rate Components

	Secondary General Service / Small C&I	Residential Service
Non-BGS Policy Components		
Transition and Other Charges		
Regulatory Asset Recovery Charge	0.003	0.004
Transitional Energy Facility Assessment Unit Tax	0.274	0.292
System Control Charge	0.003	0.003
Solar Pilot Recovery Charge	0.000	0.000
Infrastructure Investment Surcharge	0.003	0.003
Non-Utility Generation Charge	0.507	0.505
Securitization: Transition Bond Charge	0.595	0.593
Securitization: Market Transition Charge Tax	0.278	0.291
Societal Benefits Charges		
Nuclear Decommissioning Costs	0.026	0.029
Manufactured Gas Plant Remediation Costs	0.030	0.025
Clean Energy Program (Energy Efficiency & Renewables)	0.305	0.292
Uncollectable Accounts	0.069	0.062
Universal Service Fund	0.192	0.192
Lifeline	0.062	0.062
Consumer Education Program	0.005	0.005
Utility-Administered Energy Efficiency and Renewable Energy Programs		
Demand Response Working Group	0.001	0.001
Residential Controllable Smart Thermostat Program	0.002	0.003
Integrated Distributed Energy Resource Expansion	0.002	0.003
Carbon Abatement Program	0.002	0.002
Energy Efficiency Stimulus Program	0.021	0.020
Demand Response Program	0.004	0.004
Solar Generation Investment Program	0.011	0.010
Solar Loan II Program	0.002	0.002
Sales and Use Tax		
Sales and Use Tax	0.935	1.211
BGS Policy Components		
New Jersey Solar Renewable Energy Credit Ratepayer Impact	0.090	0.090
New Jersey Renewable Energy Credit Ratepayer Impact	0.024	0.024
Sulfur Dioxide Ratepayer Impact	0.230	0.230
Nitrogen Oxide Ratepayer Impact	0.075	0.075
Regional Carbon Dioxide (RGGI) Ratepayer Impact	0.061	0.061
Total State and Federal Policy	3.812	4.094

The policy components – some of which are direct charges while others are indirect – are briefly addressed as follows:

- Transition and Other Charges consists of nine separate charges, most of which are related to electric deregulation in New Jersey. A number of these charges provide compensation to EDCs for electric generation assets and electricity supply contracts that were deemed "stranded", i.e. uneconomic with the transition to competition.
- Societal Benefits Charges consist of seven fees, all of which EDCs collect on behalf of the State to pay for State-run programs, such as the CEP, EE and renewable energy market transformation programs, Lifeline, and the Universal Services Fund (USF).

- EDC-Administered EE and Renewable Energy Programs consists of EDC-planned and managed programs authorized under the Global Warming Solutions Fund Act that have been proposed by EDCs and approved by the BPU.
- Sales and Use Tax represents the tax collected on various components subject to the 7% New Jersey sales and use tax.
- NJ Solar Renewable Energy Certificate is the amount each customer must pay to support solar energy installations in New Jersey necessary for electric supplier RPS solar compliance. The charge reflects the total SRECs purchased by electricity suppliers.
- NJ Renewable Energy Certificate is the amount each customer must pay to support installation of Class 1 and Class 2 renewable energy sources necessary for electricity supplier compliance with RPS Class 1 and Class 2 requirements. The charge reflects the total RECs purchased by electricity suppliers.
- Sulfur Dioxide Allowance is an estimate of the cost impact on wholesale electricity prices of compliance with the federal emissions trading program limiting power plant SO_2 emissions
- Nitrogen Oxide Allowance is an estimate of the cost impact on the wholesale electricity price of compliance with the federal emissions trading program limiting power plant NO_x emissions.
- Regional Carbon Dioxide (RGGI) Allowance is an estimate of the cost impact on the wholesale electricity price of compliance with the RGGI emissions trading program limiting power plant CO_2 emissions. These costs should no longer appear following New Jersey's orderly withdrawal from RGGI in 2012.

On their own, none of these charges appears significant on the average monthly utility bill, even though the totals paid by all ratepayers for a specific program may be high.[63]

4.11 EE and DR Program Evaluation

Cost/benefit analyses of EE and DR programs are important analytical tools used widely for evaluating the efficacy of program investments. However, these analyses can produce misleading results if no distinction is made between program participants and non-participants. This distinction is important because it avoids confusion regarding who bears what costs and how benefits are disseminated. A proper cost/benefit analysis requires an accurate measurement and allocation of costs and benefits to distinguish which ratepayers are bearing costs and/or receiving benefits. EE and DR programs that are ostensibly cost-effective may in fact be cost-effective for the participants who receive direct benefits, while the indirect benefits accruing to non-participants may be outweighed by the costs they incur.

[63] For example, a large solar energy developer provided information showing that in 2009 the average residential customer was charged 0.17 cents/kWh for all solar programs. That amount is small, but based on average customer use, the average residential customer paid over $14 to subsidize solar energy. Residential customers as a whole paid $45 million, in total.

A rate test measures the impact of program costs and benefits when averaged over all customers' load – both participants and non-participants. A rate test is a useful measure of program effectiveness and fairness. If the program causes average rates to decrease, the program should be considered equitable for non-participants. If the program causes average rates to increase, participants may benefit from reduced electricity usage or lower bills, but non-participants will have higher monthly bills. Rate tests, however, do not account for costs and benefits outside of the electric segment, *e.g.*, job creation, property taxes, and environmental impacts. A rate test is therefore a useful benchmark of efficiency and fairness, but it is not the only benchmark.

The primary benefit of the EE and DR programs is the participants' avoided cost of electricity, separated into the energy, capacity, and other wholesale cost components. Other retail costs may be avoided, too. Non-participants (along with participants) benefit if wholesale energy and capacity market prices decline as a result of the programs. In addition, any capacity revenues from qualified DR and EE managed by the EDCs participating in the RPM market would be credited to ratepayers.

EDCs pass the costs of EE and DR programs on to all ratepayers. To the extent that a program reduces a participant's peak load, and thus permits the participant to avoid a portion of transmission and distribution costs and other fixed charges, those costs will be shifted to non-participants, at least in the short term, to assure that the EDC recoups its costs in full.

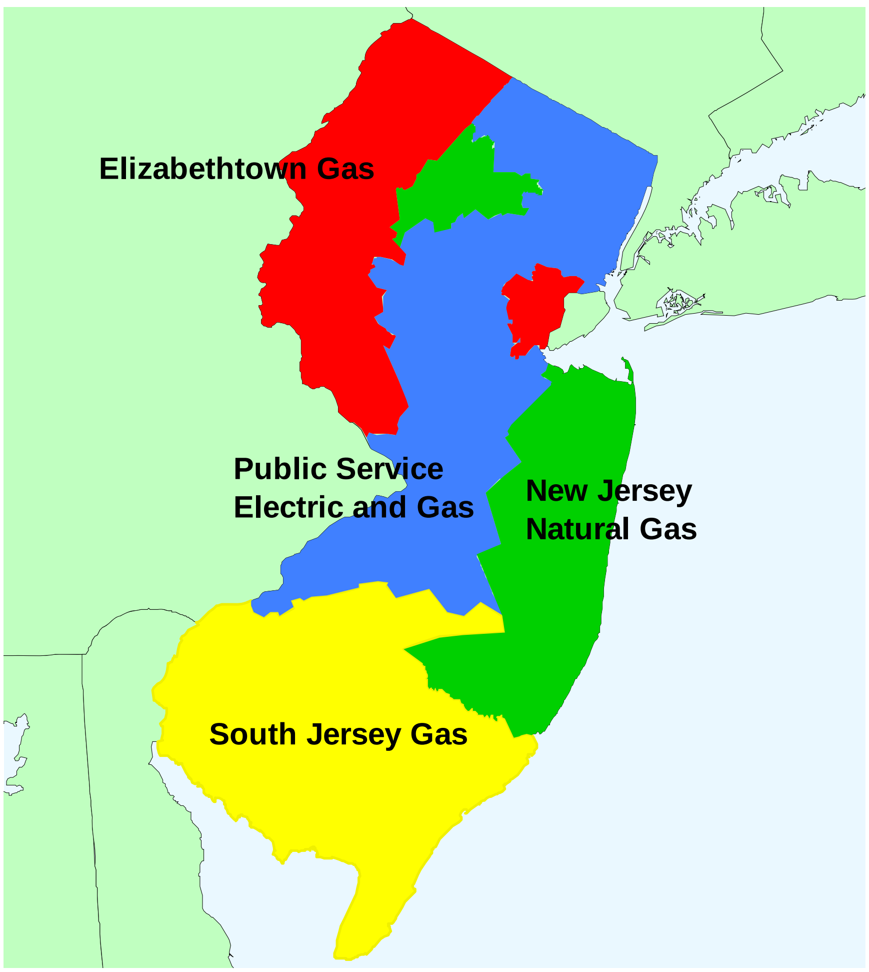
Some EE or DR strategies may be generous to participants in order to achieve aggressive targets. New Jersey must evaluate whether or not certain EE and DR programs, in particular, would clear the PJM capacity market without any financial support or, in the alternative, much less financial support than is embedded in the array of programs subsidized by New Jersey's four EDCs. In light of New Jersey's fiscal challenges, efforts must be made to strip away any largesse that constitutes a transfer of wealth from New Jersey's ratepayers to EE/DR program developers. While the Administration remains committed to increased EE/DR penetration to meet the State's planning goals, as discussed in Section 7.3 of this report, EE and DR programs should be re-evaluated to determine if PJM wholesale markets already provide adequate compensation to ensure program success, thereby obviating the need for continued State sponsorship and assistance.

5 Natural Gas and Other Fuels

5.1 New Jersey Gas Distribution Companies

New Jersey has one of the highest concentrations of natural gas use in the U.S. There are 2.9 million gas customers in New Jersey, 90% of which are residential customers. Four local distribution companies (LDCs) serve residential, commercial, and industrial customers throughout the State, including natural gas-fired power plants that are located behind the citygate, *i.e.*, served by LDCs instead of pipelines. The four LDCs are Elizabethtown Gas Co., New Jersey Natural Gas Co., Public Service Electric & Gas Co. and South Jersey Gas Co. Roughly two-thirds of natural gas sendout is for commercial and home heating applications, and the remainder is for power generation and industrial use. A small amount of natural gas is compressed for vehicle use.

Figure 28. Natural Gas LDC Service Territories

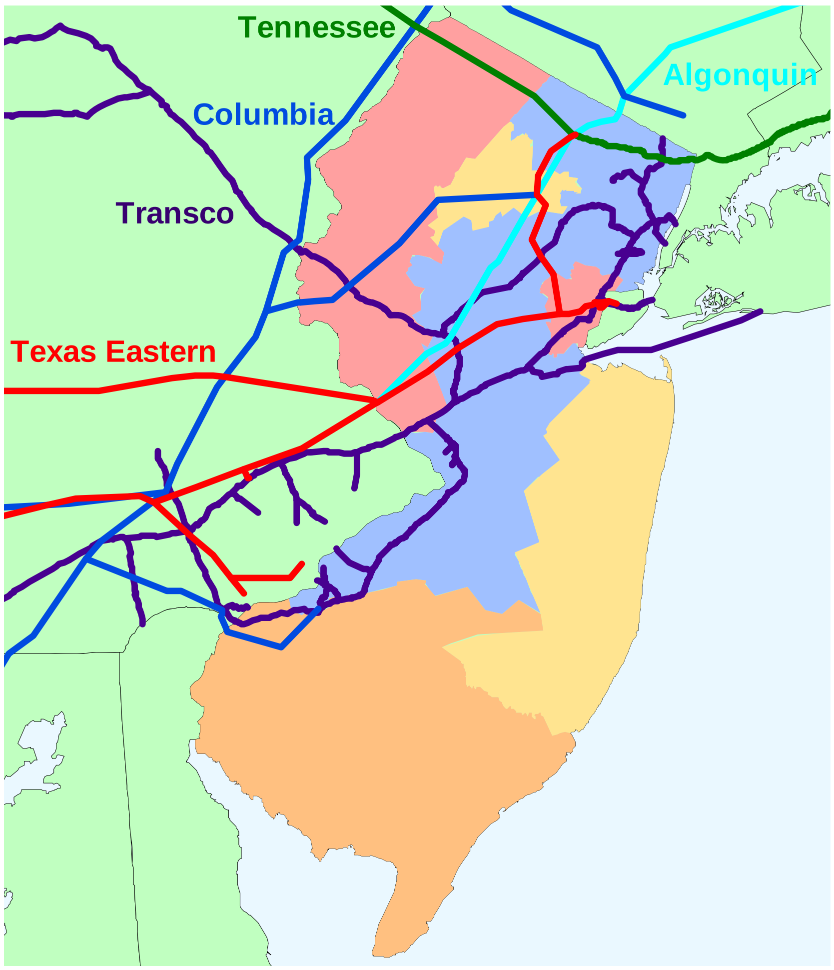


5.2 Sources of Natural Gas

Most natural gas used in New Jersey is sourced from offshore and onshore production facilities in the Gulf Coast and transported by pipeline directly to New Jersey, or indirectly via major underground storage facilities in Pennsylvania along the pipeline routes. In the last two years, a significant amount of natural gas from the Rocky Mountain states has captured market share in New Jersey as well. New Jersey does not rely on natural gas from western or Atlantic Canada.

New Jersey has about 1,500 miles of interstate transmission pipeline within the state.[64] The interstate pipelines that transport natural gas to New Jersey include the Transcontinental Gas Pipe Line (Transco), Texas Eastern Transmission, Algonquin Gas Transmission, Tennessee Gas Pipeline, and Columbia Gas Transmission. While Transco and Texas Eastern are the primary transporters to New Jersey, the other pipelines play an integral role in maintaining deliverability across New Jersey. The pipeline route systems for each of New Jersey's five interstate pipelines are shown in Figure 29.

Figure 29. Interstate Pipelines Serving New Jersey



New Jersey's LDCs are dependent on conventional underground storage facilities located in western Pennsylvania, and, to a lesser extent, West Virginia and New York, that provide incremental natural gas supplies to satisfy peak demands during the winter heating season,

[64] Source: Northeast Gas Association, Regional Market Update, December 2010, p.7.

November through March. The Leidy, Ellisburg and Oakford storage facilities have vast underground storage capabilities, which provide valuable economic and operational benefits, in particular, the ability to withdraw natural gas to serve core customers during the heating season. Transco has a large above-ground liquefied natural gas (LNG) storage facility in Carlstadt, New Jersey, which is used to supplement conventional pipeline deliveries during cold snaps in New Jersey and New York. South Jersey Gas, New Jersey Natural and PSE&G also have smaller LNG satellite tanks at the local level which are dispatched during cold snaps to bolster pressure behind the citygate. LNG supplied by these LDCs are earmarked for core customer sendout during extreme cold or operating contingencies, and is not typically available for electric generation or transportation use.

The pipelines that serve New Jersey benefit from increased production by the Marcellus Shale region. Existing pipeline connections allow for the transportation of shale gas from Marcellus in addition to conventional production from the Gulf Coast. Shale gas is expected to increase substantially in the decade ahead, and may continue to capture increased market share for decades. There are a number of competing new pipeline proposals that are expected to expand pipeline deliverability into New Jersey and the New York metropolitan area, which would provide Marcellus Shale gas producers with improved access to the market. New Jersey's pipeline and LDC infrastructure is likely to be strengthened by these new pipelines. The Christie Administration seeks to leverage New Jersey's natural gas infrastructure to foster environmental and economic goals.

5.3 Home Heating Oil

Although New Jersey has a high saturation rate of natural gas for home and commercial heating, distillate oil is also an integral fuel source for the state's residential sector. On a per capita basis, New Jersey consumes a disproportionate share of heating oil, nearly 6% of total U.S. consumption of oil in the residential sector.[65] Residential sector energy use by fuel type is summarized in Table 6.

Table 6. Residential Sector Energy Consumption, New Jersey and USA (trillion Btu)

	Natural Gas	Distillate Oil	Kerosene Oil	Other Fuel
NJ	227.8	39.6	0.3	15.4
USA	4,97.8	663.6	21.3	1,083.2
NJ Share	*4.6%*	*6.0%*	*1.4%*	*1.4%*

The prices of home heating oil, kerosene and propane move in tandem with benchmark oil prices, *i.e.*, West Texas Intermediate (WTI) crude. Crude oil and oil products are easily transported around the globe, so WTI prices are affected by world markets. In contrast, natural

[65] Source: EIA state energy profiles
http://www.eia.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/sum_btu_res.html

gas prices are largely affected by continental market dynamics. As discussed below, there has been a large oil-to-gas price differential in response to skyrocketing world oil prices in relation to relatively low cost natural gas prices in the U.S. While world oil markets are characterized by extreme price volatility, the favorable production outlook for domestic natural gas, in particular from Marcellus Shale, has dampened the historic price volatility in New Jersey. There are strong market incentives to lessen the use of distillate oil for home heating in favor of natural gas where it is available in New Jersey.

5.4 Transportation Fuels

New Jersey relies heavily on gasoline and diesel fuel for transportation. According to EIA, gasoline accounted for 66% of the total non-aviation energy consumption for New Jersey in 2008. Diesel fuel accounted for approximately 17% of that market, in particular, for freight.[66] New Jersey also uses residual fuel oil, primarily for large ocean vessels.

Overall, New Jersey uses about 3.6% of the energy used for transportation (including aviation) in the U.S. Transportation sector energy consumption by fuel type for the State and the U.S. are shown in Table 7.[67] New Jersey's high share of residual oil use is explained by the major Atlantic ports along New Jersey's seaboard.

Table 7. Transportation Sector Energy Consumption, New Jersey and USA (trillion Btu)

	Natural Gas	Aviation Fuel	Gasoline	Residual Fuel Oil	Distillate Oil	Other	Total[68]
NJ	2.2	200.4	535.8	139.1	134.8	35.0	1,019.5
USA	695.9	3,221.1	16,871.8	919.6	6,039.5	1,068.9	28,009.5
NJ Share	*0.3%*	*6.2%*	*3.2%*	*15.1%*	*2.2%*	*3.3%*	*3.6%.*

Reflecting the pattern of high volatility in the crude oil markets, prices for gasoline and diesel fuel have been volatile in recent years. Since 2005, prices have exhibited a number of peaks in the fall of 2005 (attributable in part to the effects of Hurricane Katrina), in mid-2006, and in the summer of 2008. Each peak was followed by a large price decline. In recent months, oil prices have risen sharply – the conventional wisdom is that oil prices will remain high going forward in relation to historic averages due to geopolitical concerns, robust global demand, and production pressures. In March 2011, the average rack price for premium gasoline in Newark was $3.04/gal and the price of diesel was $3.12/gal.[69] Recent prices for gasoline and diesel at Newark are shown in Figure 30.

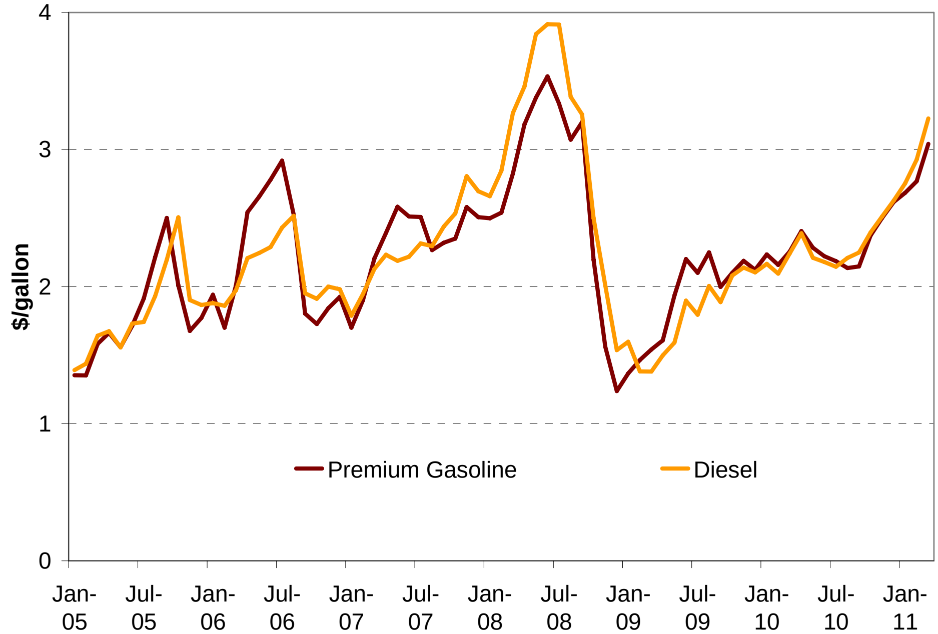
[66] See http://www.eia.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/sum_btu_tra.html for details

[67] Source: http://www.eia.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/sum_btu_tra.html

[68] Totals do not sum due to rounding and netting.

[69] Source: Bloomberg LP. The rack price is the price paid by gas stations to purchase fuel for resale to consumers.

Figure 30. Gasoline and Diesel Rack Prices, Newark New Jersey



Gasoline and diesel prices are lower in New Jersey than in surrounding states due to lower taxes and indigenous refinery capacity. According to EIA, taxes are a key driver of fuel costs, representing about 13% of the cost to consumers in February 2010.[70] Low State tax rates on gasoline and diesel fuel help to reduce the economic burden borne by New Jersey consumers. Table 8, below, shows the tax rates for gasoline, diesel fuel, and gasohol, a gasoline-ethanol mix, for New Jersey as well as a number of surrounding states.

Table 8. State Tax Rates on Transportation Fuels (cents/gallon)

	Gasoline	Diesel	Gasohol
NJ	10.5	13.5	10.5
NY	25.1	23.3	25.1
MA	21.0	21.0	21.0
CT	25.0	39.6	25.0
PA	31.2	38.1	31.2
DE	23.0	22.0	23.0
OH	28.0	28.0	28.0

Prices for gasoline, diesel, and other petroleum products move in tandem with crude oil prices, *i.e.*, WTI. Market indications show that oil prices are likely to increase over the next few years and then gradually decline. Actual oil prices in the decade ahead are highly uncertain, however.

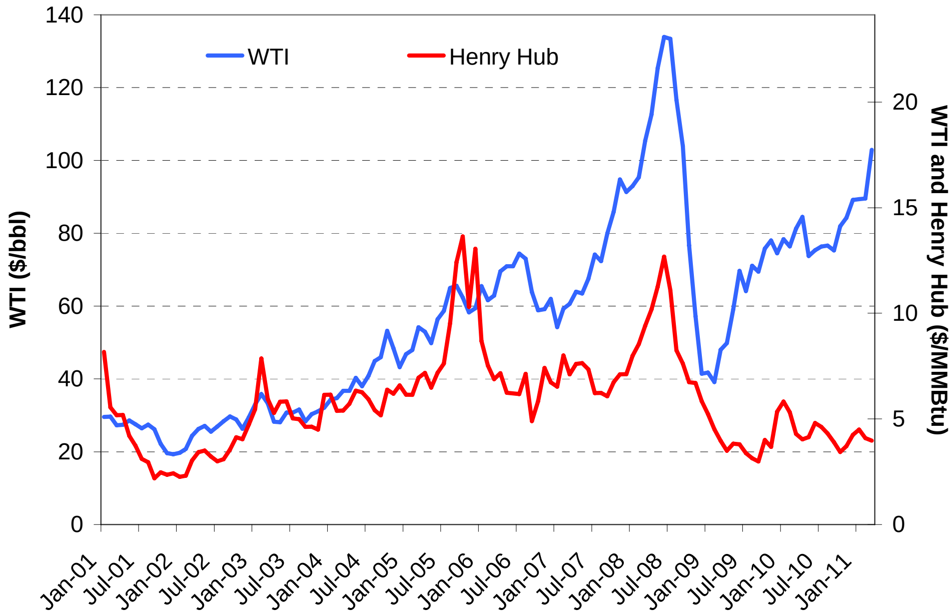
[70] Source: http://www.eia.doe.gov/oog/info/gdu/gasdiesel.asp

5.5 Fuel Market Outlook

Oil and natural gas are key fuels in New Jersey for generation of electricity, transportation, and heating. The pricing benchmark for oil is the WTI oil index, which is the physical delivery point for the NYMEX light sweet crude oil futures contract. Most residual and refined oil prices (including gasoline) move in lockstep with WTI. The benchmark for domestic natural gas is the Henry Hub, a liquid market trading point in Louisiana. New Jersey consumers pay delivered prices for natural gas that include: (i) transportation to New Jersey along the five interstate pipelines serving the State; and (ii) local LDC charges for distribution service from the citygate to the burner-tip.

Figure 31, below, shows average monthly prices for WTI and Henry Hub gas since January 2001.[71] In the figure, the left y-axis shows the WTI price expressed in dollars per barrel. The right y-axis is calibrated to display both WTI and Henry Hub prices on a $/MMBtu basis.

Figure 31. Average Monthly Prices for WTI and Henry Hub



The data indicate several important trends:

- Crude oil prices have increased dramatically over the past decade rising from around $20/bbl in early 2002 to over $130/bbl in June and July of 2008. Subsequently, oil prices hit a low of $39/bbl in February 2009, and have recently rebounded to $102/bbl in March 2011.
- Oil prices are extremely volatile. Gas prices are much less volatile, in particular, in the last two years. Natural gas price oscillations have been much less than oil price movements.

