NEW JERSEY ENERGY MASTER PLAN

UPDATE

New Jersey Board of Public Utilities
New Jersey Department of Environmental Protection

November 2015

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TABLE OF ACRONYMS

ACE	Atlantic City Electric Company
ANSI	American National Standards Institute
BGS	Basic Generation Service
BGSS	Basic Gas Supply Service
BOEM	Bureau of Ocean Energy Management
BPU	Board of Public Utilities
BRA	Base Residual Auction
C&I	Commercial and Industrial
CC	Combined Cycle
CDBG	Community Development Block Grant
CEEEP	Center for Energy, Economic, and Environmental Policy
CEP	Clean Energy Program
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Curtailment Service Provider
DA	Distribution Automation
DCA	Department of Community Affairs
DEP	Department of Environmental Protection
DER	Distributed Energy Resources
DG	Distributed Generation
DOE	Department of Energy
DOT	Department of Transportation
DR	Demand Response
EDA	Economic Development Authority
EDC	Electric Distribution Company
EDF	Environmental Defense Fund
EDECA	Electric Discount and Energy Competition Act
EE	Energy Efficiency
EMP	Energy Master Plan
EPA	Environmental Protection Agency
ERB	Energy Resilience Bank
ESIP	Energy Savings Improvement Programs
ETR	Estimated Time of Restoration
FERC	Federal Energy Regulatory Commission
GATs	Generator Attributes Tracking System
GDC	Gas Distribution Company
GT	Gas Turbine
GW	Gigawatt
GWh	Gigawatt Hour
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
ICP	Investor Confidence Project

ICS	Incident Command System
IECC 2009	International Energy Conservation Code
IVR	Interactive Voice Response
JCP&L	Jersey Central Power & Light Company
kW	Kilowatt
LCAPP	Long-Term Capacity Agreement Pilot Program
LNG	Liquefied Natural Gas
MW	Megawatt
MWh	Megawatt Hour
NERC	North American Electric Reliability Corporation
NGV	Natural Gas Vehicle
NJAES	New Jersey Agricultural Experiment Station
NJCAT	New Jersey Corporation for Advanced Technology
NO_x	Nitrogen Oxides
OCE	Office of Clean Energy
OREC	Offshore Wind Renewable Energy Certificate
OWEDA	Offshore Wind Economic Development Act
PSE&G	Public Service Electric and Gas Company
PSN	Prepared Sale Notice
PV	Photovoltaic
REC	Renewable Energy Certificates
RECO	Rockland Electric Company
RFS	Retail Fuel Station
RGGI	Regional Greenhouse Gas Initiative
ROW	Right of Way
RPM	Reliability Pricing Model
RPS	Renewable Portfolio Standard
RTEP	Regional Transmission Expansion Plan
RTO	Regional Transmission Organization
SACP	Solar Alternative Compliance Payment
SG	Smart Grid
SO_2	Sulfur Dioxide
SREC	Solar Renewable Energy Certificate
TPS	Third-Party Supplier
TO	Transmission Owner

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 and gas distribution companies, 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 price as determined by a PJM, or other entity-administered auction, or marketplace.

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)
DEP is responsible for protecting the quality of New Jersey's air, water, land, and natural and historic resources. It issues permits for air pollution control, water pollution control, land use, and the management of other environmental impacts.

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 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.

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.

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.

Million Cubic Feet (Mcf)
Is a unit of volume of natural gas equal to 1,000 cubic feet of natural gas or approximately 1,000,000 Btus (MMBtu) of natural gas.

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.

PJM
PJM 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)
PJM's capacity pricing mechanism that attempts to set "market-based" capacity prices for different regions based on supply-side and demand-side factors submitted in annual auctions.

Renewable Portfolio Standard (RPS)
An RPS is a state requirement that mandates the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal, to meet a specified goal. 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)
An SREC is a tradable certificate that represents the clean energy benefits of electricity generated from a solar energy system. An SREC is generated after 1000 kWhs are produced by the solar system. SREC quantities are established by New Jersey's RPS, and SREC prices are established by the competitive market, up to the SACP ceiling.

Therm (t)
Is a unit of heat energy equal to 100,000 Btus or approximately 100 cubic feet of natural gas. It is a measure a natural gas used converted from volume to energy at the meter.

Third-Party Supplier (TPS)
A BPU-registered company that sells electricity or natural gas supplies directly to an energy user. This entity includes, but is not limited to, marketers, aggregators and brokers.

I. INTRODUCTION

The production and distribution of clean, reliable, safe, and sufficient supplies of energy is essential to New Jersey's economy and way of life. Energy is a vital tool of economic growth and job creation across New Jersey's entire economy. Economic growth depends on abundant, affordable supplies of energy. When considering where to locate or expand businesses often identify energy costs as second only to labor costs in their decision-making process.

New Jersey's most recent Energy Master Plan was released by the New Jersey Board of Public Utilities (BPU) in December 2011. It outlined the State's strategic vision for the use, management, and development of energy in New Jersey over the next decade. It further serves as a guide to the present and future energy needs of the State. This document is an update to the 2011 Energy Master Plan (2011 EMP); it is not a rewrite of the 2011 EMP.

The 2011 EMP has guided both the Administration and private-sector decision makers through a period of economic challenge. It has provided long-term goals and implementation strategies flexible enough to respond to market changes and new information about the relative merit of competing energy technologies and strategies. It also helped guide decisions that affected the State's environment, most notably New Jersey's air quality. Energy production and use, economic growth, and environmental protection are all inextricably linked and must be considered together. As this report shows, New Jersey is achieving a successful balance among these three areas.

The impact of energy costs on New Jersey's economy must be balanced with the economic benefits offered by the energy sector. The generation and delivery of reliable and safe energy is a key element of a healthy economy. The economic data reported by the New Jersey Utilities Association shows the significant capital infusion offered by all the regulated utilities operating in New Jersey.

The regulated companies serve nearly seven million residential customer accounts and one million non-residential customer accounts 24 hours a day, 365 days a year. The companies employ approximately 28,000 men and women for a combined payroll in excess of $2.5 billion per year. New Jersey's investor-owned utilities own and operate physical infrastructure valued at more than $37 billion and have been making capital expenditures in New Jersey averaging more than $4.4 billion per year – investment that strengthens and enhances the State's economy and critical infrastructure.

In addition, these companies contribute approximately $837 million in annual revenues to local and state government through gross receipts, corporate business, property and various excise taxes. These positive economic impacts do not account for the employment or other financial contributions from the generation industry, renewable energy and energy efficiency sectors.

When the utility industry's substantial financial contribution to the state's economy are coupled with the companies' critical mission of managing and maintaining their infrastructure, which keeps the electric, gas, water and data flowing, it's easy to appreciate why stable and viable

utility companies are critical for the existence of all businesses and residents in New Jersey.

Included in this update are measures of the State's progress toward achieving the 2011 EMP goals. Where circumstances have changed, the update makes adjustments to certain goals. For example, the 2008 Energy Master Plan warned that natural gas was in short supply and three times the cost of coal, contributing to much higher costs for both electric and heating customers. By 2011, however, the energy landscape had changed. The United States had become a dominant producer of natural gas, driving down electric and heating prices. As a consequence, the 2011 EMP encouraged greater use of natural gas to improve the environmental performance of the state's power generating units and to drive down the cost of energy for consumers. This policy decision was critical to New Jersey's success in driving down the cost of electricity.

Where goals from the 2011 EMP have been modified or altered in this update, those changes reflect the effects of a new energy environment.

This EMP Update also includes a new section to address the challenges to New Jersey's energy infrastructure identified in the aftermath of Superstorm Sandy. It also includes a report on the ways in which the Administration is addressing those challenges.

In developing this update, BPU held three public hearings: August 11, 2015 in Newark; August 13, 2015 in Trenton; and August 17, 2015 in Galloway. In addition, written comments were received by BPU over a 30-day period ending August 24, 2015. A total of 82 individuals offered comments at the public hearings. In addition, 1093 written comments were received and reviewed. The written comments were posted to BPU's website and can be found at http://nj.gov/emp/comments/2015/approved/comments_archive.html. In preparing this update, BPU considered all of the comments offered on all relevant topics in the public hearings and submitted in writing.

Finally, this EMP Update will help ensure that New Jersey continues to advance the goals of the 2011 EMP, meets the new challenges which have arisen since 2011, and meets the needs of a thriving and prosperous state.

II. FIVE OVERARCHING GOALS

The 2011 EMP contains five overarching goals:

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/Reduce Peak Demand**
4. **Capitalize on Emerging Technologies for Transportation and Power Production**
5. **Maintain Support for the Renewable Energy Portfolio Standard**

Over the past 3 years New Jersey has made substantial progress in advancing these five overarching goals. This section of the EMP Update summarizes the progress made toward meeting each of the five goals.

Periodic reporting on the progress towards achieving the goals of the 2011 EMP:

- Identifies when progress toward a goal is on target;
- Provides the opportunity to make for midpoint corrections in policies or programs when needed; and
- Allows the State to identify new challenges due to changing circumstances affecting the energy environment.

1. Drive Down the Cost of Energy For All Customers

Since the issuance of the 2011 EMP, electricity prices in New Jersey have fallen across all customer classes. On average, the residential customer's electricity prices have fallen by over three (3) percent between 2011 and 2015. The state has dropped from having the fourth highest costs in the nation to tenth highest costs. This is progress, but it is not enough.[1] New Jersey should continue to pursue measures that will help drive down prices even further, especially because future costs associated with building significant new transmission infrastructure will place upward pressure on prices.

Today, New Jersey's natural gas prices are among the lowest in the country. Prices in our state were the 17th highest in the nation in 2011; today we rank 46th.[2] This huge decrease was anticipated in the 2011 EMP and has been critical to successfully reducing the cost of electricity and improving the environmental performance of New Jersey's electric generation.

The State's commitment to actively promote new electric natural gas generation and the enhancement and expansion of the natural gas transmission and distribution system, has helped

[1] http://www.eia.gov/electricity/monthly. The ranking is from highest (1) to lowest (50)
[2] http://www.eia.gov/state/rankings. The ranking is from highest (1) to lowest (50)

to reduce energy costs. Over the past several years, more than $1 billion in new and upgraded natural gas distribution infrastructure has been added in New Jersey. This has helped to moderate New Jersey energy prices overall and has the potential to increase economic development in the State.

Looking beyond the price of electricity and natural gas, the word "energy" also can be used to encompass all sources that produce power. It includes electricity and the sources that generate it, fuels used for heating and industrial processing, and fuels used for transportation. Although retail electricity prices range higher relative to other states, the latest data from the United States Energy Information Agency (EIA) and Gas Buddy shows that the average New Jersey energy customer has a lower overall energy cost than most of the country when combining the cost of electricity, natural gas, and gasoline.

This simple fact, when viewed from the perspective of state energy policies, can assist the State in its overall economic development efforts, especially in industries that use natural gas as a raw material in the development of products, such as the pharmaceutical and chemical industries. It also can assist in developing and expanding clean in-state electric generation, including renewables and distributed generation, as well as advancing energy efficiency and demand response given the customers availability to potentially finance projects.

New Jersey also offers a number of programs designed to assist low and moderate income New Jersey households. The Board created the Universal Service Fund ("USF") to help make energy more affordable for qualifying households. The Board also established the Temporary Relief for Utility Expenses ("TRUE") and Payment Assistance for Gas and Electric ("PAGE") programs to assist low and moderate income New Jersey households experiencing a temporary financial crisis. The Board mandated a Winter Termination Program ("WTP"), which protects specific categories of customers from having their gas or electric service shut off between November 15th and March 15th.

In addition, the Lifeline Program, administered by the NJ Department of Human Services provides an annual benefit to seniors and the disabled who meet eligibility requirements; and the Low Income Energy Assistance Program ("LIHEAP"), administered by the NJ Department of Community Affairs, helps New Jersey households including some renters pay for heating costs and certain medically necessary cooling expenses.

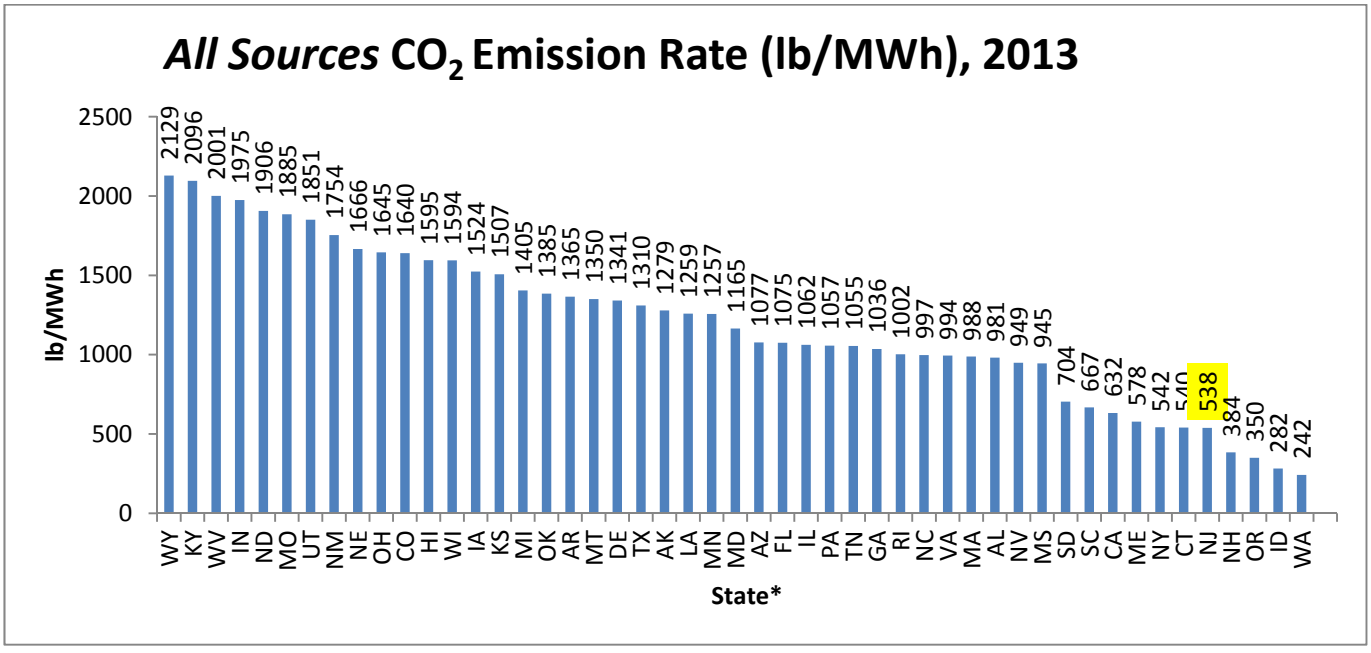
Further reductions in the cost of energy, especially electricity, will help to increase the State's economic competitiveness.