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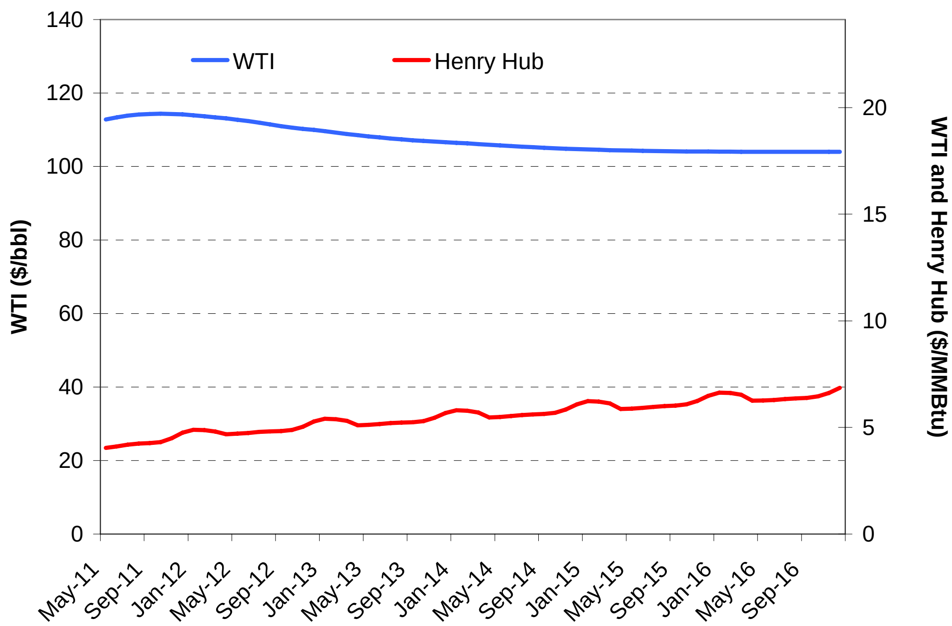
[71] Source: Bloomberg LP

- Over the last decade there has been a significant change in the relationship between oil and gas prices, *i.e.*, oil-to-gas price ratio. Historically, WTI and Henry Hub were priced similarly when measured on an equivalent Btu basis. This tight price parity relationship is reflected in the narrow bandwidth between the red and blue lines in Figure 31. This price parity ratio was approximately 6:1, *i.e.* the price of crude oil expressed in dollars per barrel was six times the price of natural gas expressed in Btu terms (dollars per MMBtu). The historic price parity relationship diverged starting in 2006. By March 2011, the spot price of WTI had risen to $102/bbl, while the spot price of natural gas was less than $4.00/MMBtu, a price ratio of almost 26:1.

Fundamental dynamics in oil and gas markets portend a continuation of the wide price differential going forward. Figure 32, below, shows the forward price curves for WTI and Henry Hub from NYMEX, traded on April 8, 2011.[72] As in Figure 31, the y-axis on the left-hand side shows the price of WTI expressed as dollars per barrel while the y-prime axis on the right-hand side shows the price of both commodities expressed on a dollar per MMBtu basis.

Figure 32. NYMEX Forward Price Curves for WTI and Henry Hub (April 8, 2011)



Market, geopolitical, macroeconomic, and legislative / regulatory factors will affect the relative price of oil and gas going forward. While natural gas prices may increase somewhat in the decade ahead, New Jersey expects strong production from Marcellus Shale and other shale formations throughout North America to temper the potential run up in commodity prices. On a BTU price parity basis, the conventional wisdom is that natural gas will remain available and will be much less expensive than oil.

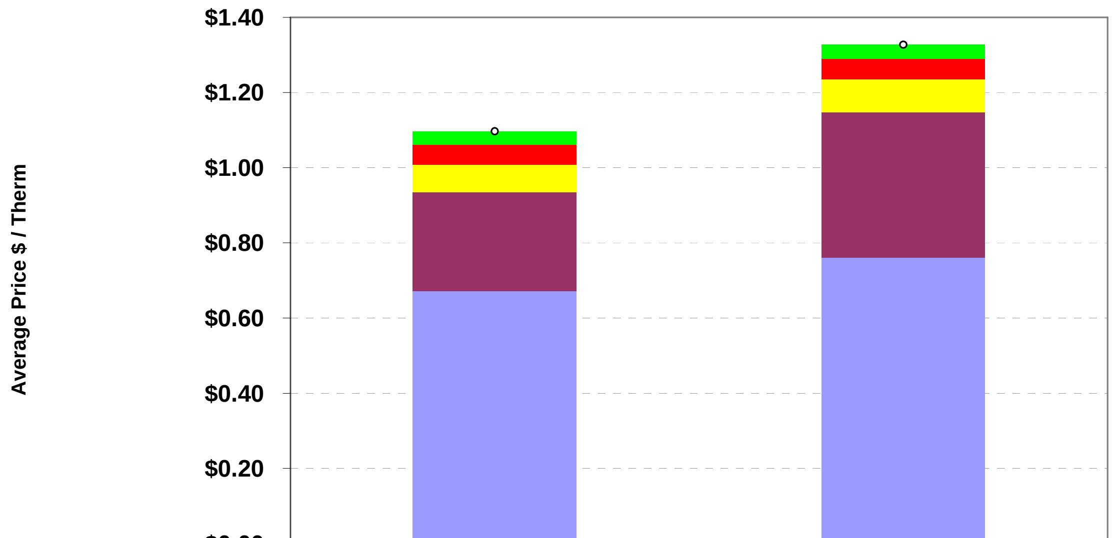
[72] Forward price curves are contract trading prices for future deliveries that result from trading on an open and liquid market. Forecasts, such as those prepared by the EIA, cover longer periods of time and may not reflect the latest market changes.

Expansion of the interstate pipeline network from the Marcellus Shale production area to the market center in New Jersey offers the State significant leveraging benefits to reduce New Jersey's reliance on diesel fuel for transportation and distillate oil for home heating fuel. There may be other valuable fuel substitution effects as well that promote the Garden State's environmental and economic goals.

5.6 Understanding Retail Natural Gas Costs

The basic natural gas utility bill includes many costs and charges that can be broadly classified under the same three groups as the electric utility bill: wholesale gas commodity cost, distribution charges, and state and federal policy costs. The major categories of residential and small commercial natural gas bill line items are summarized in Figure 33. Note that the numbers represent 2010 load-weighted averages for Elizabethtown Gas, PSE&G, Northern New Jersey Gas Co., and South Jersey Gas.[73]

Figure 33. Average LDC 2010 Rate Components



	Small General Service	Residential
Other Charges	$0.036	$0.037
Societal Benefits Charge	$0.054	$0.055
Sales and Use Tax	$0.072	$0.087
Distribution	$0.264	$0.388
Wholesale (BGSS)	$0.671	$0.760
Total	$1.097	$1.327

The various detailed line items are listed in Table 9 below with average 2010 values, grouped into the major headings of wholesale commodity cost, distribution charges, and state and federal policy costs.

[73] Rate component averages were compiled by Rutgers University CEEEP as presented in "Analysis for the 2011 Draft New Jersey Energy Master Plan Update," February 28, 2011.

Table 9. 2010 Average Natural Gas Bill Components ($/Therm)

	Small General Service	Residential Service
State and Federal Policy Components		
Other Charges		
Weather Normalization Clause	$0.001	$0.001
Transitional Energy Facilities Assessment Unit Tax	$0.022	$0.022
Conservation Incentive Program	$0.008	$0.008
Energy Efficiency Program	$0.004	$0.004
Carbon Abatement Program	$0.000	$0.000
Transportation Initiation Clause	$0.000	$0.000
Utility Infrastructure Charge	$0.001	$0.002
Societal Benefits Charges		
Clean Energy Program (Energy Efficiency & Renewables)	$0.024	$0.024
Remediation Adjustment Charge	$0.012	$0.013
Universal Service Fund	$0.013	$0.013
Lifeline	$0.005	$0.005
Sales and Use Tax		
Sales and Use Tax	$0.072	$0.087
Distribution Components		
Distribution Components		
Monthly Customer Charge	$0.017	$0.084
Average Distribution Charge	$0.247	$0.304
Monthly Capital Adjustment Customer Charge	$0.000	$0.000
Capital Adjustment Distribution Charge	$0.000	$0.000
Basic Gas Supply Service Components		
Basic Gas Supply Service Components		
BGSS Charge	$0.672	$0.762
On-System Margin Sharing Credit	($0.001)	($0.002)
Grand Total	$1.097	$1.327

5.6.1 Basic Gas Supply Service Components

The wholesale Basic Gas Supply Service (BGSS) component in Figure 25 is comprised largely by the wholesale cost of natural gas delivered to New Jersey. As discussed in Section 5.5, the wholesale price of natural gas is driven by market forces and is beyond the control of the BPU or any other state agency. Largely beyond the jurisdiction of FERC as well, commodity gas prices are indirectly affected by federal policy related to exploration and production, as well as to the development and regulation of interstate pipelines. Natural gas customers may choose the pooled cost of gas embedded in the BGSS default service, or they may contract with an alternative natural gas supplier. The average cost varies among rate classes primarily due to annual usage profiles. Residential customers generally use much more gas during the heating season, when market prices are high, than do C&I customers.

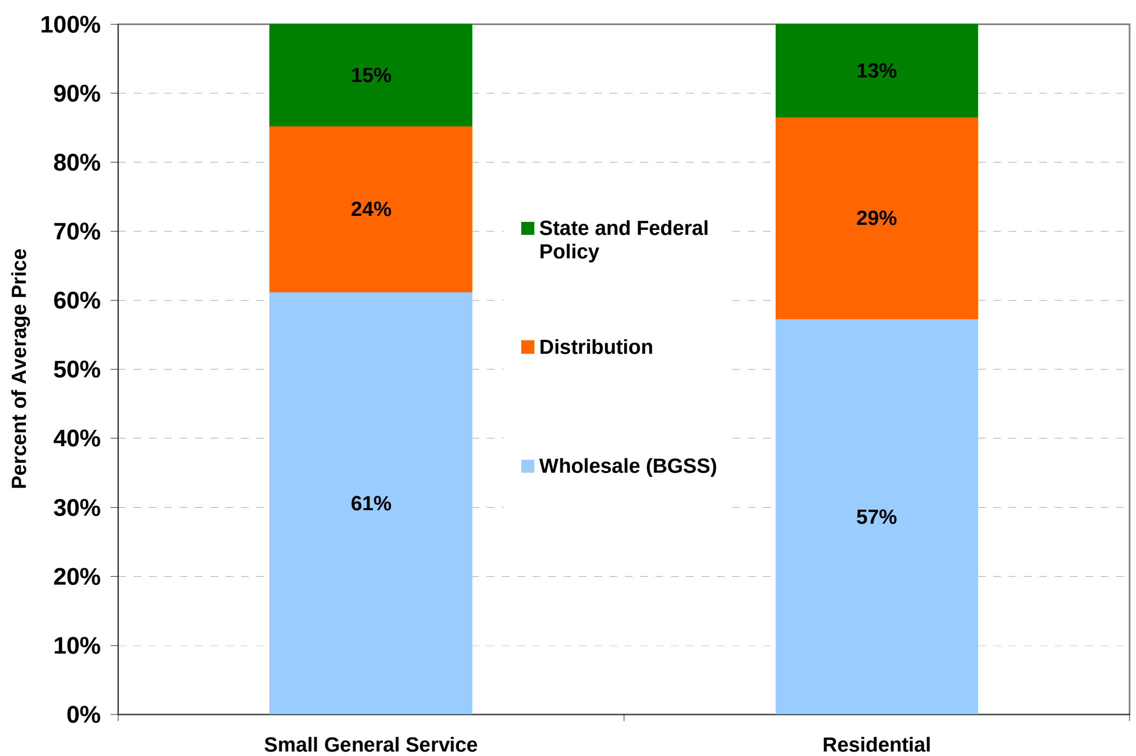
5.6.2 Distribution Charges

The distribution charges on natural gas bills provide for recovery of the capital and operating costs of the distribution system which moves natural gas from connections with the interstate pipeline system to individual customer meters. These charges generally consist of a customer charge (dollars per month per meter) and a volumetric charge ($/therm). The customer charge may be set by customer class or as a function of maximum daily delivery capacity (dekatherm per day). New Jersey's LDCs' distribution rates are regulated on a cost of service basis under BPU jurisdiction.

5.6.3 State and Federal Charges and Policies

Policy decisions, *e.g.* deregulation, taxes, and efficiency programs, add charges to utility bills or indirectly impact wholesale energy commodity costs. Not all of these charges are identified clearly, explained, or understood, and this lack of transparency prevents policy makers and ratepayers from making informed decisions about important electricity policies. Figure 27 shows the contribution of policy-related charges to commodity and distribution charges for natural gas service to residential and small commercial customers.

Figure 34. Percentage Composition of Typical Natural Gas Bills



Policy-related components are discussed by group in the following bullets:

- Transition and Other Charges represent eight separate charges that cover costs associated with utility deregulation, infrastructure management, energy conservation and EE programs, rate adjustments for abnormal weather, and the costs of stimulus programs.
- Societal Benefits Charges cover five different fees, all of which the industry collects on behalf of the State to pay for State-run programs, *e.g.*, CEP EE programs, gas manufacturing site remediation program, and the USF (for low income residents).
- Sales and Use Tax represents the total tax collected on various components subject to the 7% New Jersey sales and use tax.

It is important to note that while the costs of State and federal policies may show up as a line item on the LDCs' bills, the benefits do not materialize, *per se*. Certain ratepayer charges fund State EE programs, which can lower prices to all ratepayers. These programs are subject to a TRC test to determine if they will generate positive economic benefits for all ratepayers. Presumably, these programs would not be funded if they did not save money for ratepayers and provide net economic benefits, but in the bill analysis shown below only EE costs are identified. Direct benefits of such programs flow to the participants in terms of reduced energy bills due to lower usage. Indirect benefits, such as the reduction in wholesale natural gas prices due to lower demand, flow to all customers.

On their own, none of these charges appears significant on the average monthly utility bill, even though the totals paid by all ratepayers for a specific program may be high.

6 Recent Legislative and Regulatory Initiatives

Since the issuance of the 2008 EMP, New Jersey has enacted several pieces of landmark legislation and promulgated new regulations intended to implement and advance the State's energy policy objectives. Collectively, these initiatives are intended to steer the course of New Jersey's energy future, "plac[ing] New Jersey at the forefront of a growing clean energy economy with aggressive EE and renewable energy goals and action items, and the development of a 21st century energy infrastructure."[74] Thus, some of the legislative and regulatory initiatives provide specific goals or requirements for particular technology sectors.

There have been recent changes in the regional economic landscape, wholesale energy markets, clean energy technologies, federal environmental and tax laws, and PJM market rules. These and other developments may alter investment and consumer priorities. It is important to reassess, periodically, these regulatory and legislative initiatives to ensure that they are still aligned with policy goals. In a deregulated energy environment, there are instances where regulatory and legislative initiatives have had unintended consequences. Some conflict with other meritorious initiatives, and some worthwhile programs have not acquired sufficient traction to be implemented effectively.

A description of key legislation passed since the publication of the 2008 EMP is provided in the following sections. Where appropriate, noteworthy accomplishments as well as unforeseen issues warranting further evaluation are described. Note that these statutes are organized by subject, and not chronologically.

6.1 Initiatives to Promote a Diverse Portfolio of Efficient Generation Resources

Long Term Capacity Agreement Pilot Program, P.L. 2011, Chapter 9, supplementing C.48:3 (enacted 1/28/11) This Act established the LCAPP, which was designed to promote the development of 2,000 MW of new baseload and/or mid-merit generation facilities for the benefit of New Jersey's electric consumers. The legislation required the BPU to complete proceedings within 60 days of the legislation's effective date, *i.e.* by the end of March 2011.

In accordance with the legislation, an Agent for the BPU conducted a competitive RFP process and recommended three gas-fired CC projects, totaling 1,948.5 MW of unforced capacity (UCAP). On March 29, 2011, the BPU approved the selection of these three projects and the form of the Standard Offer Capacity Agreement (SOCA) to be executed between each project and each of the four New Jersey EDCs. The selected projects are all located within New Jersey. Two projects, the Old Bridge Clean Energy Center and the Woodbridge Energy Center, are proposed to be in operation by June 1, 2015. The third project, Newark Energy Center, is proposed to be in operation by June 1, 2016. In the aggregate, the three SOCAs are expected to provide $1.8 billion in net economic benefit on a present value basis over the 15-year SOCA terms, primarily due to lower wholesale energy prices. These projects are also expected to create approximately 2,400 construction jobs over a three-year period, and nearly 80 full-time equivalent jobs during operation of the facilities. Indirect and induced economic effects are

[74] "New Jersey Energy Master Plan," October 2008, p. 6.

expected to produce additional benefits. These projects are also expected to improve New Jersey's air quality and reduce the global carbon loadings by displacing higher emitting and carbon-intensive generation, roughly equivalent to a 250-MW coal plant.[75]

Prior to LCAPP being signed into law, PJM and the Market Monitor sent a joint letter to the BPU expressing concern over the legislation and pointing out that RPM had provisions, *i.e.*, MOPR, that were designed to prevent "uneconomic offers" such as those that might result from LCAPP and which would "artificially depress RPM auction prices."[76] On February 11, 2011 PJM filed proposed changes with FERC to broaden MOPR provisions to eliminate any loopholes that would allow subsidized capacity to submit a capacity bid below its actual cost and thus clear in the RPM auctions (Docket No. ER11-2875). Due to this mitigation risk, the economic rationale of the BPU's SOCA awards was not predicated on any capacity market benefits. However, MOPR mitigation could prevent any or all of these generators from clearing in the RPM auctions, which would effectively eliminate the benefit of the bargain associated with the three SOCA awards. FERC issued its Order on April 12, 2011 approving most of PJM's proposed modifications to MOPR, effective immediately. More discussion about FERC's approval of PJM's proposed MOPR modifications can be found in Section 7.1.2.

Retail Margin Combined Heat and Power, P.L. 2009, Chapter 34, amending and making an appropriation, C. 48:3-51 (enacted 3/31/09) This Act authorized BPU to use $60 million of Retail Margin Fund monies to provide grants for combined heat and power production (also referred to as cogeneration) and programs promoting EE and renewable energy. The Act supported the installation of CHP units at numerous business facilities throughout the state, which were ranked by the BPU after applications were received. The funds appropriated for these CHP projects were re-allocated as a budget balancing measure due to the declared fiscal emergency in FY 2010.

As further discussed in Section 7.1.5, there is significant market potential for expanded CHP in New Jersey. In the absence of funding through the Retail Margin Fund, support for CHP development through grants, loans, and loan guarantees will need to be derived from alternative sources.

On Site Generation Facilities, P.L. 2009, Chapter 240, amending and supplementing C. 48:3-51 (enacted 1/16/10) This Act expanded the definition of "on-site generation" to include cogeneration facilities which service non-contiguous thermal load customers. The Act also clarified that a cogeneration facility is not a public utility, and extended the sales tax exemption for sales of energy by cogeneration facilities. The effect of these changes was to reduce the regulatory jurisdiction of the BPU over such non-contiguous cogeneration facilities, thereby reducing their operating costs.

[75] Levitan & Associates, Inc., "LCAPP Agent's Report, Long-Term Capacity Agreement Pilot Program," March 21, 2011

[76] Maryland also has approved legislation that would authorize in-State EDCs to contract for up to 1,800 MW of new generation. In addition to PJM's actions, Exelon *et al* filed a legal challenge in federal district court that is pending.

6.2 Initiatives to Promote Renewable Energy

Offshore Wind Economic Development Act, P.L. 2010, Chapter 57, amending and supplementing C. 48:3-51 and 3-87, C.26:2C-51, C.34:1B-209.4 (enacted 8/19/10) This Act directs the BPU to develop an OREC program to support at least 1,100 MW of generation from qualified offshore wind projects. OWEDA also: (i) authorizes the BPU to accept applications for qualified offshore wind projects, (ii) sets forth the criteria to be used by the BPU in reviewing the projects' applications, and (iii) authorizes EDA to provide up to $100 million in tax credits for qualified wind energy facilities in wind energy zones.

A Special Rulemaking, as provided for in the Act, was completed by the Board on February 10, 2011, with the rules published in the New Jersey Register on March 7, 2011. A full rulemaking process has begun. The Special Adopted New Rules (N.J.A.C. 14:8-6) define the "cost-benefit" test that is a key provision of the legislation. Off-shore wind projects accepted by the BPU "must demonstrate positive economic and environmental net benefits to the State." The cost-benefit test is based on three factors: (i) positive and negative impacts on New Jersey's electricity rates over the life of the project, (ii) impacts on New Jersey's economy through the creation of employment and other direct, indirect, and induced socioeconomic effects, and (iii) net environmental impacts ascribable to the project. The cost-benefit test is intended to ensure that any subsidies in the form of ORECs that are ultimately borne by ratepayers are at least offset by the aggregated net benefits to New Jersey residents and businesses.

Solar Energy Advancement and Fair Competition Act, P.L. 2009, Chapter 289, amending C. 48:3-51 and 3-87 (enacted 1/17/10) This Act extends the RPS requirements to 2026 and establishes a 15-year SACP schedule. The Act lifts the 2 MW cap on net metering systems and extends the "shelf-life" of SRECs to three years. The Act provides that the BPU shall adopt "net metering standards, standards for electric power suppliers and basic generation service providers, safety and power quality interconnection standards and credit for generators." The BPU prepared a Special Adoption to comply with the Act on March 30, 2011. The costs and consequences of implementing SEAFCA are further discussed in detail in Section 7.2.3.

Tax Exemption for Renewables, P.L 2008, Chapter 90 (enacted 10/1/08). This Act establishes an exemption from real property taxation for property installed in any residential, commercial, or industrial building that is certified by the local enforcing agency as a "renewable energy system." The Act also requires the Commissioner of the Department of Community Affairs (DCA), in consultation with the BPU, to adopt "standards with respect to the technical sufficiency of renewable energy systems for purposes of qualification for the exemption." The Act does not specify any timeframe for promulgating these regulations, and to date, no regulations have been issued. However, applicants for the exemption are required to submit a "Renewable Energy Application Form" with their tax returns. The form was developed by DCA and mandates compliance with the Uniform Commercial Code.

Normally, the value of improvements made to residential, commercial, or industrial buildings are reflected in a proportionate increase in the building's tax assessment. That will no longer be true of the addition of a renewable energy system, if the system meets the standards adopted by DCA. Under this law, the taxing authority will not be permitted to consider any increase in value from the renewable energy equipment when assessing the property.

It is not likely that this exemption was intended to apply to large scale renewable energy systems where the primary purpose is to sell excess energy not consumed on site into the electric grid, thereby generating income for the property owner or for a third party developer. Commonly, such systems are owned, financed, and operated by a third party developer who has entered into a power purchase agreement with a host property owner. Regulations can be developed to limit the exemption in cases where the renewable energy system is primarily intended as a commercial operation, but acknowledging that the owner of the renewable system may be a different entity than the owner of the real property.

Residential Development Solar Energy Systems Act, **P.L. 2009, Chapter 33, supplementing C.52:27D-141** (enacted 3/31/09) This Act requires residential developers to offer to install a solar energy system into a dwelling unit when a prospective owner enters into negotiations with the developer to purchase a dwelling unit. The Act provides that the DCA Commissioner, "in consultation" with the BPU, *shall* adopt "standards with respect to the technical sufficiency of solar energy systems to be installed pursuant to this act." It further provides that the BPU shall adopt "orders, rules, or regulations" that provide for solar energy systems installed in accordance with its provisions "to be eligible for all applicable credits, rebates, or other incentives that may be available for the installation of solar energy systems." This legislation presents complex implementation and enforcement issues. The Act does not specify a time period for promulgating these regulations and, to date, no regulations have been issued by either the DCA or BPU.

Renewables as an Inherently Beneficial Use, P.L. 2009, Chapter 146, amending C. 40:55D-4 (enacted 11/20/09) This Act defines "inherently beneficial use" for purposes of zoning variances and specifically includes facilities and structures that supply electrical energy produced from wind, solar, or PV technologies. Before this law was enacted, what was "inherently beneficial" was determined on a case-by-case basis and often through litigation. An applicant for a zoning or land use variance normally must prove that the positive aspects of the project outweigh the negatives. If, however, the proposed project is inherently beneficial, it meets the variance requirements by definition and must only show that the proposal does not create a "substantial detriment to the public good." In cases where it is invoked to obtain approvals for development of a renewable project on farmland, this Act may be in conflict with State policies to preserve farmland.

Brownfield and Contaminated Site Remediation Act Update, P.L. 2009, Chapter 302, amending C:10B-5 and 10B-6 (enacted 1/17/10) This Act authorizes grant funding of up to $5 million per year from the Hazardous Discharge Site Remediation Fund, administered by the DEP, to municipalities, counties, or certain redevelopment agencies for projects that involve the redevelopment of contaminated property for renewable energy. The Act does not authorize the adoption of regulations.