2. Promote a Diverse Portfolio of New, Clean, In-State Generation

New Jersey has made significant progress toward achieving a diverse portfolio of clean energy. The State's promotion of new electric natural gas generation has contributed to this progress. Currently, more than 2,000 megawatts (MW) of new combined cycle natural gas generation units are under construction and all will be operational by 2015-2016 calendar years.[3] This newer, more efficient generation will help maintain lower wholesale prices for electricity, reduce emissions, and maximize integration of variable and intermittent power produced by renewable energy sources.

New Jersey also has benefitted from the enhancement and expansion of its natural gas transmission and distribution systems. Expanding and upgrading the natural gas inter- and intra-state pipelines will help further lower the cost of energy to New Jersey's homeowners and businesses and reduce emissions. BPU has approved almost $1 billion for natural gas utility infrastructure upgrades and mitigation projects. An additional $280 million in proposed projects is pending.

New Jersey enjoys some of the lowest emission rates from power plants in the country. According to the U.S. Energy Information Administration (EIA), New Jersey's sulfur dioxide (SO_2) emissions are amongst the three lowest states in the nation and nitrogen oxide and carbon dioxide (CO_2) emissions are amongst the six lowest states in the nation. In comparison to the 13-state PJM regional transmission region, New Jersey ranks, by far, the lowest of all.



*(Vermont excluded; limited power sector);
Source of Base Data: 2013 EIA State Historical Tables 1991-2013 (www.eia.gov/electricity/data/state); Emission Rate calculated as: (total emissions in Metric Tons/total generation in MWh) X 2,204.6 pounds/metric ton.

[3] Source: PJM market data and DEP Air Permits.

And, looking just at the fossil-fuel sector, New Jersey's existing electric generation power sector already beats the carbon dioxide standards for *new* fossil electric generators contained in the U.S. Environmental Protection Agency's (EPA) "Clean Power Plan." These low levels of emissions are especially impressive given the fact that New Jersey is the 22nd largest generator of electricity in the nation. (See Appendix, p. 58-63, 64, 65, 67, 68).

New Jersey's four nuclear power plants (at two sites) produce, on average, about 50 percent of New Jersey's electric power. Because nuclear power plants do not emit greenhouse gases and criteria pollutants, nuclear power generation in New Jersey is a critical component of the State's clean energy portfolio.

The State is ranked among the top three states in the nation in production of solar energy and ranks second for "net-metered" solar generation. Net metered systems produce and use energy on-site, as opposed to large scale, grid-supply projects that consume vast amounts of open space measured in square miles. This reflects the State's commitment to this clean, renewable energy source while not sacrificing open space to achieve this goal.

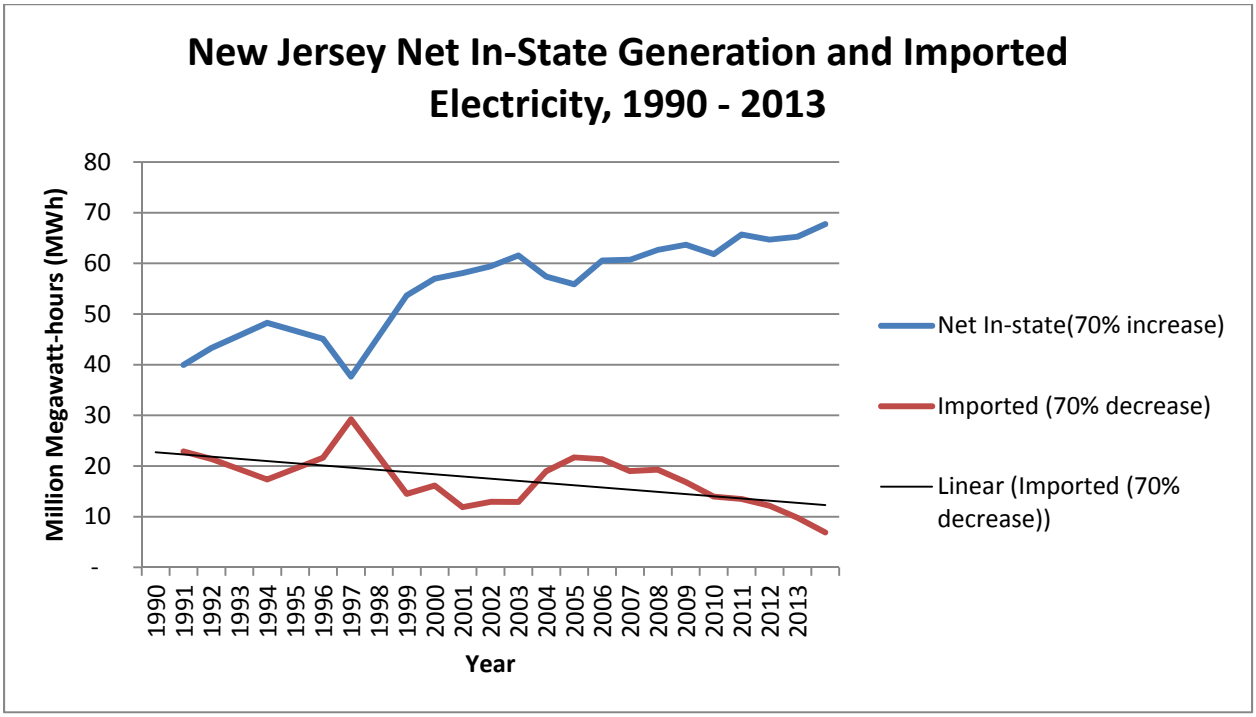
Since 2011, nearly 100 MW of new Distributed Generation (DG) Combined Heat and Power (CHP), and fuel cell power generating facilities have been installed. We recognize the importance of these DG technologies for decreasing dependence on the grid and increasing energy resilience – important lessons underscored by the experience from Superstorm Sandy. Both of these technologies are critical to reducing emissions from our power sector.

Combined heat and power facilities, MW for MW, yield approximately three times the carbon reduction benefit of photovoltaic (PV) solar and, in comparing the State's investment in dollars per ton of CO_2 displaced, CHP has received roughly 1/20th the financial support of PV solar. The development of financing programs through the Energy Resilience Bank (ERB), coupled with policy changes and other incentives in place since the 2011 EMP, will further assist in advancing progress toward this goal.

The development of microgrid projects, including single building, campus-wide and advanced microgrids to address enhanced energy resilience will also help meet the goal for new DG, CHP, and fuel cells. Two advanced microgrid studies funded by the U. S. Department of Energy (DOE) in partnership with BPU have been completed – one in Hoboken and one for NJ TRANSIT.

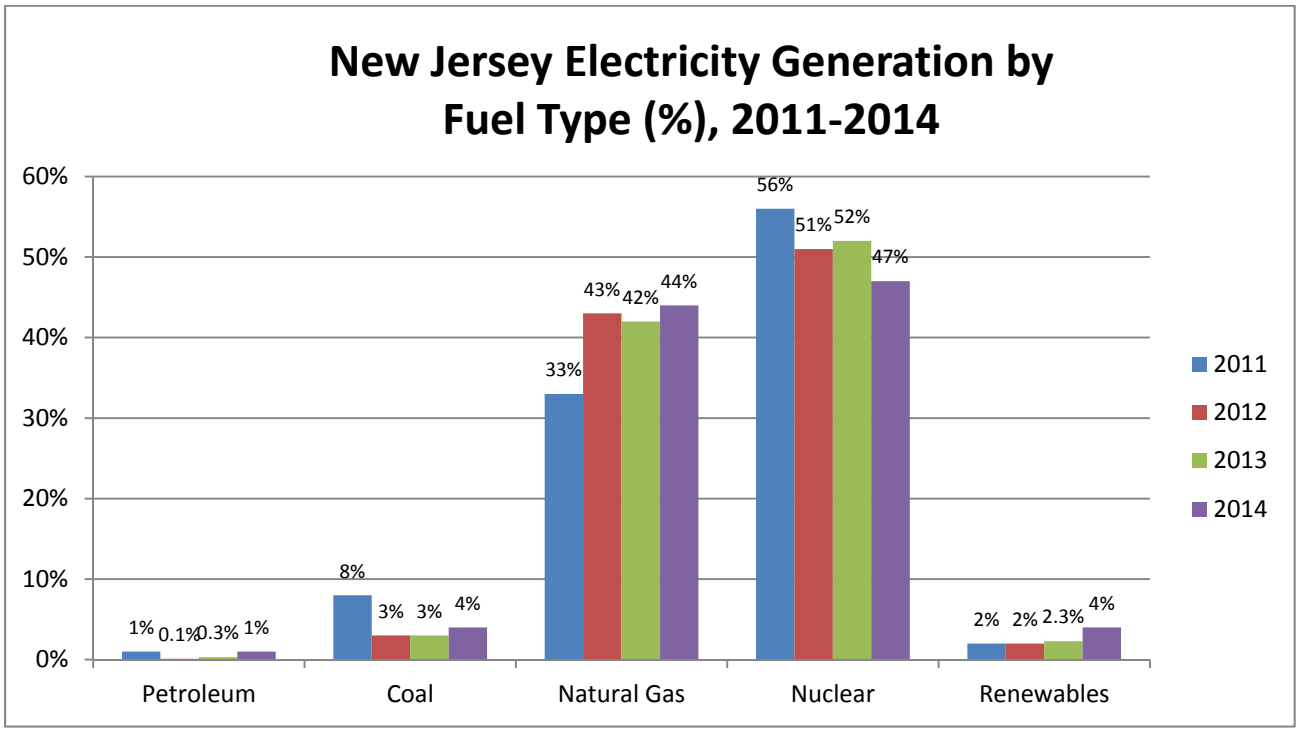
NJ TRANSIT sought funding to implement the microgrid study as part of the DOE/BPU partnership and, on November 5, 2014, the U.S. Department of Transportation awarded to NJ TRANSIT $409,764,814 in competitive federal funding to advance the project: a first-of-its-kind microgrid capable of providing highly reliable power to support critical transit services. "NJ TRANSITGRID," as the project will be called, will include DG, CHP, and fuel cell elements.

Between 2011 and 2014, electricity usage in New Jersey from in-state sources increased slightly from 65 million MWh to 67 million MWh. Significantly, however, imports from out-of-state substantially declined from 15 million MWh to 9 million MWh, demonstrating a net decrease in overall consumption from 80 million MWh to 76 million MWh between 2011 and 2014. (See Appendix, p. 66).



*In 2013, NJ imported approximately 9% of its electricity needs (Source: NJDEP)
Source of base data: **USDOE/EIA,** 30 September 2015 **(http://www.eia.gov/electricity/state/newjersey/)**

As the chart below shows, New Jersey's in-state electricity generation by fuel type has changed significantly since 2011. In-state electricity generation is measured as the total retail sales, less the out-of-state imports. Notably, imports now only account for approximately 12% of New Jersey's total electricity usage. Between 2011 and 2014, coal in-state generation was cut in half, from 8% to 4%; renewables doubled, from 2% to 4%; natural gas increased by one-third, from 33% to 44%; and nuclear held steady at an average of about 50 percent (the annual rate fluctuates due to scheduled and unscheduled outages). With the drop in natural gas prices, electricity demand has increasingly been met by cleaner, in-state, combined cycle natural gas generation (NGCC) and less on imported power from facilities with higher, more polluting, emission profiles. (See Appendix, p. 57).

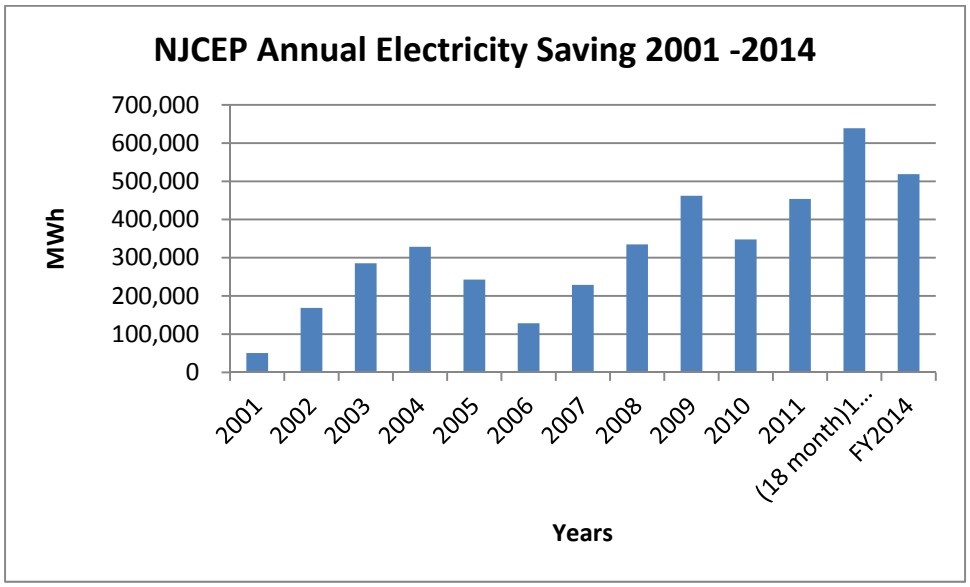


Source of Base Data: EIA State Electricity Profiles – New Jersey

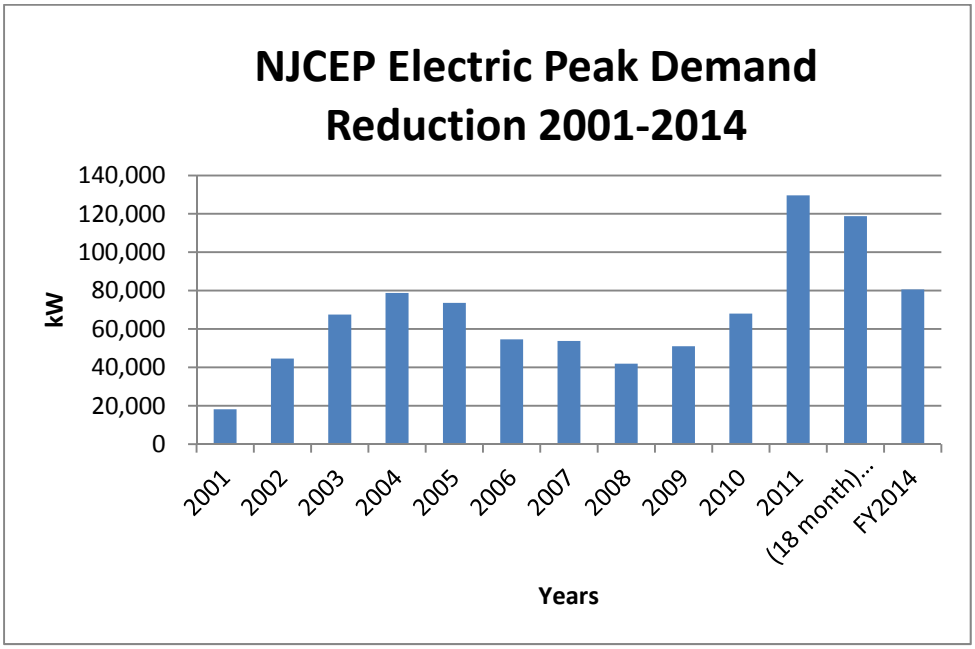
3. Reward Energy Efficiency and Energy Conservation/Reduce Peak Demand

The State has implemented a variety of Energy Efficiency (EE) and conservation programs, including CHP programs, to advance the goal of improving energy efficiency, conserving energy and lowering ratepayer costs by reducing our peak demand, which effectively determines a large portion of our total electricity bill. The State's wide array of conservation, EE, and CHP programs were designed to be a cost-effective way to reduce energy and capacity costs and reduce emissions. Nevertheless, as the State's energy portfolio changes, programs that were once cost-effective may no longer provide the same savings.

The New Jersey Clean Energy Program's (NJCEP) programs assist ratepayers with reducing energy need and reducing costs. These programs have resulted in savings of over 4 million MWh of electricity and 80 million therms of natural gas, between Calendar Year (CY) 2001 and Fiscal Year (FY) 2014. They also resulted in over 860 MW of peak demand reduction during this same time period. These energy savings by customers have the net result of less electricity and natural gas having to be produced, generated, transported and distributed through the energy systems. The NJCEP programs help to lower the overall environmental impact of energy usage and, in the case of peak demand reductions, help to reduce costs to all ratepayers. The BPU is currently in the process of transitioning from three market managers to a single market manager, which is expected to further develop cost savings and efficiencies.

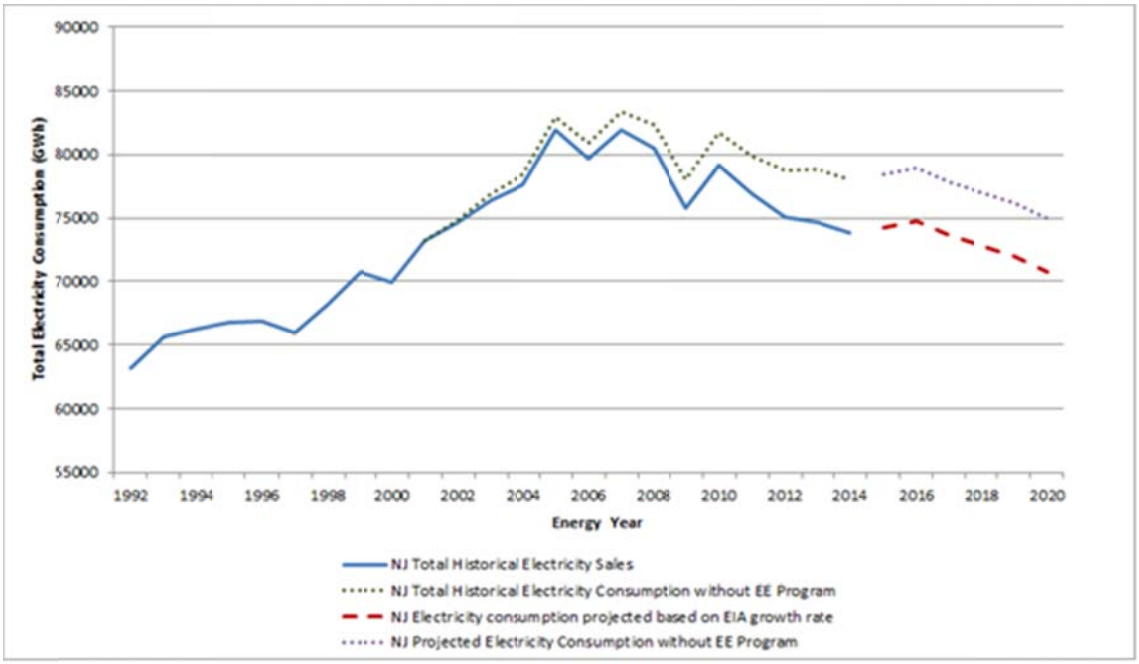


The CY 2001 program operated for less than six months during the initial startup of the programs. The 2012- 2013 program year is extended to 18 months due to changeover from a calendar to a fiscal program year. Data from the NJCEP programs - http://www.njcleanenergy.com/main/public-reports-and-library/financial-reports/clean-energy-program-financial-reports



The NJCEP reporting was initially based on a calendar year (CY) basis. The CY 2001 program operated for less than six months during the initial startup of the programs since the program was approved by the BPU as of March 2001 and was not operation until June 2001. The 2012- 2013 program year was extended to 18 months due to changeover in that year from a calendar year to a fiscal program year reporting. Data from the NJCEP programs - http://www.njcleanenergy.com/main/public-reports-and-library/financial-reports/clean-energy-program-financial-reports.

The chart below shows the impact of energy efficiency measures on electricity use in New Jersey, illustrating both the actual usage and what the expected usage would have been absent any energy efficiency programs.



NJ Historic electric sales from EIA: http://www.eia.gov/electricity/data/state/sales_annual.xls. NJ electric energy savings from http://www.njcleanenergy.com/main/public-reports-and-library/financial-reports/clean-energy-program-financial-reports

In addition to the peak demand from NJCEP programs, demand reduction (DR) programs are operated through electric distribution companies (EDCs) and third party curtailment service providers (CSPs). These programs include appliance cycling and large customer curtailment programs, which further reduce annual demand by approximately 200 MW, providing both economic and environmental benefits for ratepayers.

Furthermore, the EDCs and gas distribution companies (GDCs) operate EE and/or RE programs in their services territories. An amendment to the Electricity Discount and Energy Competition Act (EDECA) in 2008 allowed the EDCs and GDCs to implement EE and renewable energy (RE) programs on their side of the meter (distribution supply side) or the customer side of the meter (demand side).

Since the EDECA amendment was enacted, Public Service Electric & Gas (PSE&G), New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas have been approved to operate natural gas EE programs in their respective service areas. Rockland Electric Company and PSE&G have submitted, and been approved, to operate both gas and electric EE programs in their service areas. These programs complement and enhance the NJCEP EE programs. The BPU is currently exploring ways to enhance and expand these programs to achieve a higher degree of cost effective energy savings.

4. Capitalize On Emerging Technologies For Transportation and Power Production

New Jersey will continue to evaluate emerging energy technologies for energy production and transportation, but will concentrate on implementing new technologies that are cost effective, that advance both economic development and environmental quality, but have yet to penetrate the market. For example, CHP has proven its worth in terms of cost, reliability, emission reduction, and resiliency, but has been slow to take hold in the business sectors for which it is primarily suited. Similarly, there have been advances in transportation technologies that make electric, natural gas, and hybrid technology worthwhile for heavy duty and passenger vehicles, but the markets are not yet fully developed.

Energy markets can change quickly and therefore can affect the success or failure of virtually any technology. These changes have been most noticeable in the recent price decreases of petroleum and natural gas. It is worth noting that the 2008 EMP warned of overreliance on natural gas due to its high costs and lack of supply. The markets dramatically changed by the time of issuance of the 2011 EMP, with the United States transforming from a major importer to a dominant world source of natural gas and petroleum.

New Jersey has many options to pursue for clean and cost-effective sources of electricity, to utilize fuels more efficiently, and to reduce reliance on gasoline and diesel fuel as transportation fuel. These technologies will reduce emissions, create jobs, and help businesses throughout the State.

In addition, consumers seeking to purchase energy efficient products also increasingly have more choices available to them. Consider that as recently as 2010, Chrysler did not have any vehicles delivering 30 mpg; now, it manufactures a half dozen. And in 2012, General Motors sold more than one million vehicles that deliver 30 mpg or better. Last year, Ford offered eight models that are expected to deliver 40 mpg or higher. These trends in fuel efficiency are expected to continue.

As of June 2014, a total of 222,590 plug-in vehicles have been sold since the mass market roll-out in late 2010. The June 2014 number reflects 99% growth over the 111,962 sold through June 2013. In a single year-over-year comparison, 110,628 plug-ins were sold from July 2013 through June 2014, a 46% increase over the 76,045 sold between July 2012 and June 2013. The drop in petroleum prices will likely affect this trend, slowing EV sales and driving an upsurge in purchases of light trucks and SUVs. Market forces and consumer interest can quickly overwhelm policy objectives.

Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and natural gas heavy duty vehicles have the potential to increase energy efficiency and reduce emissions in the transportation sector. Worldwide, the automobile industry has made strides in the development of electric-hybrid and electric and natural gas passenger vehicles.

The State must continue to expand its efforts to promote the use of alternative fuel vehicles. The State is committed to promoting and removing barriers to the development of infrastructure needed throughout the state to encourage heavy duty vehicle class conversion from expensive and polluting diesel fuel to less costly and clean natural gas (CNG and LNG). The State will continue to facilitate the infrastructure needed to support broader use of alternatively-fueled vehicles by fleet owners as well as individuals. The State will also promote new and cleaner in-state power generation and the improvement of our electric grid, which will be needed as the electric vehicle industry continues to grow on a state and national scale. The BPU and DEP are exploring programs they can develop and implement to enhance and expand the use of alternate-fueled vehicles.

5. Maintain Support for the Renewable Energy Portfolio Standard

New Jersey remains committed to meeting the renewable energy production target of 22.5% by 2021, which was established by BPU in 2006, and adopted in subsequent energy master plans published in 2008 and 2011.[4] As set forth at N.J.S.A. 48:3-51, New Jersey statutes define two types of renewables, Class I and Class II.

"Class I renewable energy" means electric energy produced from solar technologies, photovoltaic technologies, wind energy, fuel cells, geothermal technologies, wave or tidal action, small scale hydropower facilities with a capacity of three megawatts or less and put into service after the effective date of P.L.2012, c.24, and methane gas from landfills or a biomass facility, provided that the biomass is cultivated and harvested in a sustainable manner.

"Class II renewable energy" means electric energy produced at a hydropower facility with a capacity of greater than three megawatts (MW) and less than 30 MW, or a resource recovery facility, provided that such facility is located where retail competition is permitted and provided further that the Commissioner of the New Jersey Department of Environmental Protection (DEP) has determined that such facility meets the highest environmental standards and minimizes any impacts to the environment and local communities.

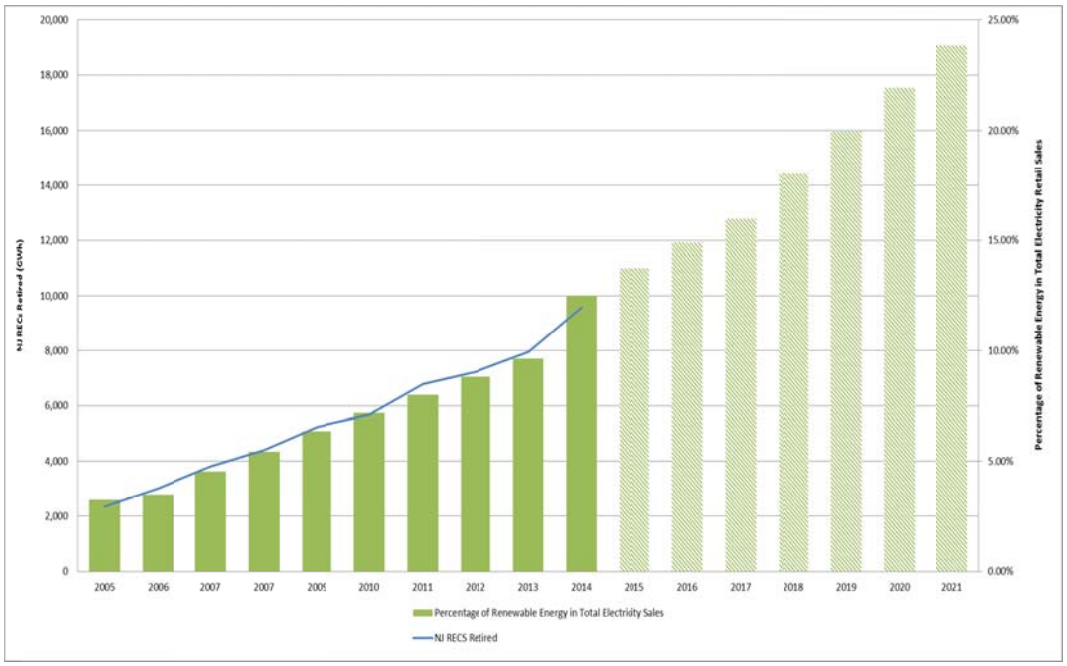
The State's RPS can be met by both in-state electricity generation as well as electricity delivered throughout the PJM region. Compliance with the Class I, Class II and Solar renewable energy portfolio standards (RPS), other than for small scale hydropower facilities and solar PV, can be accomplished through purchase of renewable energy certificates (REC) generated by facilities supplying the PJM region, but solar and small scale hydropower facilities must be connected to the New Jersey distribution system in order to generate RECs for compliance with the RPS.

[4] Based on recent amendments to N.J.S.A 48:3-87 the total Class I, Class II and Solar RPS will be 24.39% in Energy Year 2028.

A REC, Solar REC (SREC) or Offshore wind REC (OREC) represents the environmental attributes of renewable energy and does not represent the actual electricity generated by the renewable energy source. The actual electricity generated from the renewable source is either unbundled or sold separately into the PJM Energy Market, or used onsite through net-metering. A history of the RPS is available at http://www.njcleanenergy.com/renewable-energy/program-activity-and-background-information/rps-background-info. The total minimum RPS requirement for Energy Year 2028 is 24.39%.

As set forth at N.J.A.C. 14:8-2 and N.J.S.A 48:3-87 the EY 2016 RPS in New Jersey are 9.649% Class I, 2.75% solar, and 2.5% Class II.[5] The State is on schedule for meeting its RPS requirements, as illustrated by the following graph. Compliance with the overall RPS will be maintained since suppliers/providers of energy serving New Jersey customers must either purchase RECs or pay the alternate compliance payment (ACP) at the levels required to meet the Renewable Portfolio Standard (RPS). Once RECs are submitted for compliance purposes, they are counted towards the RPS and retired by PJM through the Generator Attributes Tracking System (GATS).

NEW JERSEY'S RENEWABLE ENERGY



Source: NJ's Renewable Portfolio Standard Rules Report, BPU 2015 (http://www.njcleanenergy.com/files/file/Final_2010_Annual_Report_for_New_Jersey_RPS.pdf) and Center for Energy, Economic & Environmental Policy (CEEEP) New Jersey Total Electricity Consumption Prediction.
Statutory Solar RPS for EY 2011, 2012 and 2013 are expressed as set MWh requirements. Percentages shown are based upon retail sales.