To date, the DEP has awarded grants to Bellmar Borough for development of a solar project on a remediated brownfield site. DEP has also provided grants to several other municipalities for feasibility studies of solar projects at other contaminated sites.

Farmland Assessment Act Update, P.L. 2009, Chapter 213, amending and supplementing C. 4:1C and C. 54:23 (enacted 1/16/10) This Act adds biomass, wind or solar energy generation as complying with certain conditions in the definition of "agricultural use" for farmland assessment purposes. Biomass is defined as an agricultural crop, crop residue, or agricultural byproduct that is cultivated, harvested or produced on the farm and used to generate energy in a sustainable manner. The Act provides that the Division of Taxation, "in consultation" with the Department of Agriculture, shall adopt "such rules and regulations as may be necessary for the implementation and administration" of the Act. The rules were proposed by the State Agricultural Development Commission in 2010 and will be adopted later this year.

The law places special conditions on preserved farmland, requiring: (i) no interference with the agricultural use of the land, (ii) ownership of the system by the landowner, (iii) provision of energy directly to the farm or reduction of the farm's energy costs through net metering, and (iv) a cap on the total energy production limited to demand for the previous calendar year plus 10%. Further regulatory conditions may be warranted to be consistent with the State's farmland protection policies.

Solar and Wind Energy Commission, P.L. 2009, Chapter 239 (enacted 1/16/10) This Act creates the Solar and Wind Energy Commission to study and make recommendations regarding solar and wind energy installation feasibility on State-owned property, including buildings and land. The Act does not authorize any regulations, and this commission was never constituted.

Small Wind Systems, P.L. 2009, Chapter 244, supplementing C. 40:55D-66 (enacted 1/16/10) This Act prohibits municipalities from adopting ordinances regarding the installation and operation of small wind energy systems that unreasonably limit such installations or unreasonably hinder the performance of such installations. The Act also provides a procedure for deeming a small wind energy system to be abandoned. This law does not authorize the adoption of regulations.

6.3 Initiatives to Promote Energy Efficiency and Conservation

Energy Savings Improvement Projects, P.L 2009, Chapter 4, amending and supplementing C. 18A, C.40A and C.52 (enacted 1/21/09) This Act authorizes public entities to implement energy savings improvement programs by entering into a contract with an energy services company for the implementation of energy conservation measures through a lease purchase agreement of 15 or 20 years. The Act enables public entities to acquire new, efficient heating, ventilation, and air conditioning equipment, as well as other energy-saving improvements, such as insulation and more efficient lighting, without the need for large, upfront, capital expenditures. The DCA's Director of Local Government Services, the State Treasurer, and the BPU may "adopt such rules and regulations as deemed necessary to implement the provisions of this act." Although formal regulations have not been promulgated, DCA has issued "binding guidance" through Local Finance Notice 2009-11. In addition, DCA and the BPU are developing a model RFP for government agencies to use; the model should be finalized later this year. This legislation is anticipated to result in direct economic and environmental benefits to governmental agencies, and thus taxpayers, by reducing energy costs without incurring up-front capital expenditures.

Uniform Construction Code Update, P.L. 2009, Chapter 106, amending and supplementing C. 52:27D-122.2 and 123, C. 52:27F-11 (enacted 8/6/09) This Act authorizes the DCA

Commissioner to amend the Uniform Construction Code's energy sub-code to establish enhanced energy saving construction requirements. Such requirements shall ensure that the anticipated energy savings statewide are proportionate to the additional costs of energy sub-code compliance. The Act also provides down payment assistance to certain purchasers of homes meeting enhanced energy sub-code requirements. DCA adopted regulations implementing the Act, which were effective September 7, 2010.[77]

6.4 Other New and Pending Legislation

Biofuels, **P.L. 2010, Chapter. 101, supplementing C. 52:34** (enacted 12/8/2010) This Act requires the State to purchase biofuels in lieu of fossil fuels when reasonable, prudent, and cost-effective.

[77] See 42 NJR 2043(a)

7 2011 Plan for Action

The Christie Administration's pursuit of environmental goals does not subordinate other worthwhile resource planning goals centered on reliability and economics. Reducing energy costs, encouraging employment and embracing environmental stewardship are laudable but often competing objectives. New Jersey's policy initiatives are designed to accomplish these goals in a cost-effective manner. New Jersey's environmental, economic and reliability goals require that cost/benefit studies rationally measure total impacts, including direct energy costs, quantifiable environmental benefits, and indirect socio-economic benefits. This will lead to informed decisions that incorporate good tradeoffs among competing resource planning objectives. Informed decisions must consider energy risks and uncertainties, as evidenced by the divergence between oil and natural gas prices, the Gulf of Mexico oil spill, the debate over hydraulic fracturing of shale gas and stricter emission regulations, as well Japan's nuclear power crisis. No policy choice is without risk, and each has employment, environmental, and economic consequences. The Christie Administration's objective is to set forth the foundation for change that modernizes the generation resource mix in New Jersey and promotes fuel substitution in a way that saves money, stimulates the economy, assures reliability, and protects the environment.

In the past few years, New Jersey customers have paid relatively high energy power prices driven by high natural gas prices and high capacity prices under PJM's RPM. While natural gas prices have declined significantly, capacity prices have remain high, reflecting tightening reserves in EMAAC. Domestic gas production has increased even though commodity prices have decreased, but New Jersey has not yet experienced the addition of efficient CC generation that would be expected to reduce electric energy prices throughout the State. Moreover, under the BGS mechanism, retail rates lag behind changes in the commodity gas market. Hence, New Jersey customers have not yet benefited from lower commodity prices as the BGS mechanism reflects the procurement of natural gas supply when then forward prices were higher than present commodity prices.

New Jersey can meet its renewable energy challenges through measured and cost-effective policy choices. Determining the cost-effectiveness of policy options requires a comprehensive analytic effort that considers all costs and benefits, both direct and indirect. In addition, cost-effectiveness must be calculated from both the perspective of program participants and non-participants. It is often the case that participants benefit from programs that are driven by admirable policy choices, *e.g.*, customer rebate programs that subsidize the purchase of efficient home appliances, or clean solar PV installations that encourage in-State manufacturing. It is not clear, however, if non-participants reap sufficient benefits in the form of cleaner air or lower power prices to offset the additional costs that then become enshrined in the retail electric bill. Going forward, New Jersey should implement more rigorous cost / benefit analyses to determine the cost-effectiveness of its energy policy options.

Consistent with EDECA and the near-term goals of the Global Warming Response Act, New Jersey remains committed to meeting its RPS target of 22.5% of state-wide electricity demand from renewable energy sources by 2021. The RPS target includes both Class 1 and Class 2 resources. The policy goals and action plans set forth in this EMP are designed to support this target in a way that ensures that worthwhile environmental objectives do not undermine other laudable resource planning objectives, in particular, reliability and economics, *i.e.*, price.

Informed tradeoffs among these objectives – the environment, reliability, and economics – are therefore required to achieve the annual RPS targets. In gauging the impact of new renewable energy sources to meet the RPS, New Jersey must continue to evaluate job creation prospects and associated economic multiplier effects as well as the efficiency and fairness of incentives and subsidies. Against the backdrop of high energy costs, New Jersey's current fiscal challenges remind policymakers that the method for achieving the RPS should be flexible – neither rigid nor absolute. New Jersey should formulate the incentives and portfolio of renewable energy sources that result in the most cost-effective energy alternatives possible. Mid-course corrections to achieve the RPS objectives that safeguard New Jersey's need for reliability and economic benefits are encouraged. Emphasis should be placed on resources that provide a net economic benefit to the State by providing jobs and investment, in addition to clean energy.

New Jersey's 22.5% RPS target in 2021 is a long stride in the march toward deep structural changes in New Jersey's energy infrastructure in the 21st century. The Christie Administration recognizes that New Jersey must take a far longer view than ten years in order to pour the energy foundation for a clean and secure energy future for decades to come.

The Global Warming Response Act, P.L. 2007, c.112, adopts goals for the reduction of greenhouse gas emissions in New Jersey. The law requires the stabilization of statewide greenhouse gas emissions to 1990 levels by 2020, followed by a further reduction from all sources to 80% below 2006 levels by 2050. In concert with reliability and economic planning criteria and the long-range goals of the Global Warming Responses Act, New Jersey needs to formulate a vision of what its energy infrastructure will ultimately consist of in the first half of the 21st century. A goal of 70% of the State's electric needs from "clean" energy sources by 2050 may be considered an aspiration, but it is one that is achievable if the definitional criteria for clean energy are broadened beyond renewables. Clean energy may encompass natural gas plants, and nuclear power – both license extended units and, conceivably, new nuclear.

In the alternative, if 70% of the State's electric needs are to be derived from carbon free energy sources by 2050, then the technology bandwidth available to satisfy the goal narrows. This narrowing creates tension among the environmental, reliability and economic criteria that protect ratepayer interests throughout New Jersey. Simply put, something has to give. The only carbon free technologies are renewables and nuclear power. Solar PV is expensive and intermittent. While New Jersey has high quality, harvestable wind potential in south Jersey, it too is intermittent and expensive, and there are practical limits to the heavy concentration of offshore wind in one location. Wind by wire from other PJM states raises additional concerns about reliability, the siting of new HV transmission, and PJM's integration of renewables. Both solar and wind require the addition of other conventional or innovative technologies to ensure reliability.

Smart grid technology and other DR/EE technologies behind the meter are an integral part of the resource mix, but are not scalable to meet the 70% goal by 2050 without undermining reliability and economic goals. With respect to nuclear power, New Jersey has enjoyed reliable performance from the existing nuclear units. While carbon free, nuclear energy produces radioactive waste that the Federal government has been unable to resolve. Moreover, there are safety concerns that make the permitting of new nuclear units problematic and uncertain. In addition to problems associated with the management of nuclear waste and safety concerns highlighted by the events in Japan, new nuclear is expensive, particularly when compared with state-of-the-art CC technology. Efficient gas-fired CC plants are far less carbon-intensive than conventional coal or other fossil fuel plants, but there are environmental concerns with the production of natural gas from shale formations.

Over the EMP planning cycle, New Jersey should craft a vision of the State's long-term clean energy goals through a stakeholder process. The stakeholder process should delineate the tradeoffs among competing resource planning attributes in the broader context of the 70% goal when clean energy is evaluated versus carbon free energy.

The remainder of this 2011 EMP identifies recommended policy options and action plans to manage energy in a manner that ensures a reliable energy supply at the lowest possible cost, stimulates the economy, creates jobs, and adheres to State's overarching environmental goals. While many of the proposed policy options and action plans can advance multiple goals, they are grouped into four sections, as follows:

- Conventional Generation Resources
- Renewable Resources
- Energy Efficiency, Conservation and Demand Response
- Innovative Technology Opportunities

7.1 In-State Electricity Resources

Competitive generators make investment decisions based on wholesale price signals, aided by State programs to assure stable and adequate revenues. New Jersey has many options to expand its in-state power supplies, from conventional generation technologies to alternative and renewable resources, in order to keep up with demand growth. New Jersey has the ability to induce the expansion of in-state resources like solar, wind and the new CCs that are the product of LCAPP.

Policy decisions regarding generation and transmission supply must remain mindful of New Jersey's membership in PJM. Transmission links to neighboring states allow New Jersey to obtain less expensive out-of-state energy, especially during low demand periods. In case of insufficient in-state generation, PJM also facilitates new transmission lines to assure long-term reliability. Out-of-state resources do not bring economic development, jobs, and property taxes to New Jersey. Therefore, the expansion of New Jersey's in-state electricity resources should continue to achieve sensible tradeoffs among competing resource planning objectives.

7.1.1 Advantages of a Diverse Supply Portfolio

A diverse supply / demand portfolio is an effective hedge against the uncertainties and risks associated with energy production. Risks can be mitigated through a diverse portfolio of generation and demand-side options. More options provide greater flexibility to redress future events. The current economic slowdown provides New Jersey with an opportunity to consider diverse in-State supply options, as follows: (i) increasing conventional generation resources, *e.g.* LCAPP, (ii) encouraging indigenous renewable resources, *e.g.* offshore wind, solar PV, and biomass, and (iii) reducing peak demand through EE and DR, *e.g.* CEP or the Integrated Distributed Energy Resources (IDER) Program. These options can help moderate electric prices, reduce dependence on foreign oil, provide economic activity, and help protect the environment. New Jersey cannot be complacent in light of expected near-term retirements (identified in Section 4.7.2), particularly in light of the long lead time to develop and implement supply options.

7.1.2 Advantages of New Baseload and Mid-Merit Generation

While a balanced and diverse generation portfolio requires baseload, mid-merit, and peaking resources, there are particular advantages to having additional baseload and mid-merit generation in New Jersey.[78] In-State baseload generation is provided mainly by nuclear plants, followed by coal-powered plants.[79] Baseload plants bring employment (during both construction and operation), taxes to the State and localities, and spending for local goods and services. Baseload plants also lower wholesale energy prices by displacing energy from more expensive plants. In New Jersey, the more expensive plants that run mid-merit or during peak demand conditions are oil and gas fired units.

Nuclear generation can provide a reliable source of inexpensive generation without air emissions. However, new nuclear power is expensive to construct, requires ample cooling water sources, and remains plagued by the lack of a federal solution for the long-term storage of spent fuel.[80] Arguably, the Fukushima disaster serves to highlight the efficacy of the U.S. nuclear industry's disaster preparedness in relation to that of Japan, but the risk of accidental radiation release, however low, may galvanize the public to object to any proposal to build a new nuclear power plant in New Jersey. The retirement of Oyster Creek in 2019, the nation's oldest nuclear power plant, presents the State with a challenge, as the replacement of Oyster Creek generation has the potential to add generation that increases New Jersey's carbon footprint. In addition, PJM reports that Oyster Creek's geographic location has prevented significant transmission bottlenecks and overloads in the State, and that unless replaced by new comparable baseload generation, at least $100 million in transmission upgrades will be required when Oyster Creek is retired, excluding new rights of way.

Coal-fired power plants are also expensive to construct. In light of the reduction in natural gas prices and, to a lesser extent, the cost of emission allowances, energy produced from coal plants is no longer much less expensive than energy produced from new CC plants, or even old-style gas-fired steam turbine generators. Many coal plants in PJM have had to retrofit increasingly expensive emission control equipment to meet air quality requirements. Coal plants produce a significant portion of New Jersey's greenhouse gas emissions. Some units are candidates for retirement; incentives for new generation are designed to shut down these older, dirtier, less efficient plants. While coal plants have historically produced reliability and economic benefits

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[78] These generation technologies are described in the Glossary.

[79] Mid-merit CC plants provide less energy than nuclear but more than coal in New Jersey.

[80] The federal government has not yet opened the Yucca Mountain repository, so spent nuclear fuel is being stored in storage pools or dry casks on plant sites. President Obama has opposed the activation of Yucca Mountain.

and have balanced the technology mix of generation resources in New Jersey, coal is a major source of CO_2 emissions and New Jersey will no longer accept coal as a new source of power in the State.

Natural gas-fired CC plants provide increasing amounts of mid-merit generation due to their high efficiency and low fuel prices. Around the time the PJM market was being deregulated, many merchant CC plants were constructed that relied on spot wholesale energy and capacity prices instead of long-term contracts. The majority of the merchant CC plants were added elsewhere in PJM, not in New Jersey. Given the high efficiency, low capital cost, low operating cost, low water usage, low emissions, and use of less carbon-intensive fuel, the Christie Administration encourages CC development. Under LCAPP, New Jersey could realize the benefit of 1,945 MW of state-of-the-art CC plants by 2016. System reliability would be enhanced, and material ratepayer savings would be expected from the LCAPP. The savings are explained by the anticipated reduction in wholesale energy prices in New Jersey attributable to the addition of efficient mid-merit generation.

FERC recently issued an order that modifies MOPR, thereby subjecting the LCAPP SOCA awardees to PJM mitigation.[81] Other potential modifications to PJM's RPM mechanism to improve the "bankability" of the price signal through the BRA may be pursued. Despite the promise of potential reform of the RPM, capacity prices have been volatile, making it difficult for project developers to attract capital to new generation projects based on BRA results. The LCAPP sets forth a commercial template through a contract-for-differences. The EDC contracts with the SOCA awardees through LCAPP were designed to bridge the gap between variable wholesale capacity prices and an assured revenue stream, thereby fostering the commercialization of new generation plants in New Jersey. New Jersey's ability to realize the benefit of the bargain under LCAPP is hindered by actions taken by FERC that modified the MOPR, thus subjecting the LCAPP projects to the uncertain impact of mitigation.[82]

7.1.3 Nuclear Generation to Satisfy the Global Warming Response Act

The goals of the Global Warming Response Act were ambitious even before the announcement of plans to close Oyster Creek at the end of 2019. Notwithstanding the development of significant in-State renewables over the next 8 years, additional CO_2-producing fossil fuel generation will need to be dispatched to compensate for the loss of this carbon-free energy source. Unless the State pursues additional, in-State nuclear generation, a carbon-free generation resource, the current greenhouse gas reduction goals will be unattainable.

The 2008 EMP concluded that nuclear energy would be necessary to achieve the goals set forth in the Global Warming Response Act for two reasons. First, the development of new nuclear generation will displace operation of comparatively inefficient high-carbon generation. With its low marginal cost, nuclear can displace coal-fired units, leading to less pollution and fewer greenhouse gas emissions. Second, the Global Warming Response Act presumed the continued

[81] On April 12, FERC issued its Order in docket nos. EL11-20-000 and ER11-2875-000 where it largely adopted PJM's tariff changes to the MOPR, providing a revised floor to bid prices.

[82] Failure of the SOCA awardees to clear the BRA in multiple years may result in contract termination.

operation of the existing nuclear fleet through the 2020 and 2050 timeframes. Other economic considerations associated with the high and uncertain capital cost of a new nuclear plant should be explored in the broader context of the environmental and reliability benefits ascribable to the technology.

7.1.4 Transmission Solutions and Out-of-State Resources

As described in Section 4.2.1, PJM is responsible for planning new HV transmission lines to serve regions with known transmission constraints and insufficient capacity resources. New Jersey benefits from local investment in such lines, *e.g.*, Susquehanna-Roseland, because the line costs are "socialized," in other words, apportioned across PJM based on load share. Under PJM's FERC-approved transmission rate design, New Jersey must likewise bear its proportionate share of other HV transmission projects elsewhere in PJM that do not confer any direct reliability or economic benefits in New Jersey. New Jersey will be the primary beneficiary of improved reliability and lower wholesale prices due to Susquehanna-Roseland. Transmission backbone projects like Susquehanna-Roseland often require significant amounts of land for rights-of-ways. In comparison to generation projects, transmission projects do not bring many jobs or tax revenues to New Jersey.

As discussed in Section 4, FERC provides financial incentives to TOs that construct new transmission provided the operation is turned over to an RTO, as is the case in PJM. The BPU has evaluated the appropriateness and reasonableness of providing additional incentives to EDCs for capital improvements to their electric and gas distribution systems, including: (i) a surcharge mechanism that enables the EDCs to receive full recovery of and on investments without filing a base rate case, (ii) an after-the-fact true-up to reconcile estimates with actual costs, and (iii) other recovery mechanisms acceptable to the EDCs. Annual adjustments continue until the EDC's next base rate case at which time un-recovered costs are rolled into rate base and collected through base rates. This reduces the cost of capital, lowers project costs, and ultimately reduces the burden on ratepayers.

7.1.5 Policy Direction and Recommendations

New Jersey should promote a diverse portfolio of new, clean, cost-effective in-state electric generation. The State must work with PJM and FERC, where possible, to ensure a reliable supply of energy at reasonable rates while advocating for policies that help control electric costs, maintain a reliable system, and adhere to environmental objectives. The recommended policy options follow.

Construct New Generation and Improve PJM Rules and Processes

Despite high capacity prices in New Jersey, BRA results under the RPM have not induced new generation entry in New Jersey. Generators aver that capacity payments must be adequate and stable in order to attract capital. LCAPP was designed to accomplish these objectives, thus resulting in the award of 1,945 MW of new in-state CC capacity. The expected value of the benefits under the LCAPP awards is $1.8 billion on a present value basis over 15 years.[83]

The environmental benefits of this new capacity was described by the LCAPP Agent as follows: The addition of the estimated 1948.5MW from the LCAPP process would displace incumbent generation with a portfolio of cleaner, more efficient gas-fired generation. The average net annual reductions of these pollutants and greenhouse gases would be significant. Overall, the annual reductions are equivalent, on an order-of-magnitude basis, to the annual emissions of roughly 250MW of coal-fired generation at a 100% capacity factor. In addition, this displacement would result in lower emissions of NO_x and SO_2 across the PJM region. Regional reductions in NO_x and SO_2 will contribute to cleaner air for New Jersey, because these pollutants are precursors in the formation of ozone and haze, which are transported from upwind states in PJM to New Jersey. Emissions of mercury would be reduced regionally as well as locally. CO_2, the principal greenhouse gas, is a global environmental concern, and therefore must be viewed from the system-wide perspective across the entire LCAPP modeled area. The LCAPP portfolio displaces more carbon-intensive oil or coal-fired generation and/or less efficient gas-fired generation thereby giving rise to a net reduction in CO_2 emissions in each year of the LCAPP forecast. All of the LCAPP projects propose to use state-of-the-art evaporative cooling tower systems, minimizing the use and discharge of cooling water. In addition, two of the three projects, the Newark Energy Center and the Woodbridge Energy Center, would be located on brownfield sites. The beneficial reuse of formerly impaired properties represents a significant environmental benefit that may confer additional economic benefits.[84]

The State should monitor closely the implementation of the LCAPP projects to ensure that the projected benefits are delivered to ratepayers. The Christie Administration is committed to the monitoring of rule changes, regulatory reform, and the pursuit of judicial remedies to the extent action(s) taken by FERC in authorizing modifications to MOPR impair New Jersey's goals and objectives under LCAPP.

New Jersey will continue to participate actively in and, as appropriate, challenge PJM's system planning and wholesale market design processes. In particular, the State should evaluate ways to modify RPM rules to produce more equitable capacity price results across the region. New Jersey residents should be protected from paying premium capacity prices without the benefit of the bargain with respect to modernizing the resource mix in New Jersey.

Replace Lost Nuclear Capacity

The State cannot achieve its 2050 greenhouse gas reduction goal without a significant portion of the energy supply coming from nuclear technology. Assuming Oyster Creek is closed in 2019, a planning process should commence to explore how the State will replace Oyster Creek

[83] LCAPP Agent's Report to the BPU, March 21, 2011.

[84] LCAPP Agent's Report to the BPU at pp 4-6.

capacity.[85] Explicit tradeoffs among competing resource planning criteria should be examined in order to calibrate the reliability, environmental, and economic effects attributable to new nuclear, other carbon free technology options, versus "clean" technology options that contribute to greenhouse gas emissions.

Vexing economic, safety, and environmental questions have to be answered before the State can embark on or abandon the path of developing the next generation of nuclear power plants. As nuclear plants in New Jersey age and are decommissioned, the Christie Administration supports the construction of new nuclear baseload generation, and the delineation of lessons learned from New Jersey, U.S. and global nuclear experiences.

Expand Distributed Generation and Combined Heat and Power

DG resources, such as fuel cells and emergency generators, produce power at or near the location where it is consumed, offsetting the host facility's electric load. DG is dispatchable and can lessen the burden on the transmission grid and on generating plants during peak demand hours, thereby reducing wholesale power costs and the price of electricity to all customers, *i.e.*, both participants and non-participants. Operational safety and increased emissions associated with increasing DG penetration and permitting those generators to operate for more hours are important factors that must be considered in any policy decision.[86]

Cogeneration and CHP systems are designed around small to medium-sized power generators (2-25MW), in which otherwise wasted heat energy is captured and utilized, maximizing efficiency and energy savings by displacing the need for other sources of heating or cooling. The high capital cost of developing cogeneration and CHP facilities, combined with the difficulty of raising capital in the current economy, is a continuing industry challenge. Therefore, implementation of these projects would require support from state incentives, including loans and loan guarantees as well as a streamlined permitting process.[87]

CHP is a viable and appropriate technology for State-owned, campus-type facilities such as prisons, developmental centers, juvenile detention facilities, and colleges. Much of the heating and cooling equipment in State institutions is aging and may be approaching or even be beyond their useful lives. New Jersey has experienced significant CHP development over the years. As these facilities age, the prospect of plant upgrades, repowerings or replacement should be evaluated. The State should consider a procurement process for third party providers who would

[85] There are a number of good reasons to locate a new plant on the Lacey Township property, including the presence of a highly-skilled workforce, community support for such an initiative, and the existing electrical transmission infrastructure.

[86] Emergency generators typically have minimal emission controls. Peak demands that might economically justify dispatch often occur on days when air quality falls below national standards. One solution would be to require emergency generators to be equipped with appropriate emissions controls and grant air permits that would allow them to operate for a limited number of hours on high demand days.

[87] DEP is currently developing a suite of general permits which maintain high environmental standards and make the permitting process clearer and more predictable.

build, own, and operate these facilities, providing savings in EDC costs and reduced maintenance costs without the capital outlay.