[5] Source; http://nj.gov/bpu/agenda/rules/ The current Energy Year for compliance with the New Jersey RPS is EY 2016 which is from June 1, 2015 to May 31, 2016. The NJ RPS Energy Year coincides with the PJM Energy Year. The values for Energy Year 2015 are preliminary and are being verified by BPU OCE.[5]

In EY 2012, the RPS for both Class I and Class II renewable energy was achieved through a combination of in-state and out-of-state sources. All of the solar renewable energy to meet the solar RPS was provided by in-state sources.

Renewables installed in New Jersey advance the State's goal of increasing diverse, clean in-state generation. The Solar Act of 2012, signed by Governor Christie, has helped to lower the cost of solar to the ratepayer and has stabilized the solar market. 2.75% of the electricity used by New Jersey electric customers will be generated from solar after this full Energy Year and only a handful of states can make this claim. New Jersey is third in the nation for total installed solar capacity, behind only California and Arizona[6]. The Solar Act of 2012 successfully stabilized the SREC market by boosting the RPS for several years and protected ratepayers through a reduction in the RPS requirements originally scheduled for later years.

Solar energy dominates New Jersey's in-state renewable electricity generation. It has required – and continues to require – policy support and significant subsidies to implement. However, the significant drop in the cost of solar means this policy should be continually evaluated, especially if solar reaches parity with the cost of grid power. Given the current cost projections, this will occur in the foreseeable future with larger commercial and grid supply systems. The added costs associated with upgrades to the electric transmission and distribution grid become increasingly critical to consider as this intermittent renewable energy technology becomes a larger part of New Jersey's energy portfolio.

New Jersey's limited ability to generate renewable energy in-state is due to its constrained geographic size, dense development, and limited climatic and natural resource features (e.g., solar radiance, wind, and hydrologic assets). Overall, 24% of the RPS is coming from in-state sources and 76% from out-of-state sources. The REC is supplied through a market mechanism based on the most competitive supply. The EY 2012 out-of-state RECs were supplied from renewable energy facilities in Illinois (26%), Pennsylvania (17%), Indiana (15%), West Virginia (9%), Ohio (4%), Virginia (3%) and Maryland (2%). All of the solar RPS is achieved through in-state supply[7].

The BPU and the Electric Distribution Company (EDC) solar programs assist residents and non-residential customers with installing solar at their homes, businesses, and public buildings. Because of the commitment to solar, New Jersey residents and businesses experience some of the lowest installation costs in the country. Nonetheless, the State should continue to evaluate the costs and benefits of this technology versus other technologies (both economic and environmental), and analyze the future need for and scope of subsidies to support the continued development of the maturing solar industry.

[6] http://www.seia.org/research-resources/2013-top-10-solar-states
[7] Clean Energy State Alliance (CESA) Cross State RPS Implication Report Feb 2015

III. PLAN FOR ACTION

The 2011 EMP set forth a Plan for Action that grouped 31 policy recommendations into four general sections, which are shown below:

- ❖ Expand In-State Electricity Resources
  - Build new in-state generation
  - Develop 1500 MW of CHP and DG
  - Evaluate lost nuclear capacity
  - Promote expansion of gas pipelines
  - Clean energy to be 70% of supply by 2050

- ❖ Cost Effective Renewable Resources
  - Temporarily increase the solar Renewable Portfolio Standard (RPS)
  - Evaluate and lower Solar Alternative Compliance Payment (SACP)
  - Extend the EDC's solar programs
  - Evaluate solar incentives
  - Return to the percentage obligation for solar
  - Promote certain solar photovoltaic (PV) installations
  - Reduce the cost of solar panels
  - Support offshore wind
  - Monitor European and Chinese wind
  - Promote effective use of biomass
  - Exploit tidal power in New Jersey
  - Support other renewable technologies

- ❖ Promote Cost Effective Conservation and Energy Efficiency
  - Evaluate alternatives to Office of Clean Energy (OCE) programs
  - Incentivize geothermal heat pumps
  - Monitor EE effect on solar
  - Promote EE and Demand Response (DR) in State buildings
  - Monitor PJM's DR programs
  - Evaluate use of sub-metering in residential buildings
  - Apply cost benefits test to EE programs
  - Evaluate dynamic pricing and metering
  - Add aggressive EE building codes
  - Increase natural gas EE
  - Expand education and outreach
  - Monitor energy storage developments

- ❖ Support the Development of Innovative Energy Technologies
  - Improve vehicle efficiency and funding
  - Support emerging technologies

This EMP Update adds a new section, "Improve Energy Infrastructure Resiliency & Emergency Preparedness and Response," based upon New Jersey's **Plan for Action** in the aftermath of Superstorm Sandy.

- ❖ Improve Energy Infrastructure Resiliency & Emergency Preparedness and Response
  - Protect the State's critical energy infrastructure
  - Improve EDC emergency preparedness and response
  - Increase the use of microgrid technologies and applications for distributed energy resources (DER)
  - Create long-term financing for resiliency measures through the ERB

Expand In-State Electricity Resources

- *Build New In-State Generation*

2011 Goal

The 2011 EMP directs the State to address barriers to new in-state generation in relation to regulatory authority and actions of the Federal Energy Regulatory Commission (FERC) and PJM; i.e., investigate New Jersey's electric capacity needs, transmission planning, proper functioning of the power market, barriers to, and opportunities for, new entry, and to implement the Long-Term Capacity Agreement Pilot Program (LCAPP) legislation enacted in 2011. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 81-84.]*

Goal Status

The BPU expects that more than 2,000 MW of new capacity will be in operation in calendar years 2015 and 2016. The Long-Term Capacity Agreement Pilot Program (LCAPP) was key to drawing attention to building new, in-state power generation. The LCAPP law was challenged and on October 11, 2013 the U.S. Federal District Court held that the LCAPP law interferes with FERC's ability to run a competitive capacity market and is, therefore, unconstitutional under the Supremacy Clause of the U.S. Constitution (a comparable action by the Maryland Public Service Commission was overturned for federal preemption). The United States Court of Appeals for the Third Circuit affirmed the District Court's ruling, which prompted the State to petition for certiorari to the U.S. Supreme Court.

The denial of Maryland's program was appealed to the Fourth Circuit, which upheld the ruling and likewise prompted a petition for certiorari. To date, the Court has not acted on New Jersey's petition. However, on October 19, 2015, the Supreme Court of the United States granted certiorari to review the Fourth Circuit's determination that the Maryland Public Service Commission's Generator Order is preempted by federal law. The Maryland

Generation Order and New Jersey LCAPP Act are factually similar and share the same legal question of whether state-sponsored contracts for differences that require participation in the PJM capacity market are preempted by federal law. Thus, despite the Court neither granting nor denying petitions for certiorari of New Jersey's LCAPP Act, the Court's ruling in the Maryland case will determine the fate of LCAPP.

Prior to the Federal District Court's ruling, three contracts were awarded under the LCAPP program: Hess Corporation's 655 MW plant in Newark (which, since its sale by Hess, is now known as the Newark Energy Center); NRG Energy Inc.'s 680.1 MW plant; and CPV Power Development's 663.4 MW plant in Woodbridge.

As required under LCAPP, the three selected companies bid into PJM's May 2012 capacity auction (requiring capacity to be available beginning June 1, 2015). The CPV Power and the Newark Energy Center projects cleared the 2012 auction. NRG's project, however, did not and, after also failing to clear in the 2013 auction, was canceled. An additional project – LS Power's 770 MW plant in West Deptford – which was not chosen under LCAPP but nevertheless bid into the 2012 PJM Capacity Auction – cleared the auction as well.

As stated earlier, the BPU expects more than 2,000 MW of new capacity to be built and in operation by 2015-2016. The Newark Energy Center is nearly complete, LS Power Plant (Phase 1) began construction in early 2012 and is now in service, with Phase 2 under construction with an expected operation date in 2016, and the Woodbridge Energy Center is under construction and is expected to be in service by early 2016. In addition, the 563 MW BL England repowering project, which includes an upgrade from coal to cleaner burning natural gas, awaits a decision on the alignment and construction of a new natural gas pipeline.

While imports of electricity from out-of-state sources are down in recent years because of lower prices and lower demand, increases in these areas could result in higher imports of electricity and the need to increase transmission lines and systems if sufficient in-state generation is not available. Lower cost and more efficient in-state electricity generation, as well as increased energy efficiency, including increases in the building energy codes and appliance standards, can continue to stabilize and potentially lower New Jersey's electricity costs.

The increase in in-state electricity generation to maintain the progress on controlling energy costs must also include newer, more efficient distributed generation such as combined heat and power, fuel cells and solar. Interest in local generation is growing alongside interest in DG. Distributed generation technologies can also improve and enhance the State's energy resiliency at the local level through the development and implementation of microgrids.

Recommendations

The State will continue to encourage new in-state generation, especially in areas of high congestion. The State will continue to work to assist in reducing financial, regulatory, and technical barriers and provide for opportunities for new entry. The State will continue its evaluation and analysis of New Jersey's electric capacity needs as well as other issues

associated with transmission planning to identify areas of congestion, inordinately high electricity prices, and the proper functioning of the power market. This includes enhancing the capacity of the natural gas pipeline infrastructure to take advantage of low natural gas prices to assist in lowering electricity prices.

- *Develop 1500 MW of Combined Heat and Power (CHP) and Distributed Generation (DG)*

2011 Goal

Distributed Generation includes on-site generation from both renewables, such as solar, wind and biomass, and conventional fossil fuel facilities. Combined Heat and Power facilities include district power plants that produce electricity while capturing and making use of thermal energy, as well as smaller units for on-site energy needs of a specific facility. The specific goal identified DG to reduce peak and included development of 1,500 MW of new CHP by 2021. [*For more detailed information about this subject see the 2011 Energy Master Plan, pages 84-85.*]

Goal Status

The total new DG capacity installed since 2011 is over 1,300 MW in over 31,000 facilities statewide. This includes CHP, fuel cells, wind and solar. Development of DG in New Jersey has been dominated by solar. To qualify for SRECs, all New Jersey solar must be connected to the distribution system and would qualify as DG, whether used on-site or as grid supply.

New Jersey has almost 3,000 MW of CHP which is one of the highest concentrations of CHP in the country, but only 10 percent is classified as DG. Less than 100 MW of new CHP has been installed since 2011. Of all the DG systems promoted and advanced by New Jersey, including solar, CHP is the most energy efficient and cost effective in terms of emission reductions. Because of its ability to run continuously, it also improves and enhances local energy resiliency and reliability and can provide the basis for a microgrid.

The 2011 goal of seeking 1,500 MW of CHP by 2021 was set at a specific incentive level based on the 2010 USDOE CHP Technical Assistance Program-Market Assessment study. Since Superstorm Sandy, however, the conditions for establishing this goal have expanded from economic and environmental benefits to also include energy resiliency. The implementation of resilient DG for the establishment of micro-grids is another technology under active development; however, it is more costly and takes more time to develop such projects.

With the current economic environment, and the low rate of participation in existing incentive programs, the remaining CHP market potential may be insufficient to produce additional new CHP without a more targeted effort. The State is pursuing strategic measures to advance new CHP, such as leveraging the outreach and funding available through the ERB and other means, including revisions to the NJCEP CHP and fuel cell incentive programs.

Several State agencies are collaborating in order to achieve the goal of developing 1,500 MW of new CHP projects. The DEP recognizes the environmental and energy benefits and has

simplified approvals for CHP technology by developing streamlined general permits under its air quality permitting program. The BPU administers a CHP-Fuel Cells incentive program for both large and small facilities and both BPU and Economic Development Authority (EDA) have made the advancement of CHP a priority program under the newly-created ERB in order to finance energy resiliency projects for critical facilities important to public health, safety, and the environment.

The ERB is the first public infrastructure bank in the nation to focus on energy resilience. The ERB will utilize $200 million from a federal HUD Community Development Block Grant-Disaster Recovery (CDBG-DR) allocation. The ERB will advance the State's goal of increasing local energy resiliency through not only CHP, but other forms of DG such as fuel cells, storage technology, solar inverters and micro-grids that can operate during and after an emergency.

Recommendations

In conjunction and coordination with the recommendations noted above, the State will continue to encourage new DG of all forms and keep a focus on expanding use of CHP by reducing financial, regulatory and technical barriers and identifying opportunities for new entries. The BPU should initiate a stakeholder process to determine how to reduce these barriers and increase the development of DG with a focus on CHP, fuel cells within a microgrid. This should include revisions to the CHP and fuel cell incentives to promote local energy resiliency.

- *Evaluate Lost Nuclear Capacity*

2011 Goal

New Jersey has four operational nuclear plants (at three sites) which produce about half of the electrical energy generated in New Jersey. The State sees nuclear power as an important element of a diverse resource portfolio. The oldest nuclear power plant in the state, Oyster Creek, is scheduled to retire in 2019. The retirement will result in the removal of a 654 MW carbon-free baseload resource. 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. New Jersey should continue to coordinate with the U.S. DOE regarding the next steps needed to accelerate a federal solution to the problem of storing nuclear waste. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 84.]*

Goal Status

With Oyster Creek scheduled to retire in 2019, state and local officials have been investigating how the energy and capacity associated with the facility can be replaced.

Although PJM has not identified an immediate reliability issue due to Oyster Creek's retirement, the State continues to encourage solutions to replace the lost energy and capacity. One option is the development of Combined Cycle Natural Gas (NGCC) power plants. This new, energy efficient NGCC technology reduces CO2 emissions by 60-75%, as compared to

traditional coal-fired generation. Absent the development of new, in-state power generation, New Jersey will need to rely on more transmission to meet local electricity deficiencies.

Transmission planning for enhancement and expansion of the transmission system is one of PJM's primary functions. PJM's RTEP process identifies transmission system upgrades and enhancements to provide for the operational, economic and reliability requirements of PJM customers. The process integrates transmission with generation and load response projects to ensure the overall PJM load obligations are served. PJM annual plan process reviews reliability criteria over a 15-year period. The process identifies transmission constraints and other reliability concerns as well as upgrades to mitigate identified reliability issues for feasibility and costs. Transmission upgrades have alleviated the pressure to replace aging elements of the transmission system, but as the transmission system continues to age the need for instate generation grows.

Recommendations

Despite the current economics of bringing online new nuclear power plants, New Jersey should remain committed to the objective assessment of nuclear power's role in New Jersey's diverse resource portfolio. In order to sustain New Jersey's existing fleet of nuclear energy resources (which New Jersey ratepayers funded before industry restructuring in 1999), the State should continue an active role in federal nuclear regulatory activities and continue to evaluate the economics of the nuclear industry.

In light of EPA's Clean Power Plan, the State recognizes the need to continue to support the nuclear power industry in New Jersey. As such, New Jersey remains strongly committed to the nuclear industry, which has a strong track record in New Jersey of providing safe, reliable, carbon-emission-free electricity, and is evaluating the impact of potential lost capacity and planning for the replacement of this emission-free capacity.

- *Promote Expansion of Gas Pipelines*

2011 Goal

As New Jersey increases its reliance on natural gas for electricity generation, delivery pipelines will have to be improved and expanded. Expansion of the natural gas pipeline system will also strengthen New Jersey's ability to achieve innovations in transportation fuels. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 85-86.]*

Goal Status

Although the oversight of expanded or new interstate pipeline facilities is the responsibility of FERC, the State is committed to expanding, in a safe and environmentally responsible way, the existing pipeline network that serves gas utilities, power plants, businesses, and residents throughout New Jersey. The State recognizes the controversies involved with siting new pipeline infrastructure and will evaluate applications based on applicable statutes, regulations, and policies.

Expansion of the State's gas distribution companies' (GDCs) intrastate pipeline capacity and the capacity of the interstate pipelines serving the state provides an opportunity for the State to take advantage of relatively low priced and abundant nearby natural gas supplies. This will assist in meeting the increased and competing demands upon natural gas supply as fuel for residential and commercial heat and electric generation.

Although New Jersey is generally well-supplied with natural gas pipeline capacity for heat and existing power generation, the state lacks adequate natural gas infrastructure to support new, gas-fired electrical generation, as well as substitution for other fuels in the residential and commercial sectors. Expanding the capacity for natural gas can increase economic development with lower costs for energy and enhance environmental quality through lower emissions.

Since the release of the 2011 EMP, the BPU has approved $938.7 million dollars for gas utility infrastructure upgrades and mitigation projects with an additional $280 million pending before the BPU.

Recommendations

No changes to the 2011 EMP goal are recommended. The BPU should continue to advocate for enhanced intrastate capacity at local levels and interstate pipeline infrastructure before FERC.

- *Clean Energy to be 70% of Supply by 2050*

2011 Goal

Ensure that 70% of the State's electric needs are generated by "clean" energy sources by 2050. As a practical matter, this is only achievable with current technologies if the definition of clean energy includes renewables, nuclear, natural gas, and hydroelectric facilities. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 76-77.]*

Goal Status

New Jersey's promotion of new electric natural gas generation and enhancement/expansion of the natural gas transmission and distribution systems have assisted in achieved this goal. Overall, based on EIA and PJM Environmental Information Services (EIS) data 93% of the State's total annual electricity consumption and 96% of the State's annual in-state electricity generation is produced by clean sources, as defined in the 2011 EMP. [8]

Based on U.S. Energy Information Administration (EIA) data, the electric energy supply for New Jersey for 2014 was 47% nuclear, 44% natural gas, 4% coal, and 4% renewables. New Jersey's power plants produce fewer emissions than the vast majority of the states across the country. [9] According to PJM EIS data from its Generator Attributes Tracking Systems

[8] Sources http://www.eia.gov/electricity/data/state/sales_annual.xls and https://gats.pjm-eis.com/gats2/PublicReports/PJMSystemMix.
[9] Source: EIA, Electric Power Monthly

(GATS), the annual PJM wide system mix for EY 2014 was 35% nuclear, 19% natural gas, 43% coal and almost 2% renewables.[10]

According to the EIA, New Jersey's sulfur dioxide (SO_2) emissions rank amongst the lowest three states in the nation and our nitrogen oxide emissions and carbon dioxide (CO_2) emissions from in-state electric generation units are among the lowest six states in the country. And, when considering only existing fossil fuel-fired power plants, New Jersey already surpasses the standards EPA proposes for the construction of new power plants. Most significantly, this clean generation portfolio has been achieved in a state that is ranked by EIA as the 22nd largest generator of electricity in the United States.

Despite New Jersey's achievements, however, EPA's Clean Power Plan under Section 111(d) of the Clean Air Act does not properly credit this success. EPA has set 2030 goals for more than half of the states at less stringent levels than New Jersey's fossil sector achieved in 2012. Accordingly, New Jersey will continue to advocate for fair recognition that our ratepayers have already borne the cost of an exemplary clean power sector. Nevertheless, as the 2011 EMP and this Update identify, New Jersey will continue to pursue an even cleaner power sector.

Recommendations

New Jersey has exceeded this goal; approximately 96% of New Jersey's electricity generation on an annual basis is produced by clean sources. The State will strive to improve upon this record by promoting cleaner and renewable electric energy sources, demand response and energy efficiency.

Cost Effective Renewable Resources

- *Temporarily Increase the Solar RPS*

2011 Goal

Temporarily accelerate the RPS to provide interim relief for the SREC market and an opportunity for the industry to adjust. Increase the RPS over the next three years and reduce the outlier years of the RPS schedule to minimize the impact to ratepayers. This should provide the foundation for the solar industry to continue to develop and receive SREC payments trading within a reasonable range and would facilitate a reduced SACP schedule. [*For more detailed information about this subject see the 2011 Energy Master Plan, pages 105-106.]*

[10] Source https://gats.pjm-eis.com/gats2/PublicReports/PJMSystemMix.

Goal Status

The Solar Act of 2012 accelerated the solar RPS and gave the State greater oversight over solar development. The Solar Act more than doubles the amount of solar energy that suppliers and providers must purchase annually in the near term and commensurately reduces the amount of solar that suppliers and providers must purchase in later years; the overall amount of solar that must be purchased by suppliers and providers through 2028 is approximately the same between the Solar Act of 2012 and the Solar Advancement Act of 2009. This allows for continued activity in New Jersey's solar market while also protecting the ratepayers of New Jersey from burdensome costs.

On May 21, 2014, BPU issued an Order Docket No. QO140504402, with instructions for how the suppliers and providers are to comply with the Solar Act acceleration. The first Energy Year under the Solar Act was completed on May 31, 2014, and the BPU is evaluating the reports for compliance with the requirements of the Solar Act.

After an extensive stakeholder process, which resulted in several recommendations, the BPU directed Staff to continue to:

i. Monitor solar market development activity and associated metrics, including, but not limited to, capacity installation rates, SREC registration activity, EDC financed program participation, and SREC prices; and
ii. Work with stakeholders to identify gaps in New Jersey solar market data availability and improve data transparency to benefit market participants, decision makers and stakeholders.

The Solar Act contained several provisions, which are credited with the stabilization of solar market development activity. The increase in the near term Solar-RPS purchase obligations, the authority for BPU to limit some types of SREC generating development and, to a less certain degree, the reduction in the Solar Alternative Compliance Payment (SACP), have helped to stabilize SREC prices. The SREC price has rebounded to approximately 50% of the SACP. BPU estimates that, based on the current installed solar capacity and the pipeline of projects, the SREC market will be oversupplied through Energy Year 2017. This means that through at least 2017 there will be more SRECs generated than are needed to satisfy the RPS. With demand for SRECs lower than supply, the price of SRECs will decrease and SREC prices will rebound after demand once again outpaces supply. If the solar industry continues to overbuild, SREC prices will decline accordingly.

Should "significant solar development volatility" extend for three consecutive quarters, with significant volatility defined as 40% or more change in quarter over quarter market capacity additions, the BPU recommends the following action:

i. Evaluating whether the quarterly changes in the market reflect typical market cycles and/or normal variations not requiring regulatory intervention;
ii. Engaging stakeholders in considering limiting EDC sales of SRECs to recover costs, stopping the offering of net metering for large solar electric generation facilities if

and when the total statewide aggregate of net metered energy meets the newly established cap of 2.9% of total annual kilowatt-hours sold in this State, or considering other approaches to mitigating solar development volatility; and

iii. Considering possible means of further restricting eligibility of large grid supply and net metered projects greater than 2MW to participate in the SREC market that may present potential and significant SREC market impacts.

Based on the revisions to the solar RPS in the Solar Act of 2012, the State should not make changes in the Solar RPS until there is a full assessment of the impact of grid supply and large net metered projects (equal to or greater than 2 MW) on the market for behind-the-meter solar for residential and small business customer projects. If the industry overbuilds large projects it should be expected to consider that it does so at its own risk. New Jersey should analyze the future need for, and scope of, subsidies to support the continued development of the maturing solar industry.

Recommendations

No changes to the 2011 EMP goal are recommended. The Solar Act of 2012 addressed this goal. The BPU should continue to evaluate this market.

- *Evaluate and Lower Solar Alternative Compliance Payment (SACP)*

2011 Goal

To minimize the potential rate impact of an RPS acceleration, and the cost burden borne by non-participants in New Jersey's solar market, the State should materially reduce the SACP. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 106.]*

Goal Status

The Solar Act sharply reduced the SACP beginning in Energy Year 2014, and extends the SACP schedule out to Energy Year 2028. This has the effect of continuing to foster development of New Jersey's solar market while protecting the ratepayers from unduly burdensome costs. In 2012, the BPU adopted regulations to implement the SACP schedule in the Solar Act.

Recommendations

Because the Solar Act of 2012 reduces the SACP, and the BPU amended the RPS rules to be consistent with the Act, no further action is required.

- *Return to the Percentage Obligation for Solar*

2011 Goal

Change the explicit gigawatt hour (GWh) requirement for solar energy to a defined percentage of total energy sales. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 106.]*

Goal Status
The Solar Act includes a provision that changes the solar RPS to a percentage of retail sales. It also provides an exemption from the increased requirements for certain retail electricity providers with supply contracts in place prior to the effective date of the Solar Act. With this change, the short term increase in the solar RPS and the requirement to meet the increased purchase obligation of suppliers will be shouldered by the non-exempt suppliers and providers.

The BPU has issued guidance to retail electricity suppliers and providers on how the increased solar requirements that will not be borne by exempt providers will be allocated to non-exempt suppliers and providers. The methodology approved by the BPU through an Order Docket No. QO140504402 is also anticipated to be proposed in rules to amend the RPS.

Recommendations
No changes to the 2011 EMP goal are recommended. The Solar Act of 2012 addressed this goal.

- *Extend the EDCs' Solar Programs*

2011 Goal
The State will consider programs to allow New Jersey residents who have been unable to take advantage of individual PV systems to do so, and will support an extension of the long-term contracting programs offered by utilities. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 107-10.8]*

Goal Status
In 2013, BPU approved extensions of the EDC-supported solar programs for 180 MWs, and PSE&G was approved for extensions of its Solar Loan 3 and Solar 4 All programs. These filings include a component to assist residential markets, small businesses, and landfill projects.

The continuation of the EDC Solar programs is, in effect, an incentive that facilitates participation in the New Jersey solar market by those residents who have been unable to take advantage of individual PV systems. The State should evaluate the continuation of the EDC Solar programs, especially with solar panel prices continuing to decline at dramatic rates and the proliferation of companies offering innovative ways to participate in the New Jersey solar market. The evaluation should be specific to the need for residents and small businesses to directly participate in the solar market.

Recommendations
No changes to the 2011 EMP goal are recommended. Based on both projects currently pending and installed capacity, large net-metered projects greater than 2 MW and grid-supply projects may not need further incentives.

- *Evaluate Solar Incentives*

2011 Goal

Conduct a 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 non-participant's perspective. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 105.]*

Goal Status

Active stakeholder meetings to discuss this topic are ongoing. The Solar Act of 2012 made clear what types of solar projects achieve the sensible balance noted above and it tailored state-sponsored subsidies accordingly.

Since the inception of the NJCEP incentives for solar programs in 2001, ratepayers have invested $363.5 million for solar rebates and $910.5 million through the solar RPS, including SREC and SACP, but this does not include the investments by ratepayers in net metering incentives. [11]. New Jersey, as of the end of September 2015, had installed 1,546.2 MW of solar at 39,500 locations. The majority of these projects are behind the meter projects. There are now 43.3 MW of solar projects in the pipeline at 9,796 locations, the majority of which are direct grid-supply projects.[12]

In addition to the above, from 2009 through 2015, New Jersey ratepayers through the EDC Solar programs have invested $1.25 billion . [1] The EDCs that have applied for and offer solar programs are, Public Service Gas and Electric, Rockland Electric, Jersey Central Power and Light and Atlantic City Electric. While the EDCs have made these investments in solar. some of their costs are returned to the ratepayer based on SREC revenues.

Recommendations

Changes implemented as a result of the Solar Act of 2012 address this goal. The Solar Act made clear what types of solar projects achieve the sensible balance noted above and it tailored State-sponsored subsidies accordingly. As the solar market matures, an oversupply of SRECs would be expected to drive their prices down. BPU will continue to monitor and review development in the solar market, especially as the solar RPS is reached and in light of the EPA's Clean Power Plan, the impact of which on the solar market is not yet known.

[11] Source: http://www.njcleanenergy.com/renewable-energy/project-activity-reports/project-activity-reports. The solar RPS cost is estimated based on the weighted average price for the SREC.
[12] Source: http://www.njcleanenergy.com/renewable-energy/project-activity-reports/installation-summary-by-technology/solar-installation-projects

- *Promote Certain Solar PV Installations*

2011 Goal

Solar projects that offer both an economic and environmental "dual benefit" should take priority, and any legislative expansion of SREC eligibility should also provide BPU with the ability to review and approve subsidies for grid-supply projects to ensure compatibility with environmental, land use, and energy policies. Additionally, the development of solar projects should not adversely affect the preservation of open space and farmland. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 106-107.]*

Goal Status

The Solar Act gives BPU significantly more oversight over solar projects, particularly for grid-supplied projects and those on farmland. Consequently, such authority will allow BPU to approve projects that are more compatible with the State's policy goals. The Solar Act of 2012 set the priority to promote development of grid-supply solar on properly closed sanitary landfill facilities, brownfields, and areas of historic fill.

Pursuant to the Solar Act, BPU directed staff to initiate a stakeholder proceeding to investigate approaches to mitigating solar market development volatility including an evaluation of techniques used nationally and internationally toward the development of a report to be completed within two years of the effective date of the law. Staff led the proceeding through its monthly meetings issuing periodic requests for stakeholder comments on various aspects of the issue.

After establishing a record of stakeholder input on solar development volatility in New Jersey's market, potential definitions, causes and mitigating factors, BPU engaged the Rutgers Center for Energy (CEEEP), Economic and Environmental Policy (Bloustein School of Planning and Public Policy) to analyze the findings and assist with recommendations. Based on a review the public record compiled by BPU staff, CEEEP conducted a literature review of national and international approaches to mitigate solar development volatility and engaged a consultant to write a report detailing its findings, provide specific short term and long term recommendations regarding approaches to mitigate solar development volatility in New Jersey, and present the results at a public forum.