District energy systems are the largest and most capital-intensive CHP systems. They can provide the greatest economic and environmental benefits, and present significant opportunities.[88] Developers of CHP and district energy systems often must construct both the central power plant and the underground heating or cooling distribution system. The Christie Administration is committed to developing 1,500 MW of CHP generation over the next ten years: 1,400 MW of C&I applications and an additional 100 MW from district energy systems.[89]

Promote Expansion of Gas Pipeline System

FERC is responsible for the regulatory approval process of new interstate pipelines, including facility enhancements to existing pipelines. The Christie Administration is committed to the expansion of New Jersey's natural gas infrastructure in a manner that safeguards New Jersey's natural and cultural resources and prevents any adverse impact on safety and homeland security. New or expanded pipelines will confer energy price benefits by increasing the supply of lower cost gas from Marcellus Shale, thus reducing the wholesale cost of gas and power for LDCs and EDCs, respectively. Expansion of the gas pipeline system in New Jersey will also foster fuel substitution and will serve New Jersey's renewed interest in NGVs to lessen the State's reliance on expensive diesel fuel. Other program initiatives oriented around oil-to-gas conversions for home heating are likewise well served by expanding the interstate gas pipeline system into and within New Jersey.

7.2 Cost-Effective Renewable Resources

One of New Jersey's most important policy goals is to moderate the electricity rates paid by consumers. For most businesses in New Jersey, energy costs are the second largest overhead item, behind labor-related expenses. As illustrated in Section 4.10, the all-in price of electricity includes cost components that underwrite various initiatives to advance societal goals. The State must reconsider all social policies that add to the cost of energy and must review, restructure, and reformulate the way the State promotes and subsidizes both traditional and renewable energy. This section focuses on the costs and benefits of subsidies for solar and wind power, which have received special treatment in New Jersey's renewable energy portfolio. New Jersey must ensure that investments in renewable energy that are socialized through electric rates not only advance the worthwhile goals of expanding New Jersey's "home grown" energy resources, but also create jobs in the State and provide a hedge against uncertain future costs of fossil fuels.

[88] District energy systems provide energy from a centralized location rather than multiple localized facilities. District energy systems tend to be more efficient and less polluting than multiple local energy generation systems.

[89] This goal is consistent with the conclusions presented in the August 2010 BPU/U.S. DOE study, performed by the Mid Atlantic Clean Energy Application Center, which indicated 6,000 MW of CHP market potential in New Jersey. Scaling this estimate towards actual projects and locations results in a more conservative and realistic estimate of 1,481 MW of new generation market potential.

7.2.1 Subsidies for Renewable Resources

Both state and federal mandates regarding the use of renewables are predicated on the need to establish worthwhile public policy goals to support renewable energy technology. New Jersey has been in the forefront of the national effort to encourage the development of renewable energy technologies that achieve a reasonable balance among environmental, economic, and reliability objectives. Absent such public policy goals, consumers and EDCs may lack the economic rationale to implement renewable energy sources given their high cost compared to conventional technologies.[90] The current price of fossil fuels, particularly the delivered cost of natural gas to power plants across PJM, renders renewable technology more costly than power production from many conventional resources, *i.e.*, coal, nuclear, gas-fired CC plants, peakers and hydroelectric generation. More importantly, the stable outlook for natural gas prices in the decade ahead, largely due to prolific gas production from shale gas formations, portends stable wholesale energy prices in New Jersey and throughout PJM. Hence, a value gap explained by the higher cost of producing energy from solar, wind, and/or biomass facilities versus conventional wholesale power production in PJM is likely to persist until some indeterminate point in the future when the cost of producing conventional power outstrips the cost of renewable energy supplies.

The RPS has been implemented in stages. Therefore, it has lacked a consistent, coherent, and formalized basis to plan for the addition of new renewable technologies that achieve a good balance among laudable resource planning objectives, *i.e.*, environmental, economic, and reliability benefits. To date, New Jersey's policymakers have been thrust in the unenviable role of having to pick winners and losers among the crowded field of renewable energy technologies. The absence of a net economic benefit test coupled with a number of price incentives that fix the level of subsidy to support the increased entry of competing renewable technologies hinders the role and impact of the competitive market. Ultimately, it is the competitive market rather than New Jersey's policymakers that should rationalize the amount, location, and type of renewable technologies added to the resource mix to satisfy the RPS requirement.

Of critical concern, New Jersey remains committed to achieving the 22.5% RPS target by 2021. In light of the inescapable cost burden that will be shouldered by all ratepayers to meet this target, the method of achieving this objective should be subject to rigorous quantitative and qualitative analysis and should not be driven by *a priori* assumptions and historical decisions. Going forward, emphasis should be placed on the development of renewable energy resources that confer net economic benefits to New Jersey oriented around the reduction of emissions, in particular, CO_2, reduced (or stabilized) energy and capacity prices, the creation of jobs, investment in new manufacturing capability, and the consequent direct, indirect and induced socio-economic benefits properly ascribable to clean energy.

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[90] Public companies, not-for-profit institutions, and individual investors may choose to invest in new renewable technologies, but subsidies are required to grow the renewable industry in New Jersey on a fast track in accord with New Jersey's aggressive renewable energy goals.

7.2.2 Solar PV Development

The solar PV industry is growing steadily in the U.S. The solar PV project order backlog in the U.S. market has soared past 12 GW in 2011. Ranking second in the nation to California, New Jersey's solar industry has grown substantially, with about 9,000 solar PV projects totaling 330.5 MW statewide (Figure 35). Federal tax credits bolstered by New Jersey's energy policy that has advantaged solar have induced consumers to "go green," thus supporting the trend toward increased solar in both the residential and commercial sectors as well as other market segments. The annually increasing solar RPS carve-out, the reduction in solar installation costs, the expectation of continued technology progress, and positive reports from solar participants portend continued solar penetration rates in New Jersey.

Figure 35. Installed PV Capacity in Top 10 States[91]

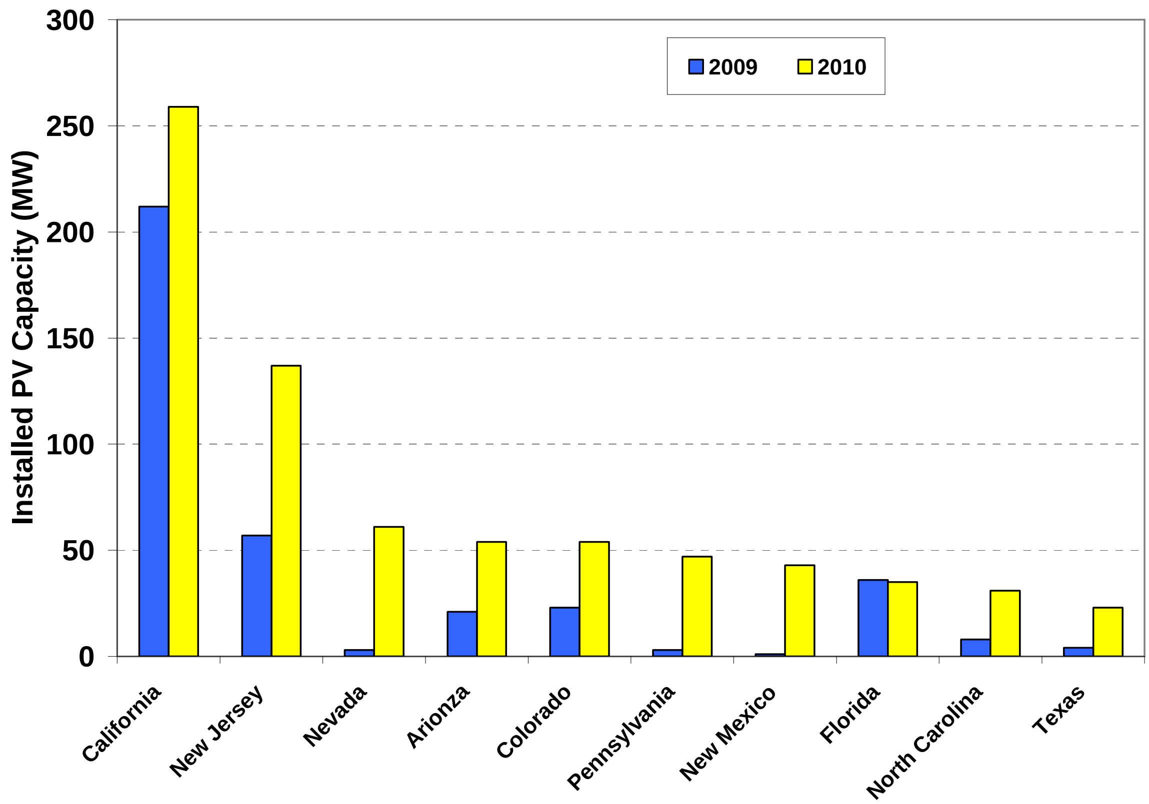
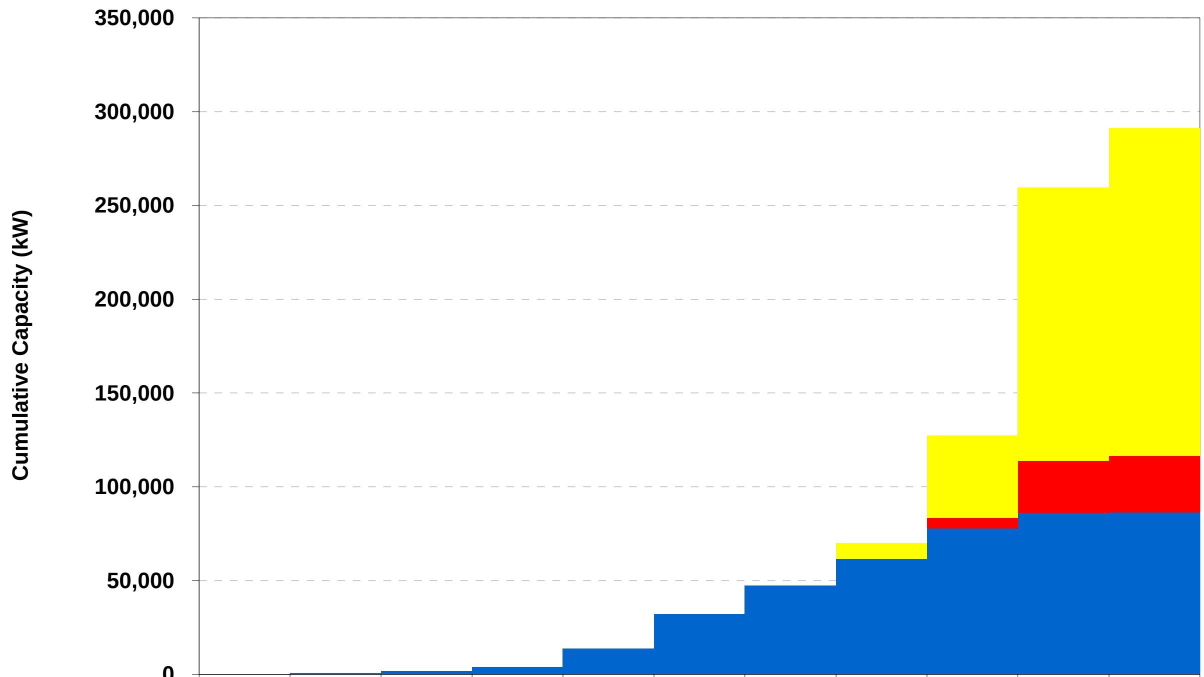


Figure 36 shows the growth of installed capacity since 2001 under a succession of subsidy programs. Prior to 2010, most projects were entitled to rebates under CORE and REIP. The CORE program offered bonus incentives for New Jersey manufactured equipment. When the CORE program was replaced by the REIP rebate program, the bonus incentives evolved into the REMI program. The REIP closed to new solar applications beginning in 2011. Now, only the REMI program complements the SREC program. Virtually all of the installations in 2010 and 2011 are entitled to sell solar renewable energy credits under the SREC program. It is important

[91] Source: Solar Energy Industries Association, http://www.seia.org/cs/research/SolarInsight

to note that both CORE and REIP are entitled to SRECs, but the qualification life starts from the time the project was installed.[92] Therefore, a 2003 installed CORE project is eligible for SREC based revenue until 2018.

Figure 36. Cumulative Solar PV Capacity in New Jersey by Program



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
SREC Solar	0	0	0	0	0	0	13	8,446	43,746	145,693	174,671
REIP Solar	0	0	0	0	0	0	0	0	5,658	27,747	30,149
CORE Solar	8	631	1,808	3,845	13,753	32,073	47,319	61,600	77,896	86,059	86,440

Table 10 shows the breakout of projects and capacity through February 28, 2011, by program and market segment. In terms of installed capacity, commercial and residential solar projects amount to 187.0 MW and 52.8 MW, respectively. The total rebate cost of the CORE and REIP programs, unitized over total installed program capacity, is $3,017/kW.[93] The average residential rebate cost is $3,255/kW, a bit higher than the average rebate cost across all segments.[94] In contrast, the average commercial rebate cost is $2,864/kW.[95] As shown in Figure 36, nearly one-half of the 291.3 MW solar PV installed in New Jersey was installed in 2010. Cumulative capacity under the SREC program is 174.7 MW, more than half the total, but

[92] The SREC qualification life is the number of years a facility can create SRECs for New Jersey's Class 1 RPS market, after which it remains eligible to generate Class 1 RECs that can be traded in the Class 1 market or the voluntary market.

[93] From Table 10: ($311,670,298+$40,128,745) / (86,439.5 kW+30,148.8 kW) = $3,017/kW

[94] From Table 10: ($116,204,944+$30,603,828) / (24,841.6 kW+20,261.9 kW) = $3,255/kW

[95] From Table 10: ($103,546,471+$8,592,149) / (30,289.1 kW+8,869.2 kW) = $2,864/kW

the cost of that program is deferred to the future via SRECs. Virtually all of the 2010 and 2011 installations are financed through SRECs.

Table 10. Summary of Solar Rebate and SREC Programs

	CORE Solar	REIP Solar	SREC Solar	Total
Number of Projects				
Commercial	486	310	452	1,248
Residential	3,413	2,590	946	6,949
Other	368	34	89	491
Total	4,267	2,934	1,487	8,688
Capacity (kW)				
Commercial	30,289.1	8,869.2	147,806.6	186,964.9
Residential	24,841.6	20,261.9	7,691.9	52,795.4
Other	31,308.8	1,017.6	19,172.8	51,499.3
Total	86,439.5	30,148.8	174,671.3	291,259.7
Rebate				
Commercial	$103,546,471	$8,592,149	$0	$112,138,620
Residential	$116,204,944	$30,603,828	$0	$146,808,772
Other	$91,918,883	$932,768	$0	$92,851,651
Total	$311,670,298	$40,128,745	$0	$351,799,044
Average Project Capacity (kW)				
Commercial	62.3	28.6	327.0	149.8
Residential	7.3	7.8	8.1	7.6
Other	85.1	29.9	215.4	104.9
Total	20.3	10.3	117.5	33.5
Average Rebate ($/kW)				
Commercial	$3,419	$969	$0	
Residential	$4,678	$1,510	$0	
Other	$2,936	$917	$0	
Total	$3,606	$1,331	$0	

Table 11 summarizes New Jersey solar PV installations by market segment as of February 28, 2011.[96] Commercial and residential solar projects account for 94% of the total number of

[96] Certain solar PV source data was provided in terms of MWdc and kWdc, indicating that the electrical output from solar PV is direct current (dc) that must be converted to alternating current in order to be utilized along with

projects and 82% of the total installed solar capacity in New Jersey. The average installation size of a solar project is 33.52 kW and ranges considerably, from an average residential size of 7.6 kW to average commercial and institutional sizes of up to 246.5 kW.

Table 11. New Jersey Solar Installations by Market Segment

Market Segment	# Projects	Installed Capacity (kW)	% of Installed Capacity	Average size (kW)
Commercial	1,248	186,964.9	64.19%	149.81
Residential	6,949	52,795.4	18.13%	7.60
School Public K-12	120	19,498.3	6.69%	162.49
Municipality	58	8,632.8	2.96%	148.84
Non Profit	113	6,614.7	2.27%	58.54
University Public	22	5,423.1	1.86%	246.50
Government Facility	42	5,281.2	1.81%	125.74
School Other	23	2,929.9	1.01%	127.39
Farm	55	1,512.9	0.52%	27.51
SUNLIT	55	1,361.7	0.47%	24.76
University Private	3	245.0	0.08%	81.67
Total	8,688	291,259.7	100.00%	33.52

7.2.3 Solar RPS and Economics

This 2011 EMP Update recognizes the integral role that solar energy can play in New Jersey's ability to meet its RPS objective as well as its role as an engine for economic growth. Since issuance of the 2008 EMP, New Jersey's economy, like that of the U.S. as a whole, has experienced a sharp, reversal, while New Jersey's solar industry has grown significantly. Any analysis of the costs of solar energy must take into account the fact that with current technology, PV solar is more costly than other energy sources. Table 12 shows the comparative levelized costs of different fuel sources. Despite the significantly greater levelized cost of Solar PV, the State has pursued an aggressive solar program.

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standard electric supplies or transmitted in local distribution systems. This EMP dropped the dc terminology for ease of comprehension.

Table 12. Levelized Cost of Generation[97]

Technology	Levelized Cost ($/MWh)
Hydro	54
Biomass (Direct)	112
Offshore Wind	251
Onshore Wind	114
Solar PV	390
Advanced Nuclear	95
Coal IGCC	92
Conventional Coal	75
Combined Cycle ($8 gas)	83
Combined Cycle ($5 gas)	62

From 2001 through 2007, the development of solar energy was supported by the CORE rebate program. The cost of this program, which supported development of 40 MW of solar PV, was $4.6 million/MW and $184 million in rebates.[98] In April 2006, New Jersey adopted an RPS goal of 22.5% by 2020, including the requirement that 2% of the supply mix be derived from New Jersey-based solar facilities. Recognizing that the CORE rebate program could not support the cost of the solar development mandated by the solar RPS requirements, the BPU commissioned a study, the New Jersey Renewable Energy Solar (NJRES) Market Transition Paper, to examine the options for supporting the solar RPS. Released in August 2008, the NJRES Market Transition Paper estimated the cost to meet the 2% solar RPS by 2021 (2300 MW) to be $10.9 billion.[99] This projection, and the recognition that CORE (replaced in 2009 with REIP) would not be able to support that large of an investment, led to the adoption of a market-based financing program through the creation of SRECs.[100]

SREC prices are set by the competitive market with quantities established by the RPS. EDCs and other load serving entities are required to purchase or produce SRECs to meet their respective solar energy obligations. Solar power systems are allowed to generate SRECs during their first 15 years of operation. To prevent an unlimited escalation of SREC prices, the BPU rules established the SACP. The SACP levels effectively establish a ceiling on the market price of an SREC. When the requisite quantity of SRECs is short relative to the solar PV requirement set forth in the Solar Advancement Act, SRECs tend to trade at or near the SACP (Figure 37). The cost of the SRECs and any SACP payments are included in the all-in cost of electricity borne by ratepayers throughout the State. By design, the SREC is intended to be the primary

[97] Source: EIA, http://www.eia.doe.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf

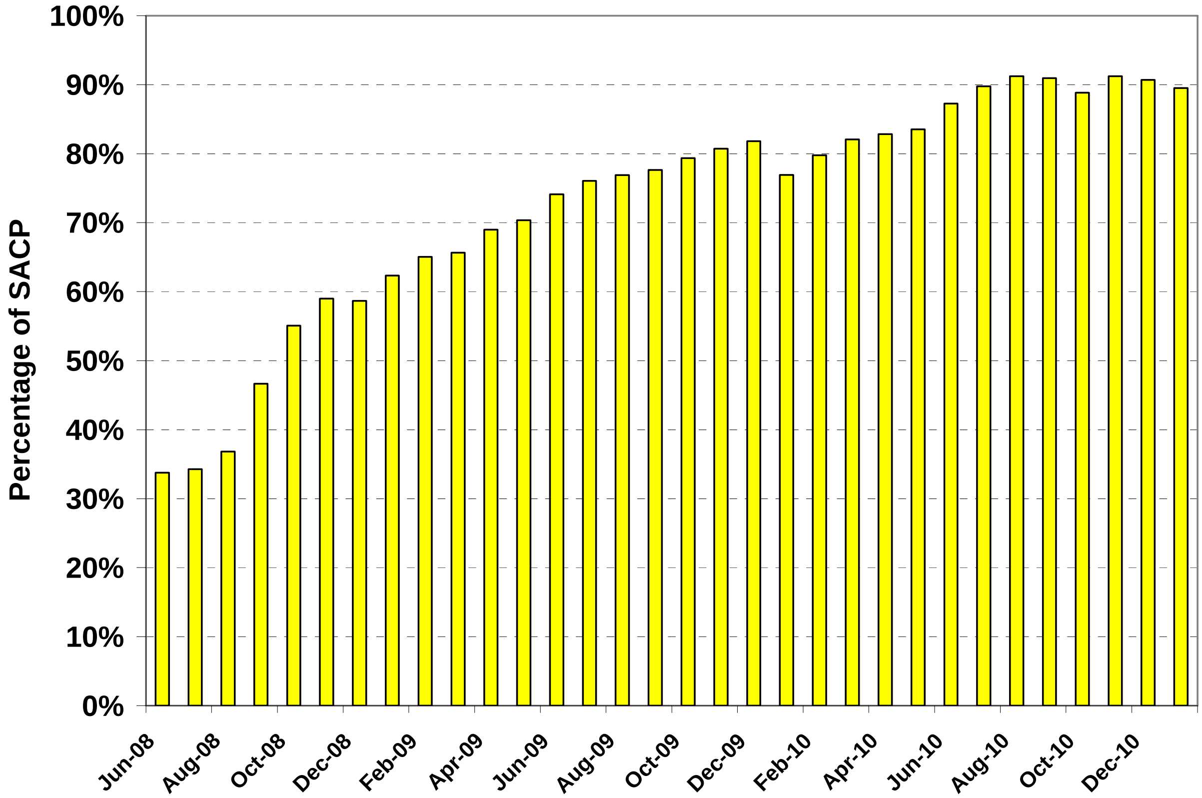
[98] The CORE program continued through February 28, 2011 with a total of 86.4 MW installed at a total cost of $311.7 million, or $3,606/kW.

[99] Summit Blue Report May 9, 2007

[100] The REIP program provided 30,149 kW of capacity in 2009 and received rebates totaling $40 million.

method of compliance with the solar requirements of the RPS. The SACP is a secondary method of compliance when SRECs are relatively scarce.

Figure 37. New Jersey SREC Price as a Percentage of SACP



While the current SACP extends through 2016, the Solar Advancement Act requires the BPU to set the SACP for another 15 years, through 2026. Although the Solar Advancement Act did not mandate action within a specific timeframe, industry stakeholders have recommended early adoption of the new schedule in order to provide certainty for solar developers as well as the debt lenders and equity investors that enable solar project development. Upon establishment of the SACP schedule, the Solar Advancement Act prohibits the BPU from exercising its regulatory authority by reducing the amount of the SACP for the designated SACP period without specific statutory authorization.

When the SACP was first established in New Jersey in 2003, it was constant at $300/MWh, *i.e.*, $0.30/kWh. In 2007, an eight-year SACP level was set in order to serve as a motivation for utilities and LSEs to procure SRECs in lieu of SACPs. The SACP levels were set approximately $100 above the SREC values that were calculated as needed to provide a return on investment of 12% to a diverse solar market, including the expectation of continued technology progress. The

8-year SACP schedule approved by the BPU on September 12, 2007 is shown in Table 13 by Energy Year.[101]

Table 13. Current SACP Schedule

Energy Year	2009	2010	2011	2012	2013	2014	2015	2016
SACP	$711	$693	$675	$658	$641	$625	$609	$594
% Reduction	-	*2.53%*	*2.60%*	*2.52%*	*2.58%*	*2.50%*	*2.58%*	*2.46%*
Years in schedule		-	1	2	3	4	5	6

The primary determinant of a solar developer or homeowner's ability to recoup the cost of a solar installation is the value of the SREC. SACP values have been set administratively rather than by competitive market forces. The rationale behind the establishment of a comparatively high SACP value has been the need to incubate solar technology in New Jersey in order to realize the benefits of green technology, including job creation in the manufacturing, installation, and operation phases of solar project development. Over the last few years, SREC values have converged on the administratively determined SACP value. Hence, SRECs have been high enough to support the installation of solar with a low cost for the homeowner or business. The ability to recoup rapidly investment on solar installations has doubtless benefited the solar industry and the participating household or business, but has not created significant benefits to the cohort group of non-participants who ultimately bear the cost of solar technology. Figure 38 is instructive to compare the SACP prices in New Jersey to those of other states having a solar RPS program. Figure 38 demonstrates that the SACP in New Jersey is the highest in the country.

[101] As defined by the Solar Advancement Act, by year in which it ends (not to be confused with PJM and BGS use).