Since stakeholders could not arrive at a consensus definition of solar market volatility, the contractors defined solar market volatility as "significant and rapid changes in market capacity additions over time in both aggregate capacity and within sectors." The report found that the market had experienced volatility, especially prior to enactment of the Act. The volatility was in response to changes in federal incentives, substantial declines in solar module costs and SREC price fluctuations (most prior to the Act), with the grid supply market segment showing the most volatility.

BPU continues to evaluate solar PV incentives to ensure that State-sponsored programs achieve an appropriate balance of economic and environmental objectives from both a participant's and a non-participant's perspective. Although a number of grid-supply solar

installations have been proposed for, and installed on, what were previously working farms and open space, the State strongly discourages the use of ratepayer subsidies to turn productive farmland and open space into grid-supply solar facilities. The policy of encouraging the development of renewable energy resources should not undermine taxpayer programs and policies that emphasize the importance of preserving open space and farmland.

Recommendations

The existing goals to promote solar projects that provide both economic and environmental benefits are sound and should be continued. The State should continue its policy of discouraging the development of solar farms on farmland and undeveloped open spaces, such as forests, and encouraging their placement on or above impervious surfaces or on reclaimed land such as remediated brownfields. The Solar Act gives sufficient flexibility to the BPU in determining what solar projects should go forward. While no action is presently required, the BPU will continue to monitor the issues related to net-metering. Should solar market volatility develop (as defined in the CEEEP report), BPU has the option to invoke the statutory provision enabling the review of offering net-metering to projects greater than 2 megawatts (MW).

- *Reduce the Cost of Solar Panels*

2011 Goal

New Jersey must foster solar efficiency, material, and technological breakthroughs aimed at reducing solar costs. Not only will these benefit ratepayers in terms of reducing SREC costs, but they will also create additional economic opportunities for the entire solar industry. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 91-100.]*

Goal Status

BPU continues to monitor the solar panel pricing market as well as supporting some new solar technologies. Although the State has limited influence on primarily market forces, according to the U.S. Solar Market Insight Reports issued quarterly and annually by GTM Research for the Solar Energy Industries Association (SEIA), New Jersey has among the lowest installation costs in the United States.

Recommendations

No changes to the 2011 EMP goal are recommended.

- *Support Offshore Wind*

2011 Goal

Examine the viability of developing offshore wind generation subsidized by the OREC program. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 108.]*

Goal Status

The United States Department of the Interior's Bureau of Ocean Energy Management (BOEM) identifies seven East Coast states as actively involved in some stage of the auction program for the leasing of underwater lands for offshore wind development (Massachusetts, Delaware, Maryland, Virginia, New Jersey, New York, and Rhode Island). The leasing of lands for the Cape Wind project in Massachusetts was announced by the Department of the Interior with great fanfare in 2010, and Massachusetts invested over $100 million to create a staging area for construction of offshore wind farms, although it was apparent that construction and jobs were to go to European manufacturers. The project stalled for failure to obtain financing, which was contingent upon the developer's ability to secure purchase agreements for the high cost of power to be produced.

A recent auction by BOEM for additional parcels off the coast of Massachusetts drew little interest from developers, with two of the parcels drawing no bids at all, and the two others going for prices considered relatively low. Although leases have been awarded in other states, none of the states are any closer to actual development of an offshore wind project, with the exception of a small project near Block Island.

BOEM conducted a federal lease auction for parcels off the coast of New Jersey on November 9, 2015. In the auction, three bidders competitively placed bids for the right to develop one of two lease areas in federal waters. Qualified bidders, who met the requirements and deadlines for participation, including the submission of bid deposits, participated in the auction. Two provisional winners of the auction were identified, one each for the North Lease Area and South Lease Area designated by BOEM. New Jersey will continue to actively monitor the development of these lease areas.

While offshore wind may become a valuable energy resource, generating energy through offshore wind carries significant drawbacks. The rigors of the offshore environment and the associated technological challenges for construction, operation, and maintenance, put upward pressure on the costs of any offshore wind project. Fortunately, the Offshore Wind Economic Development Act of 2010 (OWEDA) contains provisions to protect ratepayers from the unacceptable costs associated with unproven technologies. For a project to be approved, it is critical that a developer demonstrate the project's net economic and environmental benefits.

Although OWEDA provides an opportunity for the offshore wind industry to prove itself, and further positions New Jersey for federal dollars if Congressional incentives become available, the Act is also intended to prevent New Jersey's businesses and residential ratepayers from being exposed to unreasonable risks. While the future may bring change, offshore wind in the U.S. is not economically viable at this time.

Nonetheless, to establish a framework for a potentially viable project in the future, the BPU adopted rules (N.J.A.C. 14:8-6.1 et seq.) establishing an Offshore Renewable Energy Certificate (OREC) program in 2011. These rules provide an application process and a framework under which the BPU will review any application. BPU amended these rules in

2013, and continues to work with stakeholders and other interested parties regarding further refinements to these rules.

Recommendations
Although offshore wind projects have not yet proven economically feasible in New Jersey, BPU remains interested in examining the potential for offshore wind projects to become part of the State's energy portfolio, provided that the projects are economically viable and that New Jersey ratepayers and businesses are protected.

- *Monitor European and Chinese Wind*

2011 Goal
New Jersey will benefit on multiple levels from lessons learned with respect to wind in Europe and China, and should actively monitor technology and operating developments in Europe and China in the years ahead. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 108.]*

Goal Status
New Jersey's power industry is extremely clean when compared to other states, is extremely low in GHG emissions when compared to all other states, but electricity costs are amongst the highest when compared to almost every other state. The fundamental question is whether offshore wind technology can become economically feasible to the point where New Jersey's business and residential ratepayers are protected.

While Europe's plans for offshore wind development are ambitious, as we entered 2014, plans for global offshore wind development were being curtailed. In July 2014, Bloomberg News reported that Europe has scrapped plans for more than 5,700 MW of offshore wind projects since November 2013.

For China, Bloomberg News reports that Chinese officials have confirmed that China will not meet its ambitious 2011 plan to build 5,000 MW of offshore wind turbines in four years, enough to power 5.4 million homes. To date, less than 10 percent of that projected capacity is in place.

Recommendations
No changes to the 2011 EMP goal are recommended.

- *Promote Effective Use of Biomass*

2011 Goal
New Jersey should reassess the existing renewable energy incentives to use available in-state biomass resources more effectively and should pursue opportunities for public/private partnerships to build and operate biomass-to-power fuel plants. Fostering a more complete use of the State's underutilized biomass resources should also support the goal of preserving valuable farmland. Biomass includes energy from waste such as biogas from landfills and

wastewater facility digesters, energy from organic wastes such as food waste and other vegetative waste and energy from specifically grown crops. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 109.]*

Goal Status

In 2013, Rutgers University's EcoComplex updated the Biomass Energy Potential study it conducted for the 2011 EMP. The updated study determined that approximately 65% of the 8.2 million tons of biomass generated annually in New Jersey could ultimately be available to produce energy. This would include either 1,124 MW of electricity generation and recovery of useful thermal energy or the production of 311 million gallons of gasoline[13] .

With advancement in technology including anaerobic digestion and gasification, biomass can be converted to a sustainable biogas that could be used for power generation or transportation fuel. This opens up the potential for utilization of biomass through wastewater treatment facilities to develop them as microgrids for power and fuel generation. The study reports a number of opportunities to develop biopower and the barriers that dampen this development. Barriers include the need to develop long term contracts to collect the organic material (sometimes source separated) and the need to develop long term contracts for sale of the energy.

DEP has developed a systematic process to determine if environmental permitting of qualified biomass projects meets sustainability criteria. In addition, a number of working groups have been formed, in conjunction with Rutgers University's EcoComplex, to coordinate the development of biomass and waste-to-energy. BPU approved a budget of $3 million in competitive incentives in the Renewable Energy Incentive Program in New Jersey's Clean Energy Program. As of March 31, 2015, 31.15 MW of biomass capacity has been installed under NJCEP Renewable Energy Incentive Program in New Jersey.[14]

Recommendations

In the context of the new goals of promoting a more resilient energy industry through the ERB, the State will work with stakeholders to revisit the role of biomass in the state energy mix, especially biogas from wastewater treatment plant digesters. With the data in the Rutgers biomass study, particularly the feedstock fractions with potential for power production, BPU and DEP should review the State's clean energy incentive policies for their effectiveness in contributing to the State's resiliency, in-state generation, and environmental goals.

[13] "Assessment of Biomass Energy Potential in New Jersey." The New Jersey Agricultural Experiment Station. July 2007. NJAES Report 2007-1. http://bioenergy.rutgers.edu/biomass-energy-potential/njaes-biomass-assessment-finalreport.pdf

[14] Source: http://www.njcleanenergy.com/renewable-energy/project-activity-reports/installation-summary-by-technology/wind-biopower-and-fuel-cell-installation-reports

- *Exploit Tidal Power in New Jersey*

2011 Goal

New Jersey should support the Department of Transportation's Office of Maritime Resources' proof of concept partnership that will install a turbine system in Point Pleasant on the Manasquan River. 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. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 129.]*

Goal Status

The Department of Transportation initiated a pilot project to evaluate the effectiveness and efficiencies of this technology. However, due to changing market conditions, which lowered the overall market potential for this technology, the pilot project was discontinued.

Recommendations

BPU and DEP should continue to monitor this technology if and when market conditions change.

- *Support Other Renewable Technologies*

2011 Goal

New Jersey should encourage emerging cost-effective renewable energy technologies, such as fuel cells powered by renewable fuels, wave, tidal, micro hydro technology, geothermal heat pump systems, and advanced technologies that have the potential to incubate new businesses in the State. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 127-130.]*

Goal Status

Since the inception of the New Jersey Renewable Energy Portfolio Standard (RPS), the New Jersey ratepayers have invested over $242.4 million for Class I and Class II renewables through renewable energy certificates (REC) and alternate compliance payments (ACP). In addition, the NJCEP has provided over $25 million in rebates to wind, biomass, and fuel cell projects since 2001.

BPU staff continues to evaluate the viability of these technologies. The EDA, with BPU input, is continuing to explore opportunities for new funding mechanisms, including revolving loan funds that can provide funding and capital for new technology projects.

Recommendations

No changes to the 2011 EMP goal are recommended.

Promote Cost Effective Conservation, Energy Efficiency

- *Evaluate Alternatives to OCE Programs*

2011 Goal

Consider new ways to provide capital for Renewable Energy and Energy Efficiency to eventually eliminate the need for cost incurrence through the Societal Benefits Charge (SBC). *[For more detailed information about this subject see the 2011 Energy Master Plan, page 119.]*

Goal Status

To align clean energy programs with the investment community and increase the volume of investor-ready projects in New Jersey, BPU has directed staff to implement a pilot project with the Environmental Defense Fund's (EDF) Investor Confidence Project (ICP). EDF is working with leaders from the finance industry, engineers, project developers, and energy efficiency programs nationwide to achieve widespread adoption of standardized protocols for developing, measuring, and verifying the savings associated with EE projects.

The adoption of standardized industry protocols will allow private capital to better assess the risk associated with financing EE projects and thereby attract private investment in pools of these "investor-ready" projects. BPU has continued to update EE savings protocols since 2001.

A single market manager and program administrator of the NJCEP has been selected. This restructuring will increase administrative efficiency and allow the NJCEP to continue to implement cutting edge, market transforming EE programs. The new structure will also enable the NJCEP to transition to a greater mix of financing options for program participants.

Since 2001 through the end of fiscal year 2014, New Jersey ratepayers have invested over $2.053 billion in the NJCEP renewable energy (RE) and EE programs. This included $1.5 billion in EE and $480 million for RE programs and the remainder in administrative costs[15] . The EE investment included incentives for lighting, efficiencies in appliances, and energy efficiency beyond building code requirements. Future returns from such investments could likely become more expensive because of increasing energy building codes and appliance standards. Ultimately, EE projects should be implemented where they provide a savings over the initial investment.

In addition to the above, from 2009 through 2015 , New Jersey ratepayers through the EDC and GDC EE programs have invested $727.4 million. The utilities that have applied for and offer EE programs are Elizabethtown Gas, New Jersey Natural Gas, Public Service Gas and Electric, Rockland Electric, and South Jersey Gas. The EDC and GDC energy efficiency programs have increased participation in the Clean Energy energy efficiency programs and

[15] Source: http://www.njcleanenergy.com/main/public-reports-and-library/financial-reports/clean-energy-program-financial-reports. The remainder represents administrative and other costs such as the True Grants.

enhanced and increased the energy efficiency savings to the customers and the system. BPU is in the process of evaluating new energy efficiency programs for various utilities.

BPU and EDA established the State's ERB in 2014 and it is now managed by EDA. The mission of the bank is to finance the development of energy systems that enhance and improve energy efficiency and resiliency at the local level through, among other things, DG and microgrids. This financing program can serve as a model for the transition of the NJCEP to other incentive models that advance this EMP goal.

Recommendations

No changes to the 2011 EMP goal are recommended. New Jersey's Clean Energy Program will evaluate the programs through a stakeholder process and other analyses and will update the programs as appropriate. BPU also should evaluate ways to enhance the effectiveness of the EDC and GDC programs and consider whether it should shift energy efficiency programs to the EDCs and GDCs.

- *Incentivize Geothermal Heat Pumps*

2011 Goal

BPU can advance geothermal heat pump systems in the state by creating incentive programs that are similar to those available to promote solar to help reduce installation costs. Over the past three years, according to the NJCEP, there were 20 rebates paid to commercial/industrial organizations while on the residential side there were 167 unit rebates. The program also provides thousands of natural gas furnace/boiler rebates to customers annually. In addition, BPU, DEP and the New Jersey Corporation for Advanced Technologies (NJCAT) can work together to verify the performance of innovative systems that are efficient and affordable to New Jersey residents. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 128.]*

Goal Status

BPU is monitoring Office of Clean Energy programs that may support developments.

Recommendations

Reassess this goal and determine whether it should be modified or continued in view of changed circumstances.

- *Monitor Energy Efficiency Effects on Solar*

2011 Goal

To prevent a potential negative impact on the solar market from the State's focus on EE, BPU should be authorized to increase the overall percentage of solar required in the RPS in the event of a noticeable impact from EE Programs. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 91-100.]*

Goal Status
The Solar Act of 2012 reverted the solar RPS back to a percentage requirement from the set MWh requirement in the Solar Advancement Act of 2009. Savings from the NJCEP EE programs average approximately one half of 1% annually and cumulatively have an approximate 4% reduction on electricity consumption statewide through 2014. The effects of EE are unlikely to have a noticeable impact on solar. BPU continues to monitor the impact on the solar market from the State's focus on EE.

Recommendations
No changes to the 2011 EMP goal are recommended.

- *Promote Energy Efficiency and Demand Response in State Buildings*

2011 Goal
Leading by example, New Jersey's State government will continue to improve the energy efficiency of State owned and operated buildings through the State Energy Office in the BPU. Operating costs for these facilities may be lowered by using performance-based contracting for capital improvements to energy equipment, such as lighting upgrades, heating, ventilation, and air conditioning replacement. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 116.]*

Goal Status
The mission of the SEO is to obtain energy related cost savings for State government and agency buildings and facilities through programs and services in the areas of energy conservation, renewable energy and fuel efficiency. The SEO has implemented a number of projects and is working as a member of the State Energy Savings Initiative Oversight Committee to develop a long-term plan for energy savings in many of the 300 plus state-owned/operated facilities. The SEO has leveraged federal, state and private-sector resources to deliver the greatest energy conservation, environmental, and cost reduction benefits to the agencies and taxpayers.

To achieve its mission, the SEO strives to identify energy savings projects at government facilities, develop and support projects to decrease energy demand/consumption, provide technical support to public officials at all levels of government and produce long term savings through supply-side and demand-side energy management.

The SEO also provides guidance and services to local government, school districts and business sectors.

The Energy Savings Improvement Program Act of 2012 (ESIP), allows State agencies to contract with third parties with experience, expertise, and financial resources to implement and fund EE measures in government owned and/or operated buildings, without upfront capital investment.

BPU currently has 63 projects submitted under ESIP, and has identified more than $191 million in projects to date. Thus far, 16 projects have been completed and the remaining 47 projects are in various stages of completion of the investment grade audit or are under construction. The program estimates $14.7 million in energy cost savings from the completed projects. In addition, the State Energy Office is assisting State facilities in renegotiating energy supply contracts, and has saved the State more than $13 million so far in utility expenditures.

The State intends to provide lease financing to State agencies for the acquisition of energy efficiency projects, including those implemented through energy savings performance contracts. The State of New Jersey's Department of Treasury (Treasury) has developed an Energy Line of Credit (LOC) Program similar to the current Line of Credit Program devoted to the short term acquisition of equipment which has been successfully in place since 1995. The lending documents were executed in August 2014. Because multiple energy audits have already been completed and each recommended improvement costs in the neighborhood of $5-10 million, the Treasury has awarded the issuance of $100 million in lease obligations to finance these projects.

Recommendations
No changes to the 2011 EMP goal are recommended.

- *Monitor PJM's Demand Response Programs*

2011 Goal
In addition to monitoring the PJM initiatives, BPU needs to be proactive in promoting cost-effective Demand Response (DR) activities that are not recognized and supported by PJM programs. New Jersey will also continue to participate in DR programs that are economically sensible. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 120.]*

Goal Status
Demand Response (DR) refers to actions taken by a consumer under contractual agreement to adjust the amount or timing of energy consumption to reduce overall peak demand and avoid system emergencies and outages. DR can be a more cost-effective alternative than adding electric generating units simply to meet the periodic peaks or surges in energy demand that most often occur during the hottest summer days.

PJM was in the process of implementing new incentives to support DR to make it easier for the developers of those resources to participate and be rewarded through PJM's energy and capacity markets. However, in May 2014 the United States District Court for the District of Columbia vacated FERC Order 745, which required regional transmission organizations (RTO) to compensate DR resources participating in wholesale energy markets at the full price for energy. The ruling was based on FERC regulating the wholesale electric energy markets but not to regulated DR, which is a retail transaction regulated by State PUCs.

The District Court's ruling calls PJM's DR programs into question, and without regulatory foundation. The United States Supreme Court has accepted the case for review, and a decision is expected in 2016. BPU staff is actively monitoring existing DR programs and is evaluating the State's ability to implement DR programs moving forward, no matter the results of the litigation.

Recommendations
BPU should evaluate new opportunities for state-run DR programs in the event the Court rulings determine FERC has no regulatory authority over DR programs.

- *Evaluate Use of Sub-Metering in Residential Buildings*

2011 Goal
Enable tenants in apartment buildings and commercial buildings to monitor their own utility use and be billed for actual use. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 118.]*

Goal Status
This goal has proven difficult to implement because of the challenges associated with retrofitting existing buildings with individual meters. New construction codes and building technologies may better support this policy goal in the future.

Recommendations
Despite the challenges to advancing this goal, no changes to the 2011 EMP goal are recommended.

- *Apply Cost Benefits Test to EE Programs*

2011 Goal
Perform cost-benefit test to assess the net benefit of EE subsidies and investments. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 111-114.]*
Goal Status
Most EE programs are subject to a cost-benefit test. The cost benefit analysis (CBA) is conducted for the entire program or on a facility-specific basis, as in the Combined Heat and Power (CHP) programs. The CBA must demonstrate a net benefit or provide other social or policy benefits, as do the low income EE programs.

Recommendations
No changes to the 2011 EMP goal are recommended.

- *Evaluate Dynamic Pricing and Metering*

2011 Goal
New Jersey should consider expanding the implementation of smart meters and gradually exposing customers with lower energy demands to real-time pricing in order to encourage

behavioral changes that result in wiser energy use and reduced retail prices for all residents. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 126-127.]*

Goal Status

This goal must be re-evaluated within the context of the advancement of smart meter technologies and changing costs. Consistent specification and standards for advanced meters across the board, as well as security issues, need to be fully evaluated before expanding smart meters. In addition, the uniformity of the methods to determine costs and benefits from implementing smart meters needs to be further developed. BPU is refocusing this goal to evaluate smart grid and distribution automation systems that can improve and enhance the reliability and resiliency of the electric grid and could allow for options for smarter meters and real time pricing in the future.

Recommendations

While no change in the 2011 EMP goal is recommended, the focus of this goal should include distribution automation and smart grid and not just smart meters. The development of distribution automation/smart grid can lead to the development of smart meters. The BPU will work with the four EDCs and other interested stakeholders to evaluate the future development of advanced technologies within the context of smart grid and distribution automation plans. In addition progress in this goal can assist in the development of new DG and microgrids as well as advancing EE and demand reduction.

- *Add Aggressive Energy Efficiency Building Codes*

2011 Goal

Incorporate more aggressive Energy Efficiency (EE) requirements within the New Jersey Building Code to reduce energy use without jeopardizing economic development or environmental goals. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 116-118.]*

Goal Status

From 2011 to 2012, residential greenhouse gas emissions from fuel use decreased approximately 16% and the commercial sector's emissions declined by 7%. While the relatively mild heating and cooling demands due to the moderate weather in 2012 could account for a portion of these decreases, the effects of increased energy efficiency should not be discounted since it may have played a considerable part in the reductions.

The Department of Community Affairs (DCA) oversees the administration of the New Jersey Uniform Construction Code including building energy requirements. According to the State Uniform Construction Code Act, DCA cannot adopt its own building energy codes and is required to adopt a national model building energy code from a nationally recognized building energy code organization.

DCA conducts reviews of each edition of the national building energy model codes, including the International Energy Conservation Code, to determine whether the newer edition is in keeping with the intent and purposes of the Uniform Construction Code Act and should be adopted. Additionally, the State meets or exceeds the dictates of the U.S. Department of Energy, under the Energy Policy Act (Title III of the federal Energy Conservation and Production Act of 1976.)

DCA adopts by reference the International Energy Conservation Code (IECC) for low-rise residential buildings and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standard for commercial buildings. In 2010, the New Jersey Department of Community Affairs adopted the 2009 edition of the IECC for residential buildings and ASHRAE 90.1-2007 for commercial buildings.

On September 13, 2014 the US Department of Energy (USDOE) issued a determination on the ASHRAE 90.1-2013 which is referenced in the e 2015 IECC for commercial buildings as the energy standard for commercial buildings. In addition to AHSRAE, the energy conservation standard for commercial buildings is now sponsored by the American National Standards Institute (ANSI) and the Illuminating Engineering Society (IES) making the full title of the standard ANSI/ASHRAE/IES Standard 90.1-2013. States are required to certify to USDOE that their commercial building energy codes meet or exceed this requirement one year after publication in the Federal Register.

In January 2015, DCA published a proposal for public comment to adopt the 2015 edition of the IECC for both residential and commercial energy subcodes. The code will promote energy efficiencies in new commercial and residential buildings. An analysis of the energy savings from adoption of these new codes for both residential and commercial buildings is available at https://www.energycodes.gov/regulations/determinations.

The State, in partnership with Rutgers University, has developed the New Jersey Green Building Manual. This manual defines a baseline of performance and provides enabling economic and environmental best practices for green building. BPU, through the NJCEP Zero Energy Ready Home and Zero Energy Home 100% Renewable programs, provides incentives for the construction of new, very high energy efficient homes. The incentive assists developers to achieve the strategies in the State's Green Building Manual.

In addition, BPU reviews appliance standards for energy efficiency as they become available, including the costs and benefits of such changes. The USDOE pre-empts the majority of the states, including New Jersey, from adopting standards other than federal standards. The State participates in a number of DOE advisory groups that help to advance more efficient building energy codes and appliance standards. Although the State is satisfied with appliance standards set by the federal government, BPU should continue to monitor the changes in building energy codes and appliance standards and modify the NJCEP incentives as changes are implemented.

Recommendations
No changes to the 2011 EMP goal are recommended.

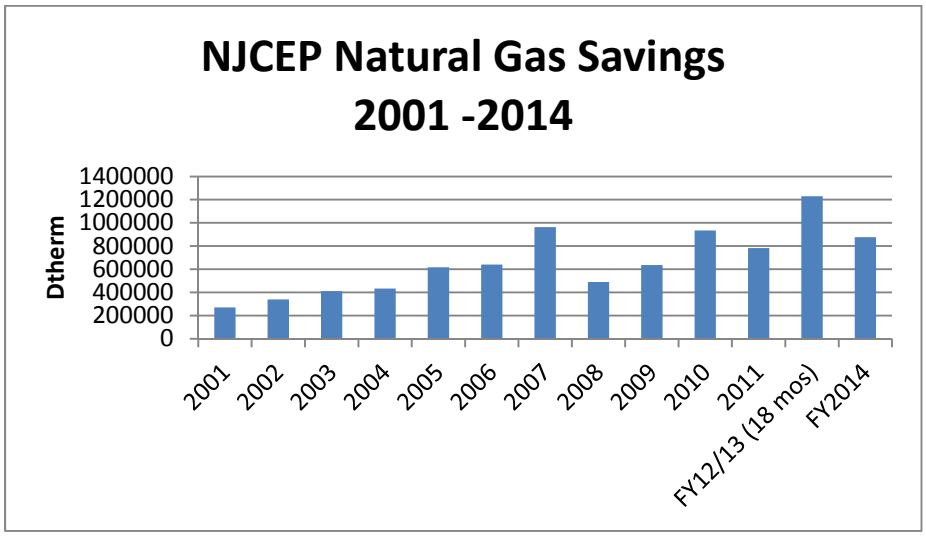
- *Increase Natural Gas Energy Efficiency*

2011 Goal
Encourage increased use of natural gas for power generation and for residential and commercial applications, including the use of high-efficiency natural gas appliances such as replacing distillate oil appliances with natural gas furnaces and hot water heaters. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 121.]*

Goal Status
The Clean Energy Program provides incentives for new or upgraded boilers and furnaces that are more efficient than the current appliance standard or building energy code upgrade. The size of the rebate depends on the overall energy saving of the new unit over the required code. On the residential side, the rebates range from $300 for a boiler to $900 for a boiler/ hot water heater combination. On average, the NJCEP provides approximately 20,000 to 25,000 rebates for more efficient residential natural gas units.

On the commercial and industrial side, the rebates range from $330 to $400, for high efficiency gas-fired boilers and furnaces, to $2,400, for high efficiency boiler economizer controls. The NJCEP's annual avoided usage of natural gas that directly results from natural gas EE programs are shown below. This avoided annual usage can be more than ten times the avoided annual usage over the lifetime of the equipment.

In addition to New Jersey's Clean Energy programs, the gas distribution companies (GDC) also operate natural gas energy efficiency programs in their services territories. New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas have been approved to operate these efficiency programs in their service areas. The plans enhance the rebates available for higher efficiency gas equipment as well as repayment plans at 0% interest.



The 2012- 2013 program year represents 18 months because of the switch from a calendar program year to a fiscal program year. Data from the NJCEP programs - http://www.njcleanenergy.com/main/public-reports-and-library/financial-reports/clean-energy-program-financial-reports.

Recommendations

No changes to the 2011 EMP goal are recommended. BPU should evaluate ways to enhance the effectiveness of the GDC programs and continue discussions with the GDCs to evaluate their EE programs.

- *Expand Education and Outreach*

2011 Goal

The 2011 EMP calls for educating consumers about energy conservation measures that they can implement, as well as EE tools available from State agencies, utilities, non-profits, and membership organizations. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 120-121.]*

Goal Status

In conjunction with the Clean Energy Program (CEP) program administrator, the Ombudsman's Office in BPU participates in ongoing educational activities and has partnered with Sustainable Jersey to increase municipal, business, and residential awareness of the CEP. The Office of Clean Energy has issued an RFP for the marketing of New Jersey's Clean Energy Program.

In response to Superstorm Sandy, BPU expanded its outreach efforts, enhanced existing incentives, and increased the suite of eligible technologies for those affected by the storm. This includes the outreach on the transition from a rebate centered incentive program to a clean energy program that focuses on financing incentives.

With electric and gas prices decreasing, it is important to increase the outreach and education for energy aggregation and retail energy procurement through third party suppliers. Outreach

and education in this area are important to protect customers from exposure to third party suppliers engaged in fraud and deceit.

Recommendations
The State should consider increasing the outreach for financing clean energy programs through the ERB. In addition, this goal should be expanded to include retail energy procurement and overall energy systems outreach and education.

- *Monitor Energy Storage Developments*

2011 Goal
Monitor the success of the State's newly developed energy storage incentive programs and the evolving development and improvement of energy storage technologies, modifying incentives where appropriate. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 123-125.]*

Goal Status
Analysis of market potential for various storage technologies concluded that there are 50 MW of economic potential in New Jersey. As part of the Comprehensive Resource Assessment (CRA) and annual budget process, the BPU approved a Fiscal Year 2016 competitive Renewable Energy Incentive Program with a budget of $6 million. This is in addition to the $3 million allocated in the FY 2015 budget. Though a competitive solicitation, BPU awarded incentives to 27 projects totaling 8,750 kW of battery storage projects for 4,451 kWhs of charging capacity per cycle.

This is an emerging and still expensive technology. The ERB is creating program phases to offer grants and low interest loans to public and critical facilities, such as wastewater treatment plants, hospitals, public housing and schools that could serve as shelters during extended power outages - for the application of storage technologies.