Figure 38. Solar Alternative Compliance Payments by State

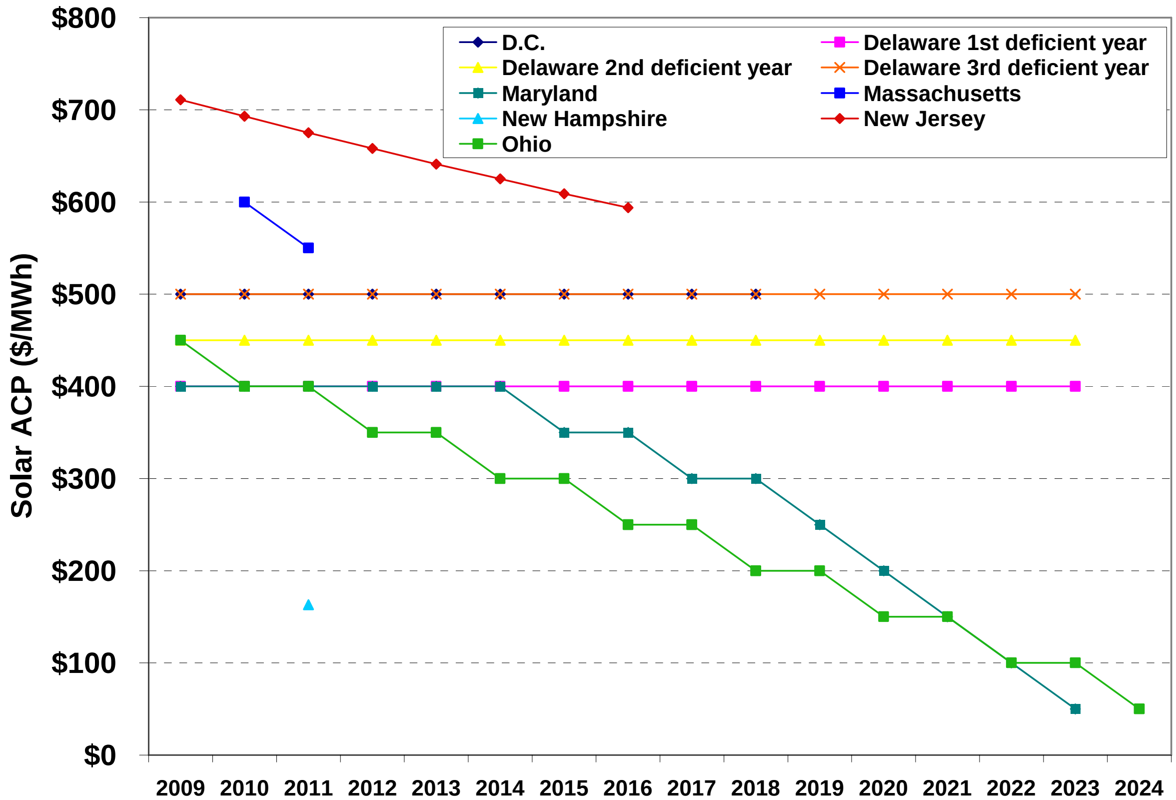
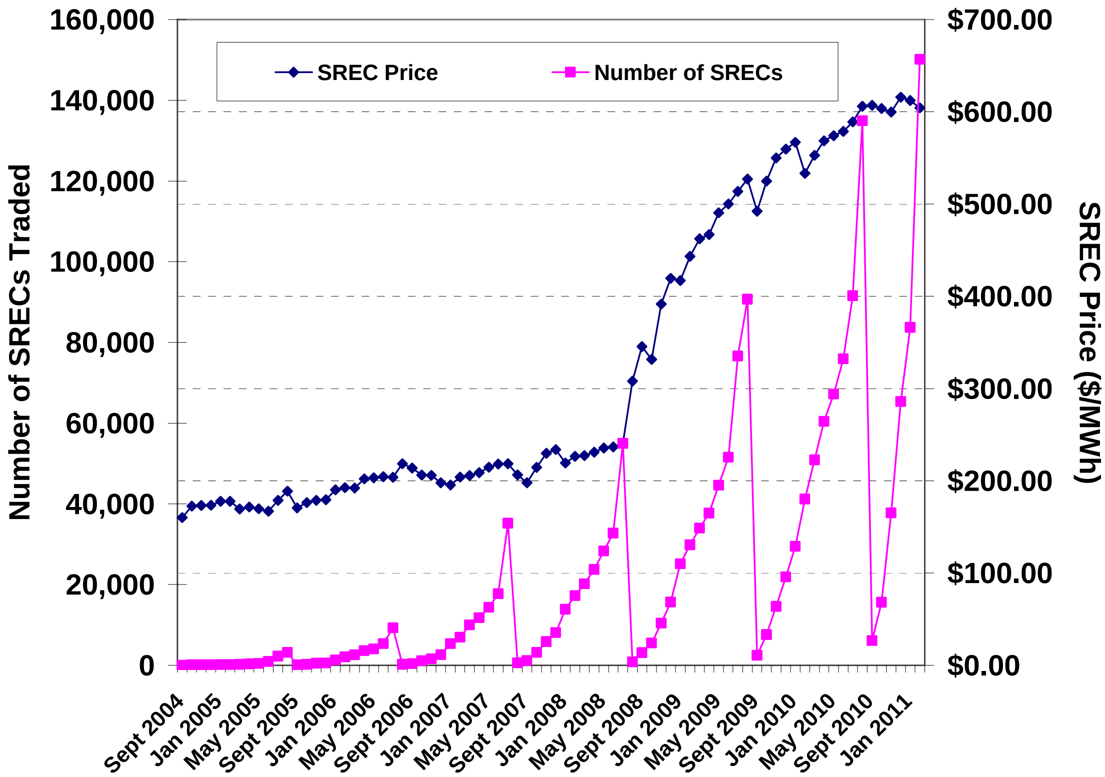


Figure 39 summarizes the historical number of SRECs traded and the SREC prices as documented by the CEP. The number of SRECs traded reflects a volatile saw-tooth pattern over time as discrete quantities of SRECs enter the market upon installation of new solar projects. In contrast, SREC prices have appreciated steadily over the last three years reaching $600/MWh in 2011, *i.e.*, $0.60/kWh. The steady appreciation in SREC prices runs counter to the substantial solar technology progress that has been sustained in the U.S. and in New Jersey, and reflects the gap between what New Jersey's LSEs are required to purchase to meet the solar purchase requirement and the quantity of SRECs available for trade.

Figure 39. Number of SRECs Traded and SREC Prices in New Jersey



Furthermore, the increase in SREC prices is not consistent with the historical decrease in solar PV module prices, illustrated in Figure 40.[102] Historical solar PV module prices are averages of various PV technologies such as multicrystalline silicon, monocrystalline silicon, and thin film. The lowest retail price for a multicrystalline silicon solar module is $1.89/watt, monocrystalline silicon module is $1.84/watt, and thin film module price is $1.37/watt. Brand, technical attributes, and certifications affect pricing, and thin film modules typically are less expensive than crystalline silicon. Currently, the installed system pricing data shows that the largest U.S. projects are now being completed in the range of $3,000-4,000/kW, approximately one-half the cost of comparable technology just four years ago.[103]

The CEEEP report tabulates solar capital costs in nominal $/kW from a variety of studies and reports. The International Energy Agency 2010 report forecasts that solar capital costs for residential installations will decrease from $6,000/kW in 2008 to $3,333/kW in 2020. For commercial / industrial installations the capital cost is projected to decrease from $5,000/kW in 2008 to $2,778/kW in 2020.[104]

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[102] Source: Solarbuzz tracks thousands of online retail prices for solar energy systems, mostly in the United States: http://www.solarbuzz.com/facts-and-figures/retail-price-environment/retail-price-methodology

[103] http://www.solarbuzz.com/our-research/recent-findings/united-states-solar-photovoltaic-project-order-backlog-surpasses-12-gw

[104] International Energy Agency, "Technology Roadmap: Solar Photovoltaic Energy", 2010.

Figure 40. Solar Retail Module Price Index

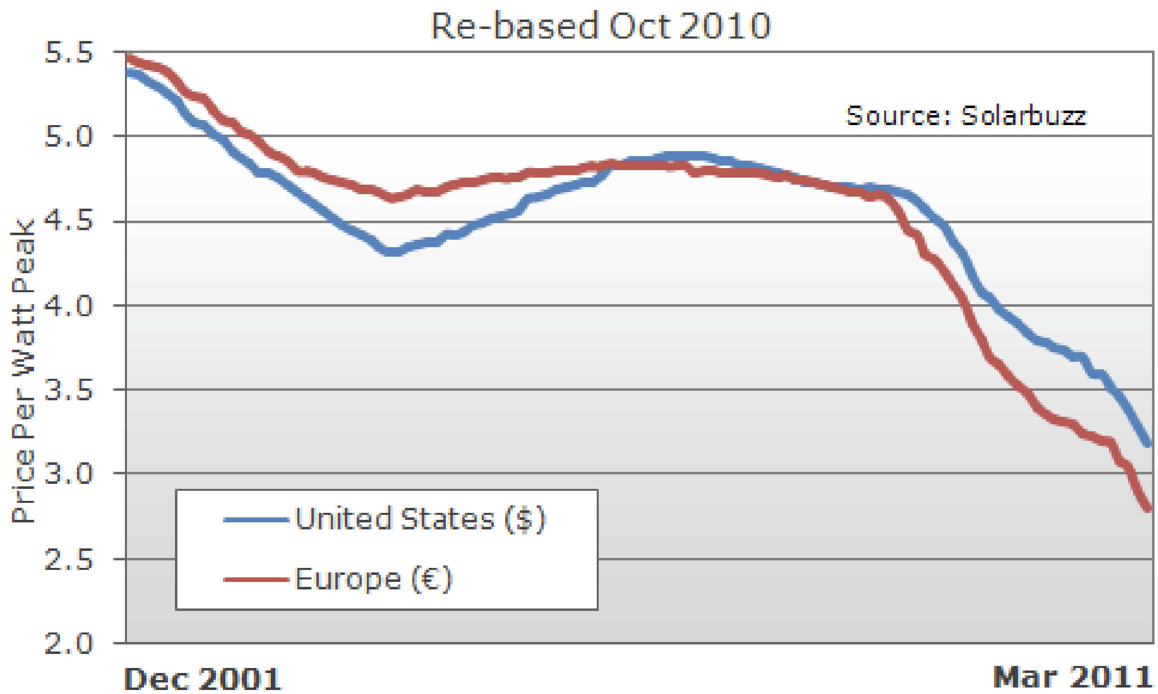
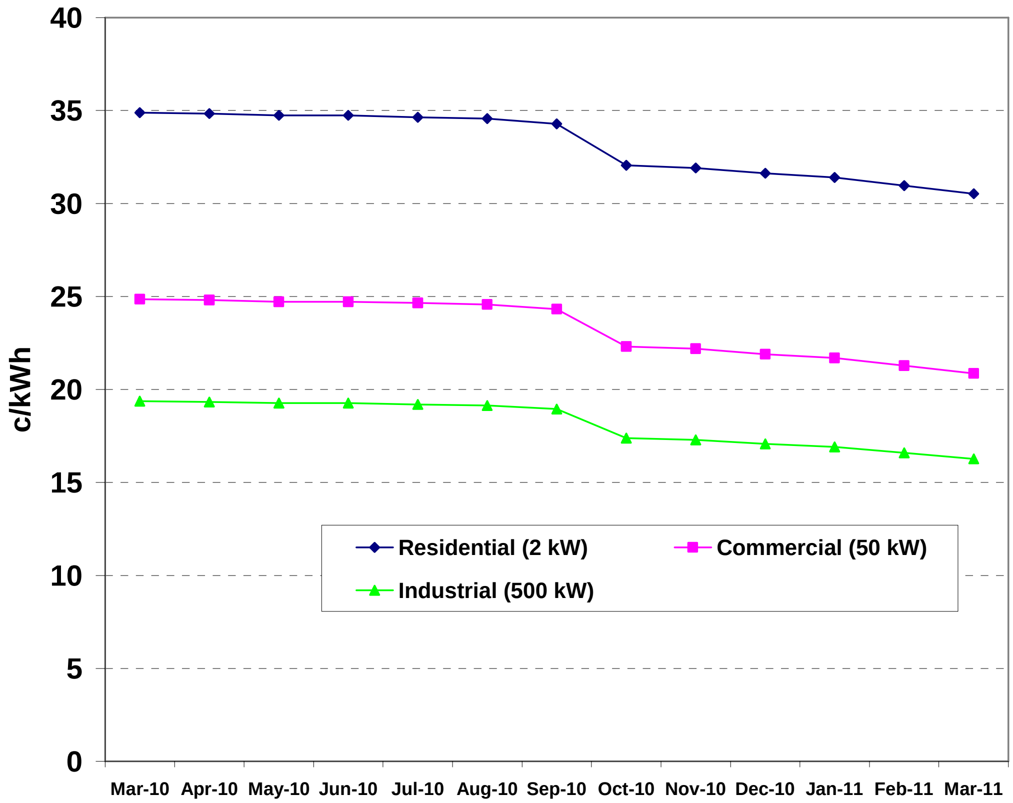


Figure 41 compares grid-connected solar-system costs, including the cost of financing the solar installation by class of service based on data from Solarbuzz.[105] Not surprisingly, residential costs of PV systems are significantly higher than commercial or industrial costs.

[105] http://www.solarbuzz.com/

Figure 41. Solar PV System Costs by Market Segment



According to the CEEEP Solar Report, the cost of New Jersey's solar RPS compliance is likely to exceed the $10.9 billion estimate of the 2008 NJRES market study. New Jersey's solar energy policy accounts for approximately 25% of the cost associated with the State and federal policy component of the average residential electricity bill.[106] The solar cost component is expected to increase in response to the more aggressive solar production target through 2026 without a reduction in the RPS for other, non-solar Class I sources. Importantly, the solar production target is an energy target, not a percentage of total energy use in New Jersey. Therefore the solar requirements are not reduced if load is reduced through aggressive conservation or EE.

In its adoption form, there was a 2% cap on the cost impact to electric rates attributable to solar, but this cap was eliminated by the Solar Advancement Act. Based on an analysis by CEEEP, when calculated against the cost of energy displaced by solar, solar's cost will be 2.6% of the total retail electric market in 2012, even though solar energy comprises less than 1% of the electric power.[107] In 2025, solar is projected to reach 6.5% of retail electric costs assuming that SRECs are priced at 75% of the SACP, while providing 5.4% of the electric power.[108] By 2020,

[106] Refer to section 4.10 of this report for a breakdown of average electric bill components.

[107] CEEEP Section VII. Solar Payback Analysis, Table 4. p. 106. Assumes SREC prices are at 75% of the SACP schedule.

[108] CEEEP Section VII. Solar Payback Analysis, Table 4. pp. 106.

New Jersey's solar requirement will increase the weighted average electricity costs by 0.92 cents/kWh, an increase of 4.5%. By 2025, the electricity rate is projected to increase by 1.58 cents/kWh due to the solar requirement.[109] If SACP prices govern due to a shortage of installed capacity, the 2020 increase could be as high as 1.23 cents/kWh, and the 2025 increase as high as 2.10 cents/kWh.

Holding aggregate State policy costs at or near current levels will not be possible because of the annual increases mandated by the Solar Advancement Act. From 2011 through 2015, the amount of solar energy mandated by the Act will increase by 260% with a total annual estimated SREC cost in 2015 of $525,262,500.[110] At this growth rate, even the complete elimination of all other EE/DR and renewable energy programs would not be sufficient to offset the increased cost of solar energy, without passing on large cost increases to ratepayers. Nevertheless, under the Solar Advancement Act, the quantity of solar energy is mandated to increase through 2026, and beyond.

The challenging economic conditions experienced throughout New Jersey limit the amount of private equity and public indebtedness available for investment in renewable technology. The sheer magnitude of the public resources being directed to achieve the substantial step-up in solar technology throughout New Jersey can crowd out investment in other renewable resources, in particular, offshore and onshore wind, and biomass. Worthwhile investments in EE/DR and, conceivably, conventional resources such as the three new CC plants under the LCAPP procurement, may be impacted. To be in strict accord with the requirements of the Solar Advancement Act through 2026, the State would need to indefinitely postpone or cancel other renewable energy and EE/DR programs because funding is limited. Absent such indefinite postponements or cancellations, significant increases to retail rates throughout New Jersey are inevitable. Moreover, portfolio diversification objectives support a blending of renewable, conventional and EE/DR technologies rather than over reliance on one green technology. For these reasons, New Jersey should reevaluate the merit of being in strict accord with the requirements of the Solar Advancement Act through 2026. Similarly, in light of substantial solar technology progress and the current high SACP through 2016, it is reasonable for New Jersey to evaluate the reasonableness of the existing SACP price level authorized by the BPU through 2016.

Solar RPS requirements affect New Jersey in four major ways. First, the solar requirements lessen the amount of CO_2 and other power plant emissions associated with conventional power production from resources in New Jersey and from other resources in PJM. Second, the addition of solar PV also reduces the need for other resources to meet electricity demand. Third, the solar requirements raise retail electricity prices for non-participants, possibly reducing business economic activity due to indirect and induced economic impacts. Higher retail electricity prices may cause industrial and commercial entities to relocate, while reducing the likelihood of new

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[109] CEEEP Section VII. Solar Payback Analysis, Table 4. pp. 106. Assumes SREC prices are at 75% of the SACP schedule.

[110] CEEEP Section VII. Solar Payback Analysis, Table 4. pp. 106.

manufacturing capability being formed in New Jersey.[111] Fourth, the solar requirements help to create a manufacturing and service industry in New Jersey. Construction and installation jobs create a transient, but significant economic gain for New Jersey, while ongoing operations and maintenance jobs result in direct, indirect, and induced economic and employment benefits.

Combining the economic impact of the additional cost of solar energy with job formation attributable to it helps to place the overall cost per job in perspective. The cost per job can then be expressed as a factor of the State's gross state product.[112] According to the CEEEP Solar Report, each in-state solar industry job currently nets out to a cost of $386,866.[113] While the cost per job decreases over time, New Jersey's current solar policy will create 1,556 net additional in-state jobs by 2020, and decrease New Jersey's gross state product by approximately $206 million or 0.04% per job.[114] Each year, New Jersey will create an average of 6.47 additional direct, one time installation jobs and less than 1 (0.19) operations and maintenance jobs per solar MW.[115]

There has been commendable technology progress in the solar industry over the last decade. There remain bright spots on the horizon as new solar PV technologies continue to demonstrate improved performance and lower cost. Some of these technologies could lead to significant decreases in installation cost that may not have been considered, suggesting a decrease in the SACP in future years.

7.2.4 Onshore and Offshore Wind Development

New Jersey has not adopted a specific technology goal for onshore wind, a Class 1 renewable energy source. The development of onshore wind has been limited due to existing laws, regulations, and concerns regarding the impact on wildlife, including bird and bat migration, habitat protection, and the lack of high quality onshore wind resources. New Jersey's wind resource map shows low average onshore wind speeds, unsuitable for wind generation, but attractive wind speeds on the coast and offshore (Figure 42). The 7.5 MW Jersey-Atlantic Wind Farm is a coastal installation which has been operating since 2006.

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[111] CEEEP Solar Report, December 27, 2010, p. 1.

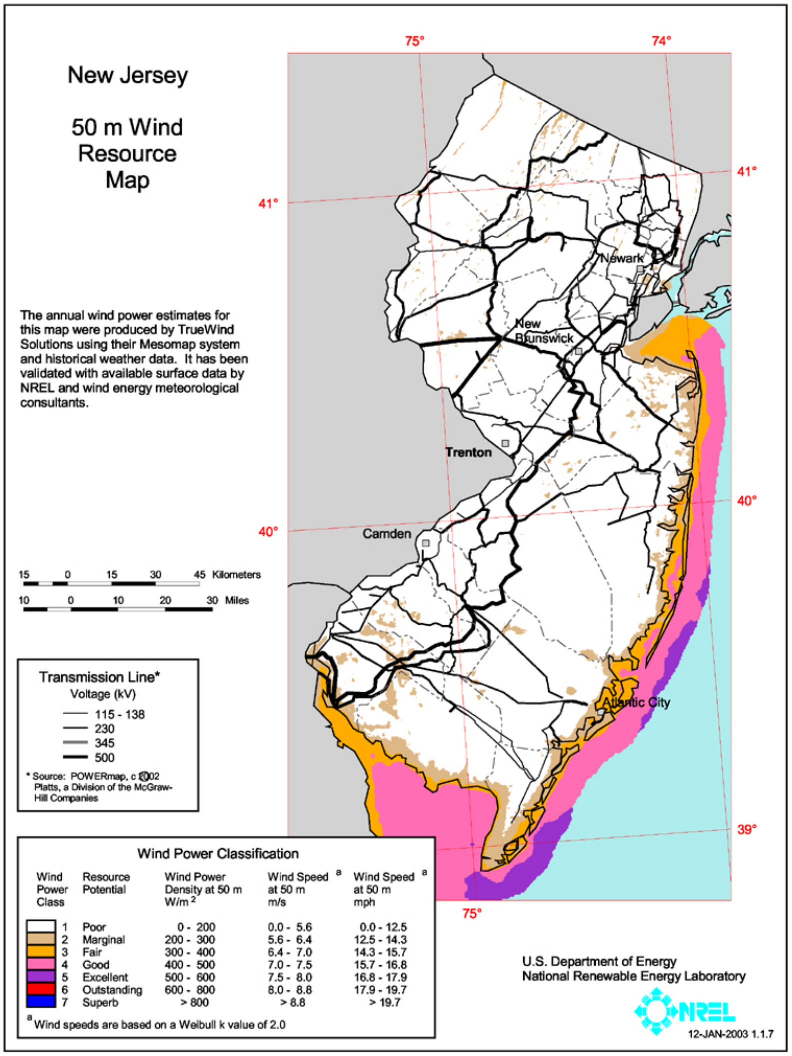
[112] The analysis assumes that there is no solar manufacturing in New Jersey. It does not account for any environmental benefits or any wholesale electricity price benefits ascribable to solar. If additional solar assembly and manufacturing employment results from the solar requirement, and/or if energy prices are lower due to accelerated solar penetration then the results presented in this section overstate the negative impact on New Jersey's economy.

[113] CEEEP, Section VI. Solar Economic Impact Analysis, Table 6, pp.103.

[114] CEEEP, Section VI. Solar Economic Impact Analysis, Table 5, pp.103.

[115] CEEEP, Section VI. Solar Economic Impact Analysis, Table 5, pp.100.

Figure 42. New Jersey Onshore and Offshore Wind Resource Map



Although a wind resource map can be indicative of wind potential, actual wind measurements for a period of at least one year are needed to determine the feasibility of installing wind turbine equipment at a specific site. The New Jersey Regional Anemometer Grant Program (NJ-RAGP) was funded initially by the DOE's Wind Powering America Program and is now run by the BPU's Office of Clean Energy (OCE). The NJ-RAGP has been available to New Jersey colleges and universities interested in administering and delivering the anemometer loan program.

Rutgers and Rowan Universities have installed anemometers for land owners for the purpose of collecting wind resource data for periods of approximately one year. This data is available to potential investors and other interested parties to understand better the local wind resource and the corresponding energy production. Richard Stockton College, Ocean County College, and The College of New Jersey are also partners under the NJ Anemometer Loan Program. These colleges assist New Jersey in providing wind resource data that may help lead to the increased deployment of small wind energy technologies throughout the State. Since the capital cost of onshore wind is much lower than either offshore wind or solar PV, it may be useful for New

Jersey to take full advantage of any onshore wind potential in order to meet the RPS objectives in a way that reasonably balances economic, environmental, and reliability objectives.

Offshore wind has been supported by the Christie Administration for a number of reasons. It is renewable, has no carbon output, and has the potential to develop a manufacturing and support industry within the State, thereby creating direct, indirect, and induced economic benefits for many years to come. OWEDA is based on all three of these elements being recognized in the review and cost-benefit analysis of any proposed offshore wind project. Although the capital cost of offshore wind is roughly twice the capital cost of onshore wind, offshore wind has higher and more consistent capacity factors than onshore wind, thus helping to reduce the net cost of producing energy and RECs from offshore locations. Capital costs increase with water depth, so the further away from shore and the deeper the installations, the more expensive the wind plant. Coastal and shallow water installations have the advantage of offshore wind characteristics at a lower cost.

The 2008 EMP called for 1,000 MW of offshore wind generation by the end of 2012. In August, 2010 when the New Jersey OWEDA was signed, it was apparent that this goal was no longer feasible. Inherent delays in federal leasing on the outer continental shelf, the failure of any project to have begun construction, the decline in wholesale energy prices, and the controversy surrounding other offshore projects elsewhere in the mid-Atlantic and New England states have stymied the offshore wind industry. To jump start offshore wind development, OWEDA called for at least 1,100 MW of offshore wind generation to be subsidized by an OREC program. Depending upon the scale, projects proposed could reach 3000 MW of offshore wind. The BPU is confident that the 1,100 MW offshore wind target objective is achievable and has adopted new rules to implement the OWEDA (N.J.A.C. 14:8-6).[116] The rules balance costs and benefits in the broader context of the overall impact on New Jersey's manufacturing and employment objectives, as well as recognition of the potential benefits offshore wind energy has on the environment and retail electricity prices. To be eligible for ratepayer financing through ORECs, projects must demonstrate net economic and environmental benefits to the State.

As of Q2 2011 there have been no offshore wind plants constructed in the U.S. Nor have there been any offshore wind projects that have completed project financing, with or without compensatory long term power purchase agreements to shift the economic burden from developers to ratepayers. Hence, under the best of circumstances, new utility scale offshore wind projects are at least several years away. The Christie Administration intends that the OWEDA will incentivize the development of offshore wind manufacturing and construction companies in New Jersey. Since turbine blades for offshore wind plants are increasing in size, it is reasonable to assume that a turbine manufacturing facility will have to be located somewhere on the East Coast to provide blades for the growing list of proposed offshore wind facilities.[117] The Port of Paulsboro and the port district of the Port Authority of New York and New Jersey

[116] The BPU authorized the submission of applications for up to 25 MW of wind energy to be supplied by wind turbines in state waters off of Atlantic City.

[117] Vestas recently announced a 7 MW offshore turbine with a rotor diameter of 164 meters, which is significantly longer than Siemens' 3.6 MW offshore turbine with a rotor diameter of 107 meters.

are well-positioned to become a major staging and assembly area to support New Jersey's offshore wind program objectives as well as programs in other mid-Atlantic and northeast states. The Port of Paulsboro is undergoing dredging and other infrastructure renovations suited for the assembly of offshore wind turbines before they are loaded onto barges for transportation to the wind farm site.

7.2.5 Biomass Potential in New Jersey

New Jersey lacks indigenous fossil fuel resources, but the State has abundant "home grown" biomass potential. For the purpose of this EMP, biomass includes both agriculturally-derived fuel, as defined by statute,[118] as well as residential and industrial waste material that is used to produce energy, either directly or indirectly.

New Jersey residents generate more waste per capita than nearly any other state in the nation. Only 17% of that waste is converted into energy by the State's five municipal solid waste incinerators, leaving the rest as an untapped energy resource. Even though the State pursues policies and programs designed to encourage waste reduction and recycling, disposal options for large volumes of waste will be needed. Waste provides a variety of energy options involving multiple technologies for electric generation, transportation fuels and small scale heating.

In September 2006, the BPU commissioned the New Jersey Agricultural Experiment Station (NJAES) to conduct an assessment of New Jersey's biomass and the potential for bioenergy production in the State.[119] The research yielded several findings, including:

- New Jersey produces an estimated 8.2 million dry tons of biomass annually;[120]
- Approximately 65% of that biomass could be available for energy production;
- This biomass could deliver up to 1,299 MW of power (approximately 9% of New Jersey's electricity demand) or the equivalent of 335 million gallons of gasoline equivalent biofuel by 2020, if all of the available biomass is used for energy production;
- Energy from waste is an attractive option due to the existing infrastructure to collect waste, the high cost of waste disposal, and the challenges of siting any new landfills in the state; and

[118] P.L. 2009, Chapter 213 defines biomass as an agricultural crop, crop residue, or agricultural byproduct that is cultivated, harvested, or produced on the farm and used to generate energy in a sustainable manner.

[119] Brennan, Margaret, David Specca, Brian Schilling, David Tulloch, Steven Paul, Kevin Sullivan, Zane Helsel, Priscilla Hayes, Jacqueline Melillo, Bob Simkins, Caroline Phillipuk, A.J. Both, Donna Fennell, Stacy Bonos, Mike Westendorf and Rhea Brekke. "Assessment of Biomass Energy Potential in New Jersey." New Jersey Agricultural Experiment Station Publication No. 2007 1. Rutgers, the State University of New Jersey, New Brunswick, New Jersey, July, 2007.

[120] This total includes biogas and LFG quantities converted to dry ton equivalents on an energy basis. This does NOT include biomass that is currently used for incineration or sewage sludge because these are not classified as Class I renewable feedstocks in New Jersey.

- Agriculture and forestry management comprise the majority of the remaining biomass produced in the State.

In combination with new State incentives, these findings are still relevant and can be used to facilitate the development of energy from this renewable resource. Practicality and cost effectiveness of the biomass resource development in New Jersey should be investigated and confirmed before any substantial new incentives are implemented.

NJAES also conducted a study of the potential for crop residues as a bioenergy resource.[121] NJAES estimated the harvestable crop residue production derived from a variety of crops produced in New Jersey, and found that the annual available production may be as high as 316 thousand dry tons, with an energy equivalent of up to about 5 million MMBtu. This estimate assumes that a minimum of 30% of the crop residue remains on the soil for conservation purposes. These biomass materials may be used as a heating fuel, either by direct combustion or converted to pellets, briquettes, or other densified forms for more efficient transportation and handling. Other methods of energy conversion include pyrolysis and gasification, and fermentation processes such as cellulosic conversion to ethanol, which can be used as a transportation fuel. To be economical, facilities that convert biomass to biofuel will require more than 10,000 contiguous acres of biomass supply within 30 miles of the facility, a situation that no longer exists in New Jersey, unless the facility can also utilize waste biomass from municipal solid waste.[122]

Currently, the State's RPS rules qualify LFG and certain forms of sustainable biomass (with written permission of DEP) as Class 1 renewable energy resources. However, waste-to-energy (WTE) is a Class 2 renewable energy resource. As noted in Section 4.9.3, the Class 1 RPS requirement increases each year, whereas the Class 1 requirement remains constant at 2.5%. This distinction has resulted in a much lower incentive for Class 2 resources, reflected in the lower price for Class 2 RECs shown in Figure 43.

Since 2009, however, the price for Class 1 RECs has fallen dramatically, recently converging on the price of Class 2 RECs for the current vintage. This trend is consistent with REC markets elsewhere in the U.S., primarily reflecting the increasing supply of renewable energy, and to a lesser extent, renewable technology progress and the decline in load growth. The price gap between Class 1 SRECs and other RECs has resulted in substantial development of solar projects, and minimal development of other Class 1 or Class 2 renewable technologies. The current REC market, coupled with the lower outlook for natural gas and energy prices, offers little incentive to utilize New Jersey's indigenous biomass resources. Moreover, if the State's offshore wind initiative is implemented fully, the OREC carve-out will diminish the demand for conventional Class 1 RECs, putting further downward pressure on Class 1 REC prices.

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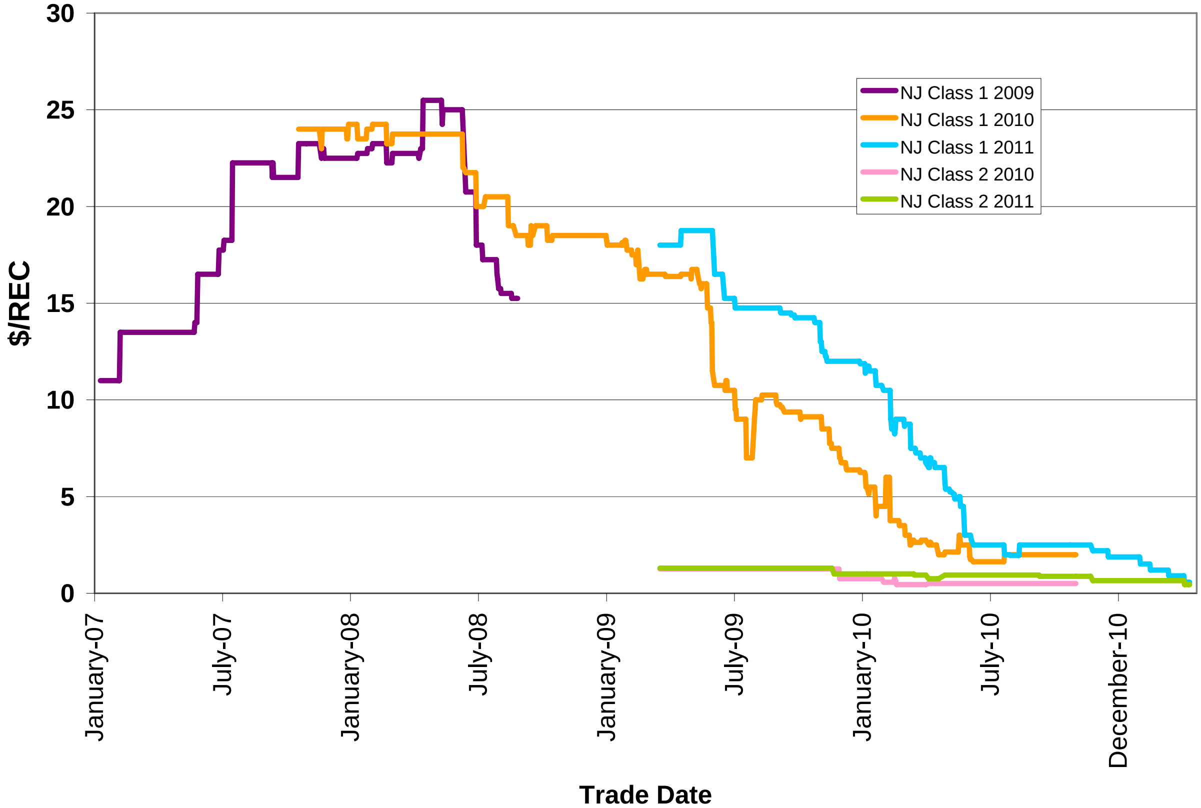
[121] Helsel, Zane R., and David Specca, "Crop Residue as a Potential Bioenergy Resource," Fact Sheet FS1116, Rutgers New Jersey Agricultural Experiment Station, December 2009.

[122] Note that certain provisions of the Farmland Assessment Act Update, P.L. 2009, Chapter 213 place restrictions on the use of biomass on preserved farms.

Figure 43. Class 1 and Class 2 REC Prices[123]



Considering the merits and environmental consequences, the higher RPS target and traditional price premium on Class 1 RECs reflect an inverted value proposition. Placing waste which contains both biodegradable and inert organic materials in a landfill, allowing materials to decay, capturing some fraction of the methane as the materials anaerobically decompose, and using the methane as a generation fuel is defined as a Class 1 renewable energy resource. If, however, the same material is taken to a facility which uses it directly as a fuel or as a feedstock for producing a hydrocarbon gaseous or liquid fuel, it is considered a Class 2 renewable resource.

Landfills occupy valuable land, pose potential threats to ground water and, if inadequately controlled, can release methane gas to the atmosphere. The uncontrolled leakage of methane gas is of particular concern; methane is a greenhouse gas with a global warming potential at least 20 times greater than CO_2.

Alternatively, when waste is used directly as an energy resource, 80% or more of the hydrocarbons are converted to energy. These efficiencies can be achieved, not only through incineration, but also by utilizing plasma gasification, pyrolysis and in-vessel anaerobic digestion. Potential energy products include heat, electric power, biogas and bio liquids. These

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[123] Source: Bloomberg LP

energy conversion technologies can be designed, permitted, and operated with state-of-the-art pollution control systems in conformance with strict emissions limits.

7.2.6 Policy Direction and Recommendations

Reduce the SACP

Technology progress, coupled with the solid operating performance to date of residential, commercial and industrial solar technologies, portends continued solar penetration in New Jersey. On a going-forward basis, emphasis should be placed on the commercialization of viable, lower cost solar technologies that increase solar penetration in New Jersey at lower incremental cost while continuing to add to the quantity of SRECs available to utilities and other LSEs throughout New Jersey. In order to minimize the cost burden borne by non-participants in New Jersey, the State should take action to reduce materially the SACP as soon as possible. The efficacy of lower cost C&I programs coupled with the anticipated continued cost decline in installing solar PV support a step-down in the SACP levels through 2025.

According to the CEEEP analysis, with SREC prices starting at $500/MWh and declining 2.5% every year, the cost of a new solar installation can be recouped in about five years for a commercial/industrial project of 10-1,000 kW, and in ten years for a residential or small commercial project of less than 10 kW.[124]

One proposal is to reduce the SACP cost by 20% in 2016, and then reduce the annual SACP by 2.54% each year thereafter, in order to reflect the continuing trend in installed costs. Under these assumptions, for the period from 2011 through 2025, the cumulative cost to ratepayers is estimated to be $11,397,642,750.[125] This cost is still greater than the early projection of $10.9 billion to meet the original (pre-Solar Advancement Act) RPS by 2021.[126]

Subject Solar Renewable Incentives to a Cost Benefit Test

As discussed in Section 7.2.2, solar PV that has been installed and is projected to be developed in New Jersey will contribute a relatively small fraction of New Jersey's energy. The solar PV buildout will provide a small offset to New Jersey's greenhouse gas emissions. Absent a revision to the SACP, solar subsidies are projected to escalate because the Solar Advancement Act eliminated the 2% cap on the cost.

Solar generation can, however, contribute to the reliability of the grid system by providing DG during the on-peak period, also reducing congestion. Currently, all solar generation is subsidized by New Jersey ratepayers through the SREC program. A New Jersey home does receive SRECs

[124] CEEEP Section VII. Solar Payback Analysis, Table 1. pp. 104.

[125] The assumption for this estimate is that SRECs are priced at 75% of the SACP. Refer to CEEEP Section VII. Solar Payback Analysis, Page 106, Table 4 for more details

[126] CEEEP has modeled several scenarios with SREC prices ranging from $252/MWh to $500/MWh. The staff SACP recommendation falls between these scenarios, which bracket an estimated payback of between 5 and 10 years.

long after the homeowner has recovered the cost of the solar installation. Given current economic conditions in New Jersey and the bleak prospect of a return to economic "normalcy" sometime soon, solar subsidies should be applied in a sensible fashion. Solar subsidies should enhance job growth and job retention objectives and should contribute to the reduction in taxes without inadvertently transferring wealth from non-participants to participants throughout New Jersey.

Promote Solar PV Installations that Provide Economic and Environmental Benefit

Behind-the-meter commercial/industrial solar installations offer an economic benefit that is not provided by subsidizing the installation of residential or grid-connected solar.[127] To the extent that the State will continue to subsidize solar installations, projects that offer a "dual benefit" should take priority for approval. Decreasing energy costs will reduce the overall cost of doing business in New Jersey, leaving revenue for expansion, job growth and job retention.

Brownfields and landfills, in particular, are well-suited for the development of large solar generation. Typically, these properties cannot be developed for general commercial or residential purposes. They do not provide adequate revenue to the towns and counties where they are situated. However, solar development can offset the costs to cap and or remediate these sites and should be encouraged.[128] Local governments should be allowed to collect property taxes from the property owners, based on the enhanced value of the site.[129]

Although a number of utility-scale solar installations have been proposed for, and installed on, what were previously working farms, the Christie Administration does not support the use of ratepayer subsidies to turn productive farmland into grid-supply solar facilities. To date, public and private entities in the Garden State have spent over $1.4 billion to preserve almost 2,000 farms, covering nearly 200,000 acres.[130] The policy of encouraging the development of renewable resources should not impact the preservation of open space and farmland. While the Christie Administration will not presume to limit the disposition of private property, New Jersey will also not subsidize the loss of productive farmland. Rules proposed by the State Agricultural Development Commission under the 2009 Farmland Assessment Act Update, but not yet finalized, should provide safeguards for property that has been designated as preserved farmland.

Many New Jersey residents are not able to take advantage of individual PV systems. Barriers to entry include the high up-front cost, the unfavorable orientation of the rooftops of their homes, and the lack of home ownership, among other things. Community solar power, in which numerous residents are connected behind-the-meter to a centrally located system, can facilitate

[127] Behind-the-meter refers to projects connected on the customer's side of the electric meter that generate power for the property owners' use. Grid-connected systems export the generated power to the electric grid for sale.

[128] The DEP maintains an inventory of closed landfills on which solar installations could be located.

[129] P.L. 2008 c 90 does not allow local jurisdictions to increase property taxes for installed solar systems and P.L. 2009 c 146 defines solar as "inherently beneficial use" which limits local jurisdictions on zoning and development of solar.

[130] Source: New Jersey Farmland Preservation Statistics, SADC, April 2011.

solar PV while retaining a long-term ownership interest. The economies of scale utilized in these projects can drive down the cost of solar. In addition to the financial benefits, community solar systems provide a net environmental benefit because the avoided use of electricity through the EDC will reduce the associated GHG and criteria pollutant emissions from fossil fuel generating facilities. Although beneficiaries have been reluctant to pay for requisite distribution system upgrades, rules to equitably allocate these costs among the owners of the centrally located system must be considered.

Maintain Support for Offshore Wind

On February 10, 2011, the New Jersey BPU adopted new rules for offshore wind to codify the statutory requirements of the OWEDA. The rules provide a framework for approving applications for projects and setting OREC prices. They will remain in effect until August 2012 when the State will readopt the regulations. The Board will have 180 days to approve or deny applications once they are submitted. The application requirements are numerous, including a cost benefit analysis for the project as well as a proposed OREC pricing method and schedule. The burden remains on the applicant to propose a reasonable OREC price which can be fixed for the proposed term or for every contract year. It is assumed that OREC pricing would represent the project's revenue requirement after tax credits and other subsidies, minus the estimated value of the spot energy market and capacity prices. If the BPU finds the proposed OREC price is too high, the BPU has jurisdiction to approve a lower OREC price that would still allow the applicant to satisfy the cost-benefit standards.

These rules intend to avoid the previous mishaps of the solar rebate and SREC programs. With an eye toward transparency, the OREC price must expose all the costs of the offshore wind project, including the cost of the requisite debt and equity capital needed to finance the offshore project. The OREC price should be sufficient to attract capital on reasonable cost terms for the offshore wind projects before the BPU, not for future offshore wind projects that may be constructed at a later date with different technology, or improved information about operation and performance, among other things.[131] Water depth is a critical factor in determining the cost of construction of an offshore wind project and the various projects that apply for ORECs might be sited in water depths that require different foundation designs.

New Jersey may be the first or second state in the U.S. to see the construction of an offshore wind facility. New Jersey will benefit on multiple levels from lessons learned in Europe and China, and should actively monitor technology and operating developments in Europe and China in the years ahead.

[131] The foundation designs used for current offshore wind projects in Europe and China are the monopile, the gravity foundation, and the tripod foundation. In deeper waters, a jacket foundation, similar to a lattice tower has been proposed for some projects. Two floating wind turbine designs are now in the pilot stages in Europe but could become commercialized in the near future and can be sited in much deeper water and therefore further from shore at the same or lower cost than traditional foundation designs.

Promote Effective Use of Biomass and Waste-to-Energy

New Jersey's abundant biomass resources – municipal and industrial solid waste, and crop and forestry residues – remain a largely untapped resource. Utilization of these indigenous, cost-effective, clean energy sources should be encouraged, and will require revisiting the Class 1 and 2 qualification requirements to provide appropriate incentives, particularly in light of the huge discrepancy between the prices of solar Class 1 and other Class 1 RECs. This should be done in conjunction with the DEP to ensure consistency with the State's goals for air and water quality protection.

To promote the effective WTE utilization, the State needs to recognize better the economic benefits of taxes, employment, and avoided landfill costs associated with this energy source. The State should provide comparable incentives for WTE and electricity derived from LFG, provided that the WTE facility is in full compliance with DEP requirements.

Recognizing that the current Class 1 and Class 2 REC markets have chilled investor interest in new WTE projects, the State should reassess the incentive structure for development of these energy sources, after taking into consideration market capacity and energy revenues. Objective technical and economic analysis should be conducted to determine the costs and benefits of these strategies before any alternative incentive levels are proposed.

Given the limited tracts of contiguous farmland, the State should not encourage conversion of valuable farmland to dedicated biofuel crops.

Support Other Renewable Technologies that can Incubate New Business for New Jersey

New Jersey should encourage emerging cost-effective renewable energy technologies, such as wave, tidal power or biomass (Section 7.4.1), that have the potential to incubate new businesses in the State.

Wave and tidal power are being developed around the world. In Great Britain, the Crown Estate, *i.e.* property owned by the monarchy, has entered into lease agreements for projects with a potential capacity of up to 1600 MW. In Spain, a pilot wave project of 1.39 MW was installed in 2006 with plans to expand to a grid-connected wave power station. The first grid connection of a wave energy device in the U.S. was completed in Hawaii in September 2010 as part of a program with the U.S. Navy. In 2008, the National Renewable Energy Laboratory (NREL) estimated that New England and the Mid-Atlantic states have 100,000 GWh/year of wave resources, while the U.S., including Alaska and Hawaii, has a total of 2.12 million GWh/yr.[132]

7.3 Cost-Effective Conservation, Energy Efficiency, and Peak Load Reduction

The most cost-effective way to reduce energy costs is to use less. Passive energy conservation, the use of energy-efficient appliances and equipment, and active DR programs result in the

[132] W. Musial, "Status of Wave and Tidal Power Technologies for the United States", Technical Report NREL/TP-500-43240, August 2008.

reduction in total energy use. Reducing customer usage during on-peak hours to ensure reliable electricity during the hottest and most humid days of the year is less costly than expanding the supply chain infrastructure--new power plants, transmission lines, and both primary and secondary distribution facilities. Reduced on-peak demand also tends to reduce wholesale electricity prices by avoiding the utilization of the least efficient generation dispatched sparingly to meet the highest demand level. Thus, reducing peak demand results in benefits that are enjoyed by all ratepayers, even those who have not taken any actions to reduce their electricity use.

7.3.1 Peak Demand and Energy Reduction Goals

The October 2008 EMP, set as a goal "…to place New Jersey at the forefront of a growing clean energy economy with aggressive EE and renewable energy goals and action items, and the development of a 21st century energy infrastructure." The 2008 EMP was designed to achieve New Jersey's 2020 and 2050 greenhouse gas targets while maintaining affordable, adequate, and reliable energy supplies. The 2008 EMP proposed to reduce projected peak demand, energy use, and natural gas use by about 20% across the board by 2020 relative to the BAU outlook. As discussed in Section 7.3.3, New Jersey's peak demand reduction target remains aggressive but has been adjusted to reflect PJM's outlook of more modest peak load growth over the forecast period.

In theory, there are great potential economic, environmental and reliability benefits associated with these goals. However, the potential economic burden of aggressive peak demand reduction, in particular, must be tested. The extent to which there may be compensating environmental and reliability benefits is not presently quantified. Hence, New Jersey must implement specific measures to ensure that the peak demand reduction and the energy use reduction goals are reasonably protective of New Jersey's economic and reliability interests, and also make meaningful progress toward the State's environmental goals.

While EE and conservation reduce overall electricity use, only a portion of the EE and conservation induced load reduction is coincident with on-peak demand. Thus the goal of reducing peak demand will require a substantial increased penetration rate of DR throughout New Jersey. While the cost savings to electric customers resulting from aggressive promotion of DR through 2020 may justify the effort, New Jersey must assess on a rigorous basis whether or not the resultant benefits associated with incremental DR are greater than the costs. Rival technology options to meet or avoid anticipated load growth must be evaluated. Hence, New Jersey's EDCs, DR program developers, and government bodies, in particular, the BPU and the OCE, should conduct the required engineering economic analysis as well as environmental assessment in order to validate the merits of the goals set forth in the EMP. Likewise, performance benchmarks applicable to the benefits and costs, and environmental benefits ascribable to energy reduction targets should be developed by New Jersey's EDCs.

Under the revised natural gas usage forecast, maintaining the goal set in the 2008 EMP would result in reducing natural gas consumption by 231 Bcf in 2020.[133] This amount represents 32%

[133] 231 Bcf = 238 trillion Btu at 1,031 Btu/cubic foot.

of the revised baseline level. For reasons discussed below, the State does not believe that this goal is reasonable, realistic, or consistent with the environmental or energy security goals delineated elsewhere in this document. The natural gas reduction goal must be reviewed by the BPU, LDCs, and other stakeholders in light of more ambitious fuel substitution goals centered on the reduction of diesel fuel and distillate oil use in New Jersey. The BPU's recent SOCA awards from LCAPP may result in the addition of 1.945 MW of clean burning, state-of-the-art CC plants. Moreover, New Jersey's natural gas infrastructure is expected to be fortified in response to the availability of lower cost gas from the Marcellus Shale. Hence, the Christie Administration does not support the 231 Bcf target natural gas reduction set forth in the 2008 EMP. Economic and environmental goals will be served better by increasing rather than decreasing total natural gas use throughout New Jersey, while striving for more efficient use of natural gas for each application.

7.3.2 Energy Efficiency and Conservation

The best way to lower individual energy bills and collective energy rates is to use less energy. Energy conservation results from consistent consumer actions, such as turning off lights and lowering thermostats. EE results from technological measures, such as insulation for rooftops and installing more efficient lighting and heating systems, to replace less energy-efficient systems. Reducing energy costs through conservation and EE lessens the cost of doing business and enhances economic development. As collective energy use is lowered, New Jersey should realize a return on investment in the form of reduced energy bills.

EE measures implemented under the CEP Energy Efficiency Program between 2003 and 2010 saved approximately $4.29 for every $1 invested in the C&I sectors, and $1.80 for every $1 in the residential sector.[134] These savings, however, are calculated on the basis of *total* customer load in each sector. As discussed in Section 4.11, only those customers who participate in the various EE program opportunities realize a direct reduction in their electricity or gas usage, and hence a direct reduction in their bills. The societal benefit charges in the EDC and LDC rates that socialize the cost of the EE investments and other subsidies are paid by *all* customers, including those who do not or can not take advantage of the EE programs. To the extent that EE measures reduce peak demand and thereby drive down the cost of energy, *all* ratepayers will enjoy the indirect savings in the form of lower rates. For this reason, a TRC test should be performed to assess the net benefit of EE subsidies and investments.

A strong EE program should also offset other macroeconomic pressures, such as increased costs of other goods and services. According to CEEEP, a strong EE program should result in an estimated net increase of 1,850 jobs by 2020.[135] Additional savings result from EE participation in RPM, the PJM capacity market. EE resources participated for the first time in the 2012/13 RPM, yielding 569 MW of new capacity across PJM. In the 2013/14 RPM, 679 MW EE

[134] Source: Analysis for the 2011 Draft New Jersey Energy Master Plan Update by Rutgers, February 28, 2011, page 95.

[135] Id., page 97.

resources cleared in the auction. While EE measures are passive resources, the addition of DR under PJM rules is tantamount to a permanent reduction in demand in the Delivery Year.[136]

The following organizations are responsible for administering and implementing EE programs: Honeywell International, Inc., TRC Energy Services, EDCs, and the New Jersey OCE. Below is a list of the State's EE programs.[137]

Residential Energy Efficiency Programs

- Residential HVAC - Electric and Gas – This HVAC program provides rebates to customers that purchase high efficiency heating and cooling equipment such as furnaces and central air conditioners.

- Residential New Construction – This program provides financial incentives to builders that construct new homes meeting the New Jersey Energy Star Homes standards which use less energy than homes built to meet the minimum requirements of existing codes.

- Energy Efficient Products – This program provides financial incentives and support to retailers that sell energy efficient products, such as appliances or compact fluorescent light bulbs.

- Home Performance with Energy Star – This program recruits and trains contractors that install EE measures in existing homes, and program includes incentives for the installation of EE measures and enhanced incentives for moderate income customers.

- Residential Marketing – This budget is for all marketing activities related to promoting the residential programs.

- Residential Low Income – This program provides for the installation of energy conservation measures at no cost to income-qualified customers.

Commercial and Industrial Energy Efficiency Programs

- C&I New Construction – This program provides rebates and other incentives to C&I customers that design and build energy efficient buildings.

- C&I Retrofit – This program provides rebates and other incentives to C&I customers that install high efficiency equipment in existing buildings.

[136] EE resources may participate in the RPM market for up to four years after installation, as long as the energy-efficient equipment, devices, systems or processes remain operational.

[137] As approved by the Board in its December 6, 2010 Order in Docket Nos. EO07030203 and EO10110865.

- Pay-for-Performance New Construction – This program will provide incentives for new buildings based on the level of energy savings delivered rather than a prescribed rebate for the installation of a specific measure.

- Pay-for-Performance – This program will provide incentives for existing buildings based on the level of energy savings delivered rather than a prescribed rebate for the installation of a specific measure.

- CHP – This program provides incentives to install CHP systems. The program was discontinued in 2008 and incentives for CHP are now included as part of the Pay-for-Performance program. The 2011 CHP budget is for commitments made prior to discontinuing the program.

- Local Government Audit – This program offers subsidized EE audits to municipalities and other government entities.

- Direct Install – This program provides incentives for the installation of EE measures in small commercial buildings.

- TEACH – The TEACH program worked with school districts to develop an energy curriculum and reduce energy usage in the schools. The OCE proposed to discontinue this program in 2011, and the Board approved the OCE proposal. The proposed 2011 budget provides sufficient funds to pay for previous commitments and associated administrative fees.

- C&I Marketing – The C&I marketing budget is for all marketing activities promoting the C&I programs.

Other Energy Efficiency Programs

- Special Studies – These studies are funded by the green jobs training grants previously approved by the Board.

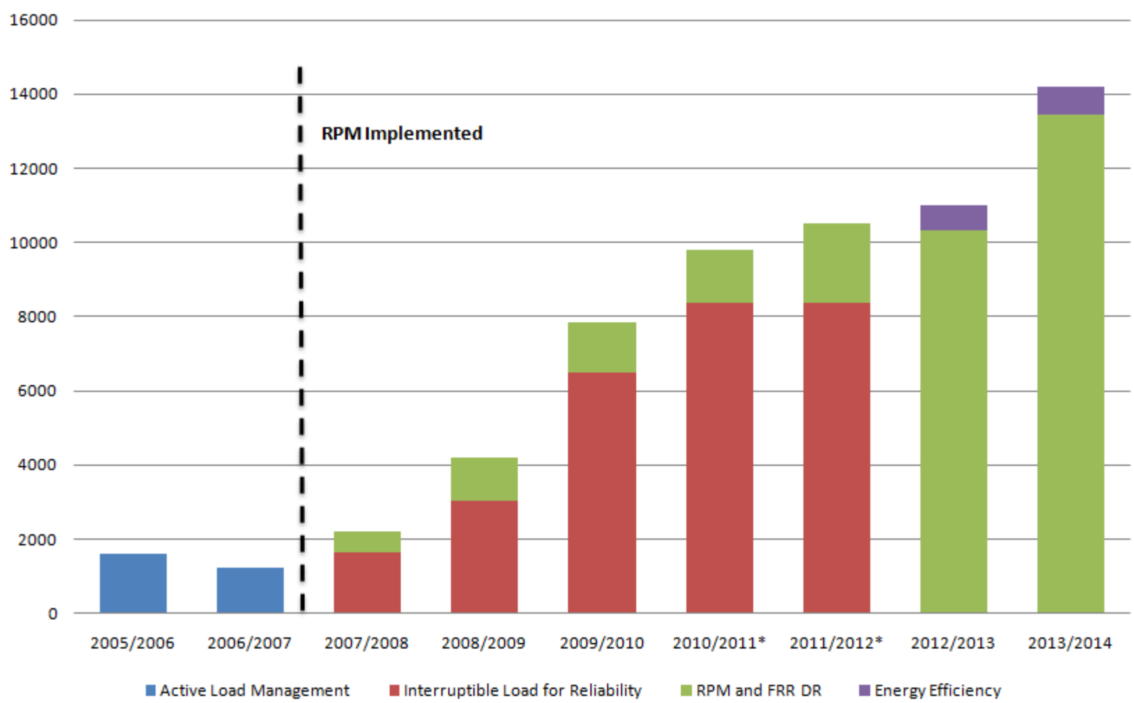
7.3.3 Peak Demand Reduction

Although electricity load rises to peak levels for a relatively small number of hours each year, the generation, transmission and distribution system must be designed to meet that peak demand reliably. Supplying energy during peak demand hours is the most expensive energy produced on the system, as gas or oil fired GTs that start up quickly, but operate at comparatively low efficiency levels are called on to produce energy. Providing adequate capacity is also expensive because there has to be enough energy sources, and the PJM transmission system has to be able to transmit that energy in spite of contingencies, *e.g.* the failure of a power plant or transmission line. Even though much of PJM's bulk power system is utilized only during peak demand hours, providing reliable service requires substantial investment in generation, transmission and distribution infrastructure. It may be more cost-effective to reduce electricity use during peak hours rather than invest in conventional supply chain infrastructure to serve peak demand.

There are various ways to address peak demand growth--through EE, building new generation, and expanding DR. Load can be curtailed, partly or fully, or shifted diurnally when demand is lower. Load shifting occurs when a consumer chooses to schedule energy consuming activities outside of the normal daily peak use periods. This can be as simple as a commercial entity scheduling an energy intensive activity to be done at night, or a residential customer deferring the use of a dishwasher or washing machine until later in the evening. More complex technology like thermal storage stores energy at night for use the following day. Load shifting does not necessarily reduce total energy consumption, but "shaves" or clips peak load. Clipping peak load also renders more efficient the use of the transmission and distribution systems. Load shifting typically requires implementation of retail rates that incentivize customers to use electricity when it is least expensive.

As defined by PJM, DR is a customer's voluntary reduction in electricity use, such as turning off or not using certain appliances, shutting down commercial or industrial processes, or turning on back-up generation, in response to PJM's dispatch instructions or pricing signals. From PJM's perspective, customer DR is a dispatchable resource that can participate in RPM as long as it can reduce reliably its demand or load. Participation of DR in RPM has increased dramatically since its inception in the 2007/08 Delivery Year. Figure 44, below, illustrates DR and EE participation in the PJM's RPM in the seven BRA starting from 2007/2008 BRA.[138]

Figure 44. Demand Side Participation in RPM from 2007/08 BRA to 2013/14 BRA[139]



[138] Starting from 2012/13 BRA, the Interruptible Load for Reliability (ILR) category has been eliminated and the former ILR resources have been included in the DR.

[139] Source – PJM 2013/2014 BRA results report.

Since the adoption of the 2008 EMP, the Board has issued orders to encourage an increase in DR by all classes of customers, both in regulated EDC-operated programs, as well as in the competitive wholesale markets. These actions have advanced several of the recommendations made in the 2008 EMP.

New Jersey's IDER Program was selected as a Smart Grid Demonstration Project by the Electric Power Research Institute (EPRI) as part of its Smart Grid Initiative. In October 2009, the U. S. DOE granted the IDER Program a Smart Grid Investment Grant of $12.6 million, as part of the Federal American Recovery and Reinvestment Act (ARRA), which allows for an additional expansion of 15 MW. The IDER Program monitors and controls non-critical customer electrical loads, in this case central air conditioners, at an individual and an aggregated level by circuit, substation or other operational grouping. The technology has been installed at over 17,000 residences to date, supporting approximately 23 MW of capacity, and will expand to approximately 38 MW over the next three years. While approved for residential customers and small C&I applications, only residential participants have enrolled in the program, to date.

For large C&I customers, the BPU approved a program proposed by the Demand Response Working Group that provides incentive payments to Curtailment Service Providers (CSPs) who registered new and incremental capacity of C&I customers into the PJM ILR Program for the 2009/10 Delivery Year. The purpose of this program was to jump start competition of New Jersey DR in the PJM capacity market by providing a financial incentive in the form of a supplemental premium payment of $22.50/MW-day to the CSPs for new and incremental capacity. This program was successful in demonstrating that with a small incentive, significant DR resources would enter the market.

7.3.4 Policy Direction and Recommendations

Promote Energy Efficiency and Demand Reduction in State Buildings

New Jersey will lead by example with an initiative to increase the EE of State owned and/or operated buildings. Energy Savings Improvement Programs (ESIP) will be used for EE and energy conservation improvements, renewable energy upgrades, and the expansion of other green oriented programs, in particular, DR and CHP.

As noted in Section 6, the use of third parties as Energy Service Companies was authorized by the ESIP Act, P.L. 2009, c. 4. This law enables State government to improve facilities without up-front capital investments. Operating costs will be lowered by using performance-based contracting for capital improvements to energy related equipment, such as lighting upgrades, HVAC replacement, and installation of building automation systems. The cost savings of the energy conservation measures will pay for the capital improvements and provide additional savings to the State in the form of lower utility bills. The "State Energy Savings Initiative Oversight Committee," appointed by the Governor, will design the framework for a successful program. The Governor's Office will stay engaged until this initiative becomes routine practice for departments and the success of EE measures becomes apparent.

New Jersey will also continue to participate in DR programs that are economically sensible initiatives and that meet the TRC test. Maximizing DR program development is a laudable goal, but one that requires the formulation of performance benchmarks to ensure that the benefits to all ratepayers are greater than the underlying costs in relation to conventional supply chain options to meet peak demand. The Christie Administration encourages reliance on third party providers that have the requisite "know-how" and access to capital to structure DR programs that obviate the need for capital investment by the State of New Jersey. Some of New Jersey's largest energy users – the Department of Corrections and the Department of Human Services – should be participants in third party DR program initiatives that depend on merchant based revenue streams administered by PJM. The Christie Administration will seek other government opportunities for participation in DR programs that facilitate the aggressive demand reduction target by 2020.

Incorporate Aggressive Energy Efficiency in Building Codes

Uniform Construction Code

Incorporating aggressive EE requirements within the New Jersey Building Code will assist in reaching our goal of reducing energy use in both new and existing buildings. Enhanced standards address numerous aspects of the building envelope, lighting, motors and heating, and HVAC equipment. Revisions to the Uniform Construction Code of New Jersey were adopted in September of 2010 naming the International Energy Conservation Code (IECC 2009) as the energy sub-code for New Jersey. This code achieves an additional 15% reduction in energy consumption through code required EE when compared to the 2008 IECC.

Within this new code are requirements for enhanced standards for the building envelope, lighting, motors and HVAC equipment that will increase the EE for all new building construction as well as renovations to existing buildings. The goal of the new sub code is to make these buildings 30% more efficient than the prior codes. The analysis for overall EE does not incorporate changes and savings from these code changes because they have not yet occurred. In addition, IECC has adopted IECC 2012, which is estimated to add an additional $3,000 to the cost of a new home; the payback in energy savings is less than 7 years and is estimated to be 15% above IECC 2009. This is 30% above the IECC 2006 Code and 50% over the 2003 Model Energy Code, which was in effect at the time the 2008 EMP was developed.

New Jersey has been awarded a grant of $360,000 from the DOE for the training of inspectors, building officials, designers and developers to gain an understanding of compliance with current energy codes. That training will be done through the DCA commencing this year. As we move forward with implementing these new code requirements we will continue to identify new opportunities for future code updates that can provide for additional cost effective energy conservation and efficiency.

NJ Green Building Manual

In 2007 a new law was enacted requiring the creation of a Green Building Manual for New Jersey. The DEP is the lead agency on the development of this manual which will be known as the "NJ Green Star Program." There has been broad stakeholder involvement in the development of the manual, which is expected to be completed later in 2011. This manual will serve as a resource for State and local governments, building owners and developers who wish to apply for State grants that reward or require consistency with green building standards.

Building Retrofits

The State will utilize benchmarking and energy auditing as mechanisms to identify those buildings that will benefit most from improvements, or retrofits. Benchmarking is the first step in any successful EE program. C&I customers can partner with their EDCs or other vendors to develop a profile of their energy use and cost on a unit of area basis. Once this "baseline" is established, a preliminary or walk-thru audit can help identify high energy uses within the facility, such as lighting, heating, cooling, office or manufacturing equipment. If additional measures require further study, the utility company or a professional auditing firm can be employed to identify costs and potential savings opportunities.

The CEP has invested in EE and renewable energy projects at the commercial, residential and local government level. These programs have been funded through the SBC. As discussed above, the method to fund EE and renewable energy programs moving forward will be re-evaluated. Energy Savings Improvement Programs can be used by public entities to improve facilities without up-front capital investments, while maintaining or lowering operating costs.

Appliance Energy Efficiency Requirements

New Jersey has been at the forefront of advocating and supporting the use of EE measures in residential homes. Programs such as combustion appliance testing, which tests the efficiency of fuel burning appliances, *i.e.*, gas furnaces, stoves and hot water heaters, under the Home Performance with Energy Star have produced significant energy savings. Additionally, there have been rebate programs to encourage the purchase of new energy efficient appliances, such as air conditioners and dehumidifiers.

The federal government, under the ARRA and the Energy Security Act, is required to adopt new EE appliance standards. Given the broader authority of the federal government to require manufacturers to improve the EE of their products, the BPU and DCA staff will monitor the new standards and continue to conduct annual reviews to determine whether the new higher efficiency standards are meeting our needs, or whether State-specific actions will be necessary. The BPU will cooperate with the Legislature and consider adopting the higher standards as they become available, including the costs and benefits of such changes.

Sub-Metering

Sub-metering enables tenants in commercial and multi-tenant residential buildings to monitor their own utility use. Instead of paying a flat rate as part of their rent, tenants would be billed for actual use of electricity, water and/or gas and thereby be encouraged to reduce their energy use and costs by conserving and/or, investing in energy efficient appliances.

Current State regulations allow for sub-metering of commercial and/or industrial accounts, but the practice is not allowed in existing multifamily residential buildings. Most residential tenants pay for utilities as part of their rent, with little or no knowledge of their actual use or the real cost to their household. This makes it difficult to encourage EE measures or to use real time energy pricing opportunities.

Representatives of multi-family residential buildings have advocated for this, and a petition is currently pending before the Board to authorize sub-metering for new construction. Apartment residents have opposed sub-metering by landlords or building management due to concerns that this would become a new cost to residents and a new source of revenue for property owners. Residents have also expressed concern that sub-metering can be unfair in older buildings with substandard insulation or older, inefficient HVAC and appliances. However, the benefits associated with better transparency and knowledge of energy use points to the need to work with these associations and building owners.

Redesign the Delivery of State Energy Efficiency Programs

We continue to recognize the value of the EDCs in delivering EE and conservation programs. The EDCs already have access to the potential consumers of these resources through the monthly billing statements, call centers, field offices, and field activities. Billing statements as well as online tools can highlight conservation and EE programs when customers are paying closest attention to the cost of energy in their homes or places of business. With the appropriate education and training, EDC employees can convert routine customer interactions into effective outreach for these programs.

The C&I sector represents 65% of the overall electric power used in the State and returns the greatest savings for the dollars invested. Identifying opportunities for EE in this sector will require outreach to thousands of businesses, building owners and lessees. Success will depend upon the ability to deliver improvements that reduce energy use and costs immediately, with a reasonable pay back period on investments.

The LDCs and EDCs have experience developing and implementing EE programs for their customers. Most of these EE programs are simple and cost effective. EDC programs such as the Powersaver air conditioning cycling by JCP&L and ACE reduce peak demand and provide cost savings for the residential customer. PSE&G has a number of programs such as the Direct Install Program for Government Facilities that provide similar benefits.

The BPU will evaluate several alternatives and recommend a structure that can optimize the delivery of effective EE programs to a wide array of customers. This will involve a review of past practices of State management through the BPU's OCE, and consideration of a new way to provide capital for EE and renewable energy programs that can eliminate the need for cost incurrence through the SBC. Following this evaluation, the BPU will put forth a proposal for the management of EE and renewable energy programs.

Alternatives that will be considered include a revolving loan program and the creation of an "energy efficiency utility" that would generate revenue out of energy savings.[140] The former program could begin with an RFP process through which bidders would apply for long term, no-

[140] The "start up" money for such programs would be provided out of the SBC.

or low-interest financing of EE programs. The companies receiving the awards would market the programs, conduct EE audits, recommend retrofits, and perform the renovations. The cost of the improvements, along with a reasonable return, would be repaid by the customer out of the energy savings, and the amount of the original loan would be repaid to the Clean Energy fund. Such a program would allow the fund to become self-sustaining. SBC funds could be re-directed and/or the charges to ratepayers could be reduced.

The prospect of centralizing the EE bidding protocol through an EE utility should be explored. This process would be supervised and implemented by the BPU. Centralization of the PJM bid protocol through the EDCs could also operate as a trading platform for all renewable energy certificates, thereby collecting transaction fees. Ultimately, this approach would foster the wind down and elimination of the CEP portion of the SBC.

Monitor PJM's Demand Response Initiatives

PJM has implemented many incentives and resources to support DR. Recent FERC rulemakings strengthen the economic rationale for DR, thereby making it easier for new DR programs in New Jersey to participate successfully in the capacity and energy markets administered by PJM.

PJM's long-term vision appears to be that Price Responsive Demand (PRD), the next generation of DR, will be the ultimate solution to customer DR participation. In PRD programs, customers respond to market prices and voluntarily reduce their electricity usage when wholesale prices warrant. PRD would be enabled by advanced metering devices. Smart meters and electricity price display devices, coupled with dynamic retail rate structures linked to wholesale market prices, would allow customers to react on a voluntary basis. In light of New Jersey's aggressive peak demand reduction target in 2020, New Jersey must continue to monitor DR and PRD initiatives in order to gauge any impact on New Jersey.

The retail rate design of PRD customers must vary in some fashion in response to wholesale market prices. PJM recognizes that PRD requires coordinated efforts between PJM and their member states that have jurisdictional authority over retail rates. In addition, advanced metering and dynamic tariff design would necessitate coordination among EDC, load serving entities, CSPs, and others who provide electricity and DR services to customers.

In addition to monitoring the PJM initiatives, the BPU needs to be proactive in promoting cost-effective DR activities which are not recognized and supported by PJM programs. For example, thermal storage presents an option that should be explored to determine if it can deliver significant peak load reductions. Currently, it is not eligible under any existing or proposed PJM programs.

Further expansion of merchant DR is likely to continue because additional incentives are on the horizon. Thus, in March of 2011, FERC issued Order 745 with the final rule removing remaining barriers for entry of DR in the wholesale markets. The final rule is designed to allow dispatchable DR resources to participate and be compensated in the energy market.

Expand Education and Outreach

Implementation of any of the above measures will require education of consumers, including students and homeowners, business owners, developers, building owners, and all levels of government. State agencies, EDCs, non-profits, and membership organizations can assist in delivering information to consumers about energy conservation measures and EE tools.

Despite the success of the OCE's Energy Efficiency Program that requires initial investment by the participants, residential consumers have shown reluctance to make investments in these programs without incentives (in the form of rebates). In an attempt to make the benefit of these technologies known to the general public by providing rebates on purchases, the program may have instead given consumers an incentive to delay such purchases until rebates are available. Education is needed about the other "green" reason to install energy efficient products – long term cash savings.

The C&I sector represents 65% of the overall electric power used in the State and returns the greatest savings for the dollars invested in EE and conservation measures. Identifying opportunities for this sector will require outreach to thousands of businesses, building owners, and lessees. Success will depend upon the ability to deliver improvements that reduce energy use and costs immediately, with a reasonable payback period on investments.

Together with its partners, the State can develop and deliver valuable information through web sites, workshops, conferences, and literature on such topics as EE, DR, on-site generation (including CHP), and renewable energy systems. As part of the implementation phase of this EMP, education and outreach programs will be developed jointly with all appropriate partners.

Improve Natural Gas Energy Efficiency

Since publication of the 2008 EMP, natural gas has become a more attractive energy source, largely due to its lower commodity cost and fewer emissions of pollutants. It is now being used by a larger percentage of residents and businesses, as well as for electricity production. In the narrow context of traditional gas use for industrial, commercial, and residential customers, including power generation in New Jersey, the Christie Administration recognizes the merit of reducing natural gas consumption by 231 Bcf by 2020 with respect to baseline use of natural gas. That this goal represents a 32% reduction from the baseline forecast is commendable, but it may be no longer consistent with the Administration's emphasis on LCAPP generation and the reduction in oil usage, particularly for freight applications and mass transit, including passenger service. Natural gas EE remains a worthwhile goal with respect to increasing the penetration rate of high efficiency gas burning appliances, gas-related EE programs, and general conservation trends. Going forward programs aimed at increasing the number of CNG truck, bus and vehicle engines will reduce oil use, but increase natural gas use. New Jersey should evaluate what infrastructure changes regarding slow and fast fill stations, fleet availability and maintenance, and labor are required to retrofit existing vehicles in order to accelerate the substitution of natural gas use for oil.

7.4 Innovative Energy Technologies and Businesses

New Jersey has a long history of being the birthplace of innovation. New Jersey is home to world-class universities, renowned private and public research institutions, and abundant entrepreneurial businesses. Collectively, they have the intellectual capital to develop new, clean, cost-effective sources of electricity, to utilize fuels and electricity more efficiently, and to lessen reliance on gasoline and diesel fuel as the primary transportation fuel. In this section, the array of innovative energy technologies associated with meeting New Jersey's electricity, fuel, and transportation requirements is explored. Behind-the-meter options are part of the energy technologies of relevance. Options geared toward the displacement of premium fossil fuels for truck, transit, and passenger vehicles are also explored.

7.4.1 Energy Technologies to Simulate Economic Growth

Fuel Cells

The first fuel cell was built over 150 years ago; fuel cell technology is not technically innovative. Insofar as fuel cell technology has not established a significant market share in New Jersey, it is included in this section. Fuel cells generate electricity by combining hydrogen and oxygen in a relatively low-temperature electrochemical reaction. The nature of this electrochemical reaction means that fuel cells are not subject to the thermodynamic cycle efficiency limits that are characteristic of steam or combustion-based generating technologies. Hence, the potential generation efficiency of fuel cells can be high. In addition, the low operating temperature produces comparatively low NO_x emissions. In recognition of their extremely low emissions, fuel cells are exempt from New Jersey's air emissions permitting requirements. If a hydrogen source is available, fuel cells themselves produce no CO_2 or carbon monoxide (CO) emissions. When used with hydrocarbon fuels, such as natural gas, fuel cells require a reformer to create hydrogen gas. The production of hydrogen gas also results in the release of CO_2 and low levels of CO.[141]

There are many fuel cells that are operational in the U.S., but to date the technical promise associated with this technology has been stymied by the high capital cost of installing the resource. Losses associated with the design and material selection in fuel cells have limited the efficiency of commercial units to roughly 40%, far lower than the theoretical efficiency underlying the technology. Because fuel cell efficiency levels are lower than state-of-the-art CC plants and the capital cost is much higher, fuel cells have not been economically competitive with more conventional generation options in most commercial applications.

Unlike many generating technologies, fuel cells can be scaled up or down in size without much loss in efficiency. Furthermore, much of the fuel energy in a fuel cell that is not converted to electricity is available as heat, so that their total fuel utilization efficiency when used in institutional or commercial CHP applications can be high. The fuel cell technologies that have

[141] Natural gas is the predominant source of hydrogen in commercial fuel cells, but bio-gas has also been used successfully.

been most successful in this niche market are phosphoric acid and molten carbonate systems, which range from 100 kW to 1 MW in size.

Tidal Energy

New Jersey's extensive Atlantic shoreline can be harnessed for tidal energy production. Use of 1% of the shoreline could support roughly 500 MW of clean, renewable energy. There are large direct, indirect and induced socioeconomic benefits associated with harnessing tidal energy along New Jersey's shoreline.

There are three primary methods of extracting energy from tides. The most promising of the three methods is tidal stream generators.[142] Tidal stream generators are similar to wind turbines, except that they extract energy from the moving water of tidal currents rather than air movement. In relation to air, water is dense. Thus, more power can be extracted at lower velocities and from a smaller swept area compared to wind turbines. Among all forms of renewable energy, none is as consistent or predictable as tidal power.

Unlike wind turbines, there is no standardized design for a tidal stream generator. Many prototypes have been tested. The most common type is the axial flow turbine, which is similar in design and operation to the now-standard propeller-type wind turbine. Other types include horizontal or vertical-axis crossflow turbines (such as the Darrieus rotor) and oscillating devices that use the principle of hydroplanes. These designs may also use ducts or shrouds to direct the flow through the turbine and increase the output and efficiency.

The New Jersey Department of Transportation (DOT) Office of Maritime Resources is involved in a proof of concept partnership that will install a turbine system in Point Pleasant on the Manasquan River by early 2012. DOT is also leading a review of the top 20 potential in-State tidal turbine transportation sites. DOT could incorporate tidal power into Marine Transportation System projects and facilities, and into bridge applications. An example of such a project is the potential placement of water turbines in the Point Pleasant Canal from which energy gained could be used to power the Point Pleasant Station of the New Jersey State Police Marine Services Bureau.

Another tidal power site is under consideration in Salem adjacent to a DOT owned bridge. The initial power production estimates, with ten turbines installed, are a minimum of 3.5 million kWh per year. Pending the findings of an on-going assessment, up to thirty tidal turbines could be installed in the Salem River project.

The proof of concept partnership will reveal economic and operational information that will help guide New Jersey's assessment of the potential long term role this renewable technology may play in meeting the State's environmental, economic and reliability objectives.

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[142] The other two are tidal barrages and dynamic tidal power. Tidal barrages are essentially hydropower dams across the entire width of an estuary. They have very high cost, and there are few usable sites. Dynamic tidal power is a theoretical method of much larger scale, with a structure extending 20 miles or more from the shore into shallow coastal water with strong tidal currents parallel to the coast.

Offshore Wind Turbines

Over the past decade, wind turbines have developed into a significant source of renewable energy across the globe. Major wind developments in Europe and Asia have culminated in 147 GW of installed wind capacity, some of which is offshore wind.[143] In Europe, there are nearly 3,000 MW of offshore projects.[144] China is presently embarked on an ambitious offshore wind development initiative. Over 40,000 MW of onshore wind power capacity has been installed in the U.S. including 8 MW in New Jersey.[145] While many offshore wind projects have been proposed along the Atlantic seaboard, to date there have not been any offshore wind projects that have been constructed or financed. As discussed in Section 7.2.4, a number of offshore wind projects have been proposed off the coast of New Jersey and may be developed in response to State incentives aimed at jump starting the large commercial potential associated with offshore wind technology.

Offshore locations offer important advantages over onshore, including higher wind speeds, higher capacity factors, and fewer siting issues. The main drawback to offshore wind turbines is the much higher installation cost and, to a lesser extent, operating costs associated with the offshore location. OWEDA directs the BPU to develop an OREC program to support at least 1,100 MW of offshore wind projects.[146] Governor Christie signed the legislation at the site of the future Port of Paulsboro, where offshore wind equipment and materials would be staged and assembled.

Energy Storage

Typically, large-scale energy storage is used to provide electricity during periods of peak demand, and thus serves as a source of peaking generation. On a smaller scale, energy storage is used to reduce demand, and acts as a substitute for peaking generation. Either way, energy storage tends to flatten the load curve, and can lower costs for all customers by reducing the need for peaking generation sources.

One of the difficulties inherent in the widening use of renewable electric generation technologies such as wind and solar energy is the intermittent nature of the resource. The availability of electrical energy storage would facilitate the integration of renewable energy as a reliable capacity resource by effectively shifting renewable energy to meet demand during peak times. As the percentage of intermittent renewable energy use increases, electrical energy storage becomes more important.[147] Despite the increasing need, the energy industry still is looking for

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[143] GWEC – Global Wind Report, p. 11.

[144] Ibid, p. 39.

[145] Source: U.S. Dept. of Energy, Wind and Water Power Program: http://www.windpoweringamerica.gov/wind_installed_capacity.asp

[146] The Act is described in Section 6 of this report.

[147] Several studies indicate that when renewable energy sources reach 25% of our generation mix, storage will be a critical component of PJM’s ability to safeguard grid reliability objectives. Currently, intermittent resources are backed overwhelmingly by conventional, gas-fired generation.

a reliable and affordable technology for the storage of large quantities of electricity beyond traditional technologies, *e.g.* pumped storage hydroelectricity (discussed below).

A number of new energy storage technologies exist. The challenge is to make them robust, reliable, and economically competitive, while matching the most suitable technology to each energy source or location. In most cases, energy storage costs are considerably higher than more traditional reliability options for distribution and transmission systems.

Usually, a decade is needed to develop a battery from research to commercialization. While venture capital has poured into the energy storage space over the last five years, according to staff scientist Venkat Srinivasan at The Battery Program at Lawrence Berkeley National Laboratory, major capital investment in energy storage will come from power producers and other industry stakeholders in collaboration with universities and research institutions. Government's ongoing support is also an important driver.

Pumped Storage Hydroelectricity

Pumped storage hydroelectricity provides lower-cost, on-peak electricity, and is the energy storage system currently in widest use in New Jersey. Pumped storage works by moving water between two reservoirs. During off-peak hours, low-cost electricity is used to pump water from one body of water (the lower reservoir) to another located at a higher elevation (the upper reservoir.) During hours of high-peak demand, water is released from the upper reservoir and flows through a turbine to generate electricity.

Siting of the upper and lower reservoirs requires a very specific geographic terrain for pumped storage. New Jersey has one pumped storage facility, the 400-MW Yards Creek Station in Warren County. In northwestern New Jersey, the dams and related infrastructure that could be used for pumped storage hydro were built to maintain river water flows and to prevent salt intrusion into the river systems. This primary use limits their viability as a peak generation resource. Also, reservoir levels tend to be low during the hot summer months, particularly during droughts, so water cannot be released to satisfy generation needs.

Thermal Energy Storage

Thermal energy storage systems typically produce chilled water or ice during off-peak periods for use during peak demand to supply building or process cooling systems. Princeton University and the Trenton District Energy System use stratified (layered) chilled water to displace electric powered chillers, which would otherwise have run on-peak to provide building cooling. Recently, Richard Stockton State University installed the first aquifer thermal energy storage system in the US that stores chilled water during the winter for use during the summer cooling season. The American Society of Heating Refrigeration and Air-conditioning Engineers has endorsed thermal energy storage as a cost-effective technology for new C&I buildings and as a significant retrofit opportunity.

Compressed Air Energy Storage

Compressed air energy storage systems pump air into an underground cavern or some other type of containment during off-peak periods and subsequently release it to power turbines during times of peak demand. Such systems are not efficient, however. If suitable storage is available and if there is a large diurnal price spread, the economic potential associated with compressed air energy storage technology could be harnessed.

World-wide, there are only two large-scale compressed air energy storage facilities, a 110 MW plant in McIntosh, Alabama and a 290 MW plant in Germany. The technology shows some promise for the future – new facilities are in development in New York, California, and Iowa. The Iowa facility is being sited next to an existing wind farm, and is being promoted as a means of storing wind energy for use when it is needed.[148] In New Jersey, PSEG Global entered into a joint venture with Dr. Michael Nakhamkin to form Energy Storage and Power LLC, to develop what they consider to be the second generation of large-scale compressed air energy storage technology.

New Jersey's dependence on natural gas fired generation and the wholesale market dynamic that has narrowed the diurnal price spread under deregulation, do not bode favorably for the commercial applicability of this technology.

Flywheels

One of the most straightforward ways to store energy is in a spinning flywheel where electrical energy is converted into the kinetic energy of rotation by running it through a motor/generator, which accelerates the flywheel. The kinetic energy is extracted from the flywheel when it is needed by the motor/generator, which slows the wheel down and produces electricity.

Regionally, U.S. DOE awarded a $24 million stimulus grant to PJM for a 20 MW energy storage facility based on flywheel technology. The federal funding to PJM is the fourth highest grant award for an energy storage project, and the only grant award for frequency regulation. This award should help advance the technical examination of energy storage solutions with respect to PJM's efforts to integrate intermittent resources. In practice, in order to keep size and costs reasonable, the flywheel has to spin very fast, yet be strong enough to keep from coming apart. Flywheel storage systems are only commercially available in a form that can deliver small amounts of power for short periods. More technical research into utility-scale flywheel projects is anticipated in the years ahead. While flywheel storage systems provide short bursts of energy to maintain transmission system integrity, flywheels represent promising innovative technology that could hedge against unanticipated drops in wind-based energy production. In conjunction with New Jersey's support for offshore wind, New Jersey should monitor the technical and commercial developments that may support the installation of flywheels to promote grid reliability objectives in response to increased wind penetration in New Jersey.

Smart Grid

A smart grid extends and improves the functioning of the existing electrical grid, *i.e.*, transmission and distribution system, by overlaying the capability of two-way digital communications. Instead of adjusting the supply of electricity in response to unpredictable

[148] In 2010, Iowa generated 15.4% of its electricity from wind power, the highest of any state in the country.

demand, a smart grid allows for accelerated development of DR. When reserve margins deteriorate due to unanticipated operating contingencies and/or extreme temperature conditions, smart grid technology allows for price signals to trigger cycling or the shut off of non-essential loads. Smart grid technology has broad commercial applicability across governmental, industrial, commercial and residential classes of service throughout New Jersey. While smart grid technology is already widely used in the industrial and commercial sectors, the extension of this technology to the residential level has the potential to contribute to New Jersey's economic, environmental and reliability objectives. Residential participants with smart grid technology could control individual appliances, such as refrigerators, water heaters or air conditioners, to respond to real-time price energy signals. Small-scale DG and energy storage systems could also respond to real-time price or dispatch control signals.

In a smart grid system, storage and demand reduction technologies would work in tandem, thereby serving to even out the customary peak / trough consumption pattern. According to DOE, a smart grid would use digital technology to improve reliability, security, and efficiency (both economic and energy) of the electric system, and would enable dynamic optimization of electric system operations, maintenance, and planning.[149] Smart grid technology would cover the following portions of the electric system:

- Delivery infrastructure, *e.g.*, transmission and distribution lines, transformers, switches
- End-use systems and related distributed-energy resources, *e.g.*, building and factory loads, DG, storage, electric vehicles
- Management of the generation and delivery infrastructure at the various levels of system coordination, *e.g.*, transmission and distribution control centers, regional reliability coordination centers, national emergency response centers
- Information networks, *e.g.*, remote measurement and control communications networks, inter and intra-enterprise communications, public Internet.

Smart grid technology continues to be refined in the U.S. Widespread implementation is years away. New Jersey expects that smart grid technology will be an integral part of the energy balance throughout the State. To that end, New Jersey is involved in a smart grid demonstration project in the JCP&L service area. This demonstration project involves a two-way communications network that enables JCP&L to monitor available load for control and to measure load reductions associated with central air conditioning systems.

Smart Metering

Smart meters are advanced meters which allow consumers to monitor and manage their level of energy use by providing two-way information about when and how much electricity is being consumed. Two-way communication provides customers with timely access to energy usage,

[149] Source: U.S. DOE, Smart Grid System Report, 2009, p. iv.

thereby allowing customers to respond to dynamic pricing signals by avoiding usage and/or participating in DR programs.

The two fundamental elements of any smart meter are: the capability to measure and record customer consumption in real-time or short intervals, such as in 1-minute, 5-minutes, 15-minutes, 30-minutes or 60-minutes increments; and reliance on two-way communications between the meter and the utility. Smart meters alone, however, cannot ensure that customers will be able to respond to electricity price signals, and to reduce demand during peak periods of electricity use. Such meters need to be able to communicate with in-house communication displays or be integrated with in-home load controllers. In addition to these customer benefits, smart meters also provide greater functionality and cost savings to the EDCs. Smart meters support improved customer services and allow the EDCs to remotely control load, connect/disconnect customer service, identify outages, and detect meter tampering and electricity theft more rapidly and cost-effectively.

Smart meters can be supported by various communication technologies, including combinations of existing fixed radio networks, broadband over power line, wireless, and other networks. Prospectively, smart meters and two-way communications could support a dynamic integrated energy management system on both the customer and utility side of the meter. Such an energy management system could support dynamic systems control, electricity distribution operations, data management, efficient building systems, DG such as customer-sited renewable energy and energy storage systems, automatic control of smart customer appliances, equipment and devices, and plug-in hybrid vehicles.

There are a number of barriers to smart meter implementation. Smart meters are more expensive than traditional meters, as are two-way communication costs. There has been a lack of standardized communications protocols, but some progress is being made. Of critical importance, smart meters must be able to communicate not only with the EDC, but also with evolving technologies, equipment, the smart grid, and the computer chips in future smart appliances. The installation of smart meters prior to standardized communication protocols has exposed ratepayers to stranded costs resulting from obsolete equipment. The smart meters of tomorrow will have to be built with the capability to communicate with the evolving smart grid.

Currently, in New Jersey, all customers with demand of 1,000 kW and above, *i.e.* large industrial and commercial customers, have interval meters that store power use data at regular intervals and two-way communications that support dynamic pricing. Customers with demand above 750 kW have interval meters, but are not required to have two-way communications. New Jersey should continue to monitor smart metering technology advances in the broader context of gauging the increased market potential of smart grid technology.

7.4.2 Innovative Technology Opportunities in Transportation

There are multiple energy sources being discussed for transportation-- freight, mass transit, and passenger vehicles. Fuel source options available will vary by the nature of the transportation type but are aimed at lessening New Jersey's dependence on traditional gasoline and diesel fuel to propel ships, trains, trucks, buses, and passenger cars in furtherance of the State's environmental and economic objectives.

Freight

The transportation of freight in New Jersey is by over-the-road trucks, ships and rail. Air freight is a small and specialized transportation issue and presents few energy alternatives. Ships and barges represent the largest means of transporting bulk and heavy cargoes. Most ships and tugs utilize diesel fuel. A small number of large ships can use heavier fuel oil, but they are often too large for New Jersey ports. The most significant opportunity for energy savings and emission reductions is to provide onshore or dockside steam and electric service to ships in port. These ships frequently use main engines or dedicated generators to provide shipboard power, which is inefficient, has high emissions, and may release pollutants to the water.

Railroads provide both passenger and freight transportation. The inter-modal capabilities and proximity of population centers to New Jersey ports is an important part of the State's competitiveness. Trains provide the lowest cost and least air emissions per ton of freight transported per mile. Freight engines are diesel or diesel-electric and have limited options for alternative fuels, other than including a blend of bio-diesel in the fuel supply.[150] While the supply of bio-diesel and potential for including a 5% to 20% blend is feasible, the withdrawal of the federal subsidy for bio-diesel heightens the economic challenge associated with the potential use of this new fuel supply.

Trucks are the dominant means to move freight and goods within New Jersey. Due to the need to provide range and load capability, only two fuels meet the needs of heavy truck engines: diesel fuel (bio or petroleum); and CNG for NGVs. Interstate trucks and many existing vehicles are not compatible with CNG due to the limited availability of refueling infrastructure, but state and regional incentives to increase the availability of CNG refueling stations along interstate highways have the potential to induce heavy vehicle class conversion from expensive diesel fuel to much lower cost CNG.

NGVs offer a complementary technology to other new technologies designed to supplant gasoline and diesel fuel usage for transportation. CNG for NGVs has been commercialized around the globe for decades. Hence, NGV is not technically an innovative energy technology to meet New Jersey's environmental and economic goals. However, CNG market penetration in New Jersey has been stalled in relation to the growth of CNG in other states and Europe. High diesel fuel costs coupled with expensive emission compliance costs make CNG a viable alternative to conventional diesel engine and internal combustion vehicles. CNG has been demonstrated to work efficiently for waste haulers, package and beverage delivery services operating in a comparatively small radius around urban areas. In addition to lessening New Jersey's reliance on oil, the conversion of fleet vehicles that haul freight has the potential to serve well New Jersey's environmental objectives as tailpipe emissions from CNG do not include oxygenated hydrocarbons associated with diesel fuel.[151] There are some dedicated fleet

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[150] Diesel engines drive locomotive wheels directly; diesel-electric engines drive generators that run motors at the drive wheels.

[151] According to the DOE, tests were performed at West Virginia University's mobile chassis dynamometer laboratory that indicated that CNG trucks had much lower emissions than diesel trucks: CO was 75% lower, NO_x

vehicles fueled with CNG, the most prominent of which are waste collection trucks that start and return to the same depots daily and have a limited operational radius. Importantly, the size and weight class of the heavy truck vehicles do not allow for electric battery operation, thereby rendering conversion to CNG for freight application a potentially worthwhile initiative in accord with New Jersey's economic and environmental objectives.

Mass Transit

New Jersey's mass transit is composed of buses and commuter light rail systems. The majority of the buses are diesel, with 77 CNG buses in service (35 of which will be replaced in 2011). CNG has been demonstrated to work well for municipal bus fleets, service vans and jitneys. New Jersey's NGV fleet may be expanded in response to state and federal incentives to use CNG for transit. In addition, a limited number of hybrid diesel-electric buses have been introduced successfully elsewhere in the U.S. Many of the light rail and commuter rail systems use electric power, and recent innovations include regenerative braking, an excellent energy conservation technology that captures braking energy and applies it for acceleration. Some passenger trains still use diesel engines, but recent advances in diesel technology enable higher miles per gallon and lower emissions. Again, there is an opportunity to introduce bio-diesel blends without adversely effecting emissions or performance. Mass transit in New Jersey provides an efficient mode of transportation. Technology progress, including the blending of bio-diesel fuel, offers New Jersey potential economic and environmental emissions improvements in the years ahead.

Passenger Vehicles

Passenger vehicles continue to be dominated by gasoline fuel. Small inroads have been made by high-tech diesel engines, electric vehicles, and gas/electric hybrid vehicles, all of which offer outstanding miles per gallon. Despite some early success, CNG has not been accepted broadly as a passenger vehicle fuel. Efforts elsewhere in the U.S. to enable slow fill CNG for passenger vehicles have potential applicability in New Jersey over the long term, but the renewed emphasis on NGVs is placed on fleet conversions around major metropolitan areas rather than passenger vehicles.

The most discussed opportunity in vehicles has been all-electric and plug hybrid electric vehicles. At this time, Chevrolet, Honda, Nissan and Toyota offer all-electric or plug hybrids, with Ford and other companies expected to follow. Even with new developments in battery technology, the market penetration of the all electric or plug in hybrids is expected to be small in the next 5 to 10 years. Furthermore, there is much uncertainty about the rate of technology progress regarding advanced battery design, the impact of federal and state incentives, and the public's appetite for electric vehicles in response to escalating and volatile gasoline prices. Currently, the residential electric distribution system is adequate for only limited numbers of electric vehicles. A large expansion of this market would require off-peak charging, which residential meters do not support, and an increase in infrastructure. Nevertheless, several states

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49% lower, hydrocarbons and nonmethane hydrocarbons 4% lower, and CO_2 7% lower. See DOE/NREL Truck Evaluation Project, United Parcel Service CNG Truck Fleet: Final Results, August 2002, p. 28.

have adopted programs to promote electric vehicles, and these programs should be followed and evaluated for possible application in New Jersey.

Electric vehicle batteries can be used as a distributed energy storage resource. Coupled with smart grid technology, electric vehicles have the potential to plug-in to the electric grid, thereby providing a valuable injection when market conditions warrant. As the distribution system reflects the advent of smart grid technology and metering advances, a number of vehicle to grid applications may promote the increased penetration of electric vehicles coupled with the addition of new "renewable" technology that supplants or reduces the need for conventional resource additions.

As we look at the benefits of CNG, electric battery, and other transportation fuels, we need to recognize that existing State and federal fuel taxes provide the funds to build and maintain the intrastate and interstate highway system. In New Jersey, fuel taxes also support mass transit and the Transportation Trust Fund. Departures from the *status quo* may affect the ability to fund these societal costs on an equitable basis.[152]

7.4.3 Policy Direction and Recommendations

The Christie Administration supports initiatives that capitalize on emerging technologies for clean energy solutions in power production and transportation. While the market will determine the winners and losers, promising new technologies will require State leadership in order to build the necessary infrastructure, foster investment, and promote market penetration. The specific recommendations below identify those promising technologies that are in early stages of implementation, those that appear to have the greatest potential, and those that are "too early to call." The State must continue to monitor the evolving development and improvement of innovative energy technologies and businesses.

Monitor Progress in Fuel Cell Technology

Despite the lackluster economic performance associated with fuel cell technology to date, fuel cells still hold promise for DG applications, particularly in conjunction with CHP. New Jersey should monitor PSEG Global's joint venture and other worldwide developments pertaining to compressed air energy storage facilities. New Jersey should monitor technology progress regarding solid oxide fuel cells which has the potential to improve its economic and operational performance.

Monitor Progress in Energy Storage Technologies

Despite its promising future from a technical perspective, the primary barrier to implementation of energy storage projects is the high cost of available technologies. New Jersey should continue to monitor the evolving development and improvement in energy storage technologies. Closer examination of the life cycle costs and cost allocation issues should be addressed.

[152] This policy issue is also being discussed at the federal level; options include instituting a vehicle-miles-traveled tax and a diversion of state taxes collected on electric bills for transportation projects.

Evaluate Smart Grid Demonstrations

New Jersey expects that smart grid technology will be an integral part of the energy balance throughout the State. The JCP&L demonstration project will allow parties to evaluate the cost effectiveness of smart grid technologies and to measure energy savings and DR. This information will inform future decisions regarding the use of the technology, how it will be paid for, how the technology will be deployed, and many other policy-related issues.

Expand Dynamic Pricing and Smart Metering

New Jersey will expand implementation of smart meters and gradually expose customers with lower energy demands to dynamic pricing. Dynamic pricing customers will need the operational functionality that smart meters provide to allow such customers to see and to respond to electricity prices. The smart meters of tomorrow will have the built in capability to communicate with the evolving smart grid. This feature will strengthen New Jersey’s ability to monitor smart metering technology advances in the broader context of gauging the increased market potential of smart grid technology.

Improve Transportation Efficiency

The BPU should work with New Jersey Transit to pursue opportunities to increase the use of newer, more efficient fuels for trains and buses. The BPU, working together with DOT and DEP, will continue to monitor and evaluate the impact of battery powered vehicle design on the electric grid. Substantial modifications may be required to the primary and secondary distribution systems to support an increase in the number of electric vehicle users in New Jersey.

The enormous potential of Marcellus Shale gas promotes NGVs. The BPU, working with other State governmental entities and New Jersey’s LDCs, should assess the economic and environmental merit of promoting the substitution of NGVs for diesel fueled trucks. High conventional fuel costs and emission compliance requirements constitute market incentives to switch fleets to CNG, but other regulatory inducements may be required to accelerate the transition. A sensible first step is the promulgation of other incentives to induce waste haulers, package and beverage delivery services operating in a comparatively small radius around urban areas to switch from diesel fuel to CNG. The BPU and other state government entities should explore what state and federal incentives may be available to promote fuel substitution for diesel fueled trucks and vehicles. New Jersey’s gas utilities should provide guidance on the construction, operation and maintenance of CNG fueling stations for business fleets. CNG has been demonstrated to work well for municipal bus fleets, service vans and jitneys for small passenger service, as well. Although the prospect of CNG for passenger vehicles is eclipsed by all-electric and plug-in hybrids, New Jersey should continue to monitor technology developments affecting this promising fuel for passenger vehicles in the long run. The state supports the growth of the EV industry, and will encourage investment by the industry in infrastructure necessary to meet development consistent with federal requirements and market demand.

Create a Technology Evaluation and Verification Process

In order to get ideas to market successfully, New Jersey must adopt a technology evaluation and verification process. Such a process encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals perform a comprehensive evaluation of vendor specific claims. The result is an independent, third party confirmation of claims that provides valuable information to business and governmental decision-makers. In the past, The New Jersey Corporation for Advanced Technology (NJCAT) has provided this service for the state. NJCAT is a public-private partnership designed to promote the retention and growth of technology-based businesses in emerging fields. We will evaluate the current role of NJCAT, as well as alternative methods of carrying out this function and make a recommendation on a process going forward. In addition, the NJDEP Office of Economic Growth and Green Energy is completing a guidance document for the review of new technologies around fuel sources and their impact on energy and transportation.

Support New Jersey's Technology Incubator Network

The New Jersey Business Incubation Network (NJBIN) offers an extensive array of services to client companies, professional partners/service providers, and investors. The incubators are the home to exciting technology companies in their early stages. Access is provided to high growth, emerging, IP based technology companies that are looking to invest in these early stage companies. Through their support for emerging companies and the connections provided, the incubators can play a leading role in helping New Jersey start ups become market and industry leaders. The state should continue its support of the incubator network.

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