The initial offer for battery storage in wastewater and water treatment facilities, which was approved by the BPU and EDA Boards in September, is $5 million, of which 40% can be grants and principal forgiveness, and the remaining 60% as low interest loans. The total allocation for this sector is $65 million. The ERB financing and grant programs have been expanded to include hospitals. The ERB new hospital program will also include battery storage as an acceptable technology. In order to streamline the administrative functions the ERB financing program is now fully managed through EDA with only technical support by BPU.

Recommendations
No changes to the 2011 EMP goal are recommended.

Support the Development of Innovative Energy Technologies

- *Improve Vehicle Efficiency and Funding*

2011 Goal

Encourage the greater use of Battery Electric Vehicles and Plug-in Hybrid Electric Vehicles by improving and expanding the infrastructure needed throughout New Jersey. To induce heavy duty vehicle class conversion from expensive and polluting diesel fuel to less costly and clean natural gas, the State should facilitate the infrastructure needed to support broader use of alternative fuel vehicles (AFV) by fleet owners as well as individuals. The State should also promote new and cleaner in-state power generation and the improvement of our electric grid which will be needed as the electric vehicle industry continues to grow on a state and national scale. *[For more detailed information about this subject see the 2011 Energy Master Plan, pages 134-137.]*

Goal Status

In 2012, the BPU approved a pilot program by New Jersey Natural Gas to build compressed natural gas (CNG) fueling stations. In 2013, South Jersey Gas and Elizabethtown expanded their compressed natural gas (CNG) fueling stations program under existing tariffs.

New Jersey Natural Gas is developing three CNG refueling stations. The host sites are: Waste Management, Toms River; Middletown Department of Public Works; and Shore Point Distribution Co. in Freehold Township.

South Jersey Gas (SJG) has three company-owned CNG fueling stations, located in Glassboro, Millville, and Lindenwold. These stations are available for public use. SJG has converted 60 vehicles of its 170 vehicle fleet to CNG and is on track to convert all 170 within 5 to 7 years.

In 2013, SJG and Wawa entered into an agreement for a three store pilot to provide CNG fueling capabilities at Wawa fueling stations. SJG and Wawa are in the site selection phase and anticipate construction starting in 2015.

According to USDOE New Jersey presently has 11 public CNG refueling stations and 143 electric charging stations.[16] In addition Powered by CNG estimates another 22 CNG stations that are on private facility sites.[17] Use of these alternative fuel stations has resulted in 19,218 tons of avoided CO_2 greenhouse gas emissions and 3,898,356 gallons of avoided gasoline usage, according to the Clean Cities Coalition. EMP workgroup activities on transportation are ongoing.

[16] http://www.afdc.energy.gov/fuels/electricity_locations.html
[17] http://poweredbycng.com/new-jersey-cng-stations/

Recommendations

More work is needed to accelerate the progress to achieving the 2011 EMP goal. BPU and DEP will continue to develop policies that remove barriers and expand the use of the entire array of alternative fuel vehicles, including plug-in electric vehicles (EV), vehicles powered by Compressed Natural Gas (CNG) and any other AFV from the transportation sector that has the potential to increase mileage efficiency and reduce emissions.

BPU and DEP are working to develop incentives to promote and increase the use of alternately fueled vehicles including CNG and electric vehicles in New Jersey

- *Support Emerging Technologies*

2011 Goal

Support initiatives that capitalize on emerging technologies for clean energy solutions in power production and transportation. The State must continue to monitor the evolving development and improvement of innovative energy technologies and businesses. Based on the ranking of technologies available in the near term, the State should evaluate program opportunities to support increased development and use of these technologies. *[For more detailed information about this subject see the 2011 Energy Master Plan, page 136.]*

Goal Status

BPU, through a partnership with EDA, supports the commercialization and proof of concept of innovative clean energy technologies. These programs include the Edison Innovation Clean Energy Manufacturing Fund (CEMF) and the Edison Innovation Green Growth Fund (GGF).

BPU continues to explore opportunities for new funding mechanisms including revolving loan funds.

Recommendations

No changes to the 2011 EMP goal are recommended.

IV. ADDITIONAL CHALLENGES AND GOALS SINCE 2011 ENERGY MASTER PLAN

Improve Energy Infrastructure Resiliency & Emergency Preparedness and Response

In recent years New Jersey has been struck by a series of unprecedented weather events which have damaged the State's economy and energy infrastructure. The magnitude and increased frequency of these events have produced a paradigm shift for weather event preparedness and critical infrastructure protection, especially in the energy sector. While this increased focus on emergency preparedness was prompted by weather events like Hurricane Irene and Superstorm Sandy, such planning efforts will protect the State in the event of any major emergency event, weather related or otherwise (i.e.: cyber attack).

The economic impact to the State and loss of essential services to the public caused by the extended power outages during Hurricane Irene in 2011, the 2011 October snowstorm, and Superstorm Sandy in 2012, have prompted policymakers and industry leaders to take a closer look, not only at infrastructure resiliency and hardening measures, but also at emergency preparedness and response.

To illustrate the scope of the problem, Superstorm Sandy downed 9,441 utility poles, left more than 100 transmission lines out of service, and damaged or flooded more than 4,000 transformers statewide, leaving 2.8 million electric customers without power after the peak of the storm. Full restoration of power took 14 days, despite having more than 17,000 crew workers, coming from across the country, and working around the clock.

The damage caused by Superstorm Sandy highlighted the interdependency of New Jersey's energy system and the risks posed by such interdependency. Some gas stations were unable to run their gas pumps when the overall electric grid failed, and many stations with back-up diesel generators were unable to provide service because the pipelines that move liquid fuels and the "racks" for supplying delivery trucks were down as a result of the grid failure. Panic buying was a major factor in short-term gasoline shortages, resolved quickly with implementation of an "odd-even" purchase requirement, and the arrival of supplementary fuel from refineries and storage facilities in South Jersey and the surrounding region.

Additionally, 94 wastewater treatment plants across all 21 counties lost power and were flooded, leading to between 3 and 5 billion gallons of untreated wastewater being discharged into New Jersey waterways. A total of 267 of the 604 water systems across the State were without power, and 37 of those systems issued boil water advisories following the storm. Power to hospitals was down, and, in some critical areas, patients had to be transported to other facilities after the storm.

The damage and disruption caused by Superstorm Sandy was unprecedented, but weather-related disruptions to the State's power infrastructure are not uncommon. Between 1985 and 2013, New Jersey experienced 143 events that caused a sustained outage (greater than 5 minutes), and of

those sustained outages, 27 were found to be a "major outage" – or an outage that impacts more than 100,000 electric customers (defined as electric meters) for a period of more than one day.

Based on a review of the events and consequences described above, the State revisited the EMP and created a new overarching goal: *Improve Energy Infrastructure Resiliency & Emergency Preparedness and Response*, which includes the following action steps:

- *Protect the State's Critical Energy Infrastructure*

  Background
  From a regional perspective, high-level electricity, natural gas, and liquid fuel critical infrastructure assets are designed and operated with built-in redundancy to ensure a certain degree of system reliability and resiliency.

  In the electric power sector, system vulnerabilities and critical infrastructure protection at the regional grid level are addressed as part of PJM's annual Regional Transmission Expansion Plan (RTEP) process. Through the RTEP process, load forecasts, studies, and computer models test the transmission system for vulnerabilities and weaknesses against mandatory North American Electric Reliability Corporation (NERC) reliability standards.

  At the State level, non-intentional threats and vulnerabilities identified by the EDCs tend to be local in nature. Overhead distribution systems on power poles, for example, are highly susceptible to tree damage during high winds or tropical storms, and substations located near rivers and streams are vulnerable to flood waters during heavy rains or tropical storms. The consequences of these threats and vulnerabilities were evident during the recent series of severe weather events, including Superstorm Sandy when tree damage and flood waters disrupted service to more than 2.8 million New Jersey residents for an extended period of time.

  Lessons learned and recommendations to improve these areas were documented in the BPU's December 14, 2011 Staff Report following Hurricane Irene[18]. Infrastructure protection and resiliency issues uncovered in the wake of the 2011 and 2012 weather events were also addressed in a series of BPU Orders including an Order establishing a generic proceeding to review and investigate the prudency costs incurred prior to, during, and following any Major Storm Event[19].

  EMP Update Goal
  Reduce the vulnerability of the State's critical energy infrastructure by encouraging the assessment of current vulnerabilities to threats and promoting efforts to reduce those vulnerabilities and increase response and restoration times to damage to the State's critical energy infrastructure.

[18] New Jersey Board of Public Utilities, Hurricane Irene Electric Response Report
[19] BPU Docket No. AX13030196

Goal Status

Between January 2013 and April 2014, the BPU issued a series of Board Orders in response to the devastating weather events that struck New Jersey in 2011 and 2012. The Board's Orders not only direct the EDCs and GDCs to implement specific measures with regard to emergency preparedness and response, storm mitigation, and vegetation management, but also direct the review and investigation of EDC prudency costs related to Major Storm Events.

In response to the Board's Orders, four separate petitions were filed with the BPU in 2013 for approval of infrastructure hardening and storm mitigation projects. Petitions were submitted by PSE&G, New Jersey Natural Gas (NJNG), Elizabethtown Gas (ETG), and South Jersey Gas (SJG). The Board approved approximately $1.3 billion in infrastructure hardening and storm mitigation projects. The State as a matter of policy through the years has supported proposals, especially for infrastructure investment after recent storm events, to support infrastructure hardening as long as these measures were structured in a financially prudent fashion.

New Jersey's liquid fuel infrastructure is not just important to New Jersey residents and businesses, but it also plays a critical role in delivery of transportation, electric generation and heating fuels to customers in New York and Pennsylvania. In evaluating lessons learned from Superstorm Sandy, New Jersey recognized that commercial suppliers and delivery services were best equipped to respond to emergent needs, with appropriate guidance from government emergency personnel.

New Jersey developed a resiliency program specifically for retail fuel. The Retail Fuel Station (RFS) – Energy Resiliency Program is a grant program created by the Governor's Office of Recovery and Rebuilding and implemented by the New Jersey Economic Development Authority (EDA), New Jersey Department of Environmental Protection (NJDEP) and New Jersey Board of Public Utilities (BPU). The program is funded through $7 million from the FEMA Hazard Mitigation Grant Program (HMGP).

This voluntary grant program is designed to enhance the operational resiliency of retail fuel stations statewide from future outages by incentivizing the installation of back-up generators, quick-connects or back-up electric generators. (A quick-connect is a fixture for facilitating a rapid connection of a portable generator.) To date, this program has approved $3.625 million in grant awards to retail gas stations in the form of reimbursement for the cost of 48 permanent generators and 57 quick-connects. Another $230,000 is allocated for applications currently under review by FEMA, and $445,000 is allocated for applicants that are currently under review.

In October of 2013, the State announced the $25 million Hazard Mitigation Grant Program (HMGP) Energy Allocation Initiative to support back-up power and alternative energy solutions for local governments to enhance energy resilience. Due to the overwhelming demand for this program and the availability of additional HMGP funding, the State targeted an additional $13 million in HMGP funds to support the new "Lifeline / Life Safety

Program" to fund additional local energy projects at critical facilities. This initiative builds upon the Administration's efforts in the aftermath of Superstorm Sandy to enhance energy resilience at critical infrastructure throughout New Jersey.

HMGP awardees consisted of two groups; A. Energy Resilience grants; and, B. Lifeline and Life Safety Grants. Awardees represented all 21 counties, receiving almost $38 Million in funding to various energy projects. http://www.ready.nj.gov/programs/hmgp.html

Recommendations
The State should increase the focus on energy assurance planning that ensures effective all-hazards response to all energy emergencies, emphasizing infrastructure resiliency measures and system hardening. BPU should review the GE Energy Consulting Group Report and consider the report's recommendations as they relate to storm hardening costs and benefits, and industry initiatives. BPU should also continue to work with EDCs on the new vegetation management pilot program currently under way to reduce tree-related outages. The State should continue to support infrastructure hardening or preparedness applications of the utility companies as long as financially prudent.

- *Improve EDC Emergency Preparedness and Response*

Background
Every New Jersey community is dependent on electric power, and the loss of electric service causes immediate community impact. Communities must increase their ability to prepare for future major events and to respond to such events more quickly and effectively.

EMP Update Goal
The State should encourage and promote greater emergency preparedness and response among its local and county governments to reduce the impact of future emergency events.

Goal Status
Following the widespread utility outages in 2011 caused by Hurricane Irene and the October snowstorm, BPU initiated an investigation of electric utility storm preparedness and response efforts. This review resulted in two BPU Orders directing the EDCs to implement emergency preparedness, response and restoration improvement measures.

The first Board Order, issued on January 23, 2013, incorporated more than 120 improvement measures recommended by BPU's consultant. A second Order, issued on May 29, 2013, included additional measures designed to address communications concerns of customers and municipal officials that were raised during Superstorm Sandy. The improvement measures outlined in the Board Orders fall into the following five categories: 1) Preparedness Efforts; 2) Communications; 3) Restoration and Response; 4) Post Event; 5) Underlying Infrastructure Issues.

BPU is tracking the EDC's implementation of the improvement measures as outlined in both the January 23, 2013 Order and the follow-up Order of May 29, 2013, and actively monitors their progress. Some of the key recommendations include the need for EDCs to improve the

estimated time of restoration (ETRs), establish and maintain EDC webpages describing storm safety and preparedness information, plan for worst-case scenario, adopt the Incident Command System (ICS) emergency response model, mobilize all communications channels at an EDC's disposal as soon as potential Major Events are forecasted, and develop Interactive Voice Response (IVR) messages to provide customers with immediate information.

Recommendations

The EDCs should continue to test and exercise all new preparedness and response measures, particularly those involving the application of new technologies used to inform customers about potential outages before a storm hits or ETRs during the restoration process. The EDCs should also work with emergency management officials on ways to improve existing measures as disaster planning assumptions continue to change.

- *Improve and Enhance the EDC Smart Grid and Distribution Automation Plans*

Background

As noted above, New Jersey electric systems have been negatively impacted by significant weather events. This has highlighted our dependency on electric power. In addition to community preparedness and assessment of vulnerabilities and threat response, the electric distribution systems must be continually upgraded with the most current technology to improve and enhance the grids reliability and resiliency. While focusing on critical facilities, the analysis and upgrade to a smart grid (SG) through distribution automation (DA) should advance. A smarter grid through distribution automation can address increased DG systems, including renewables and storage on the grid, as well as demand response and advanced meters options in a smarter grid.

EMP Update Goal

BPU will require the four EDCs to submit updated plans for SG/DA that further detail the progress to date, future plans and the overall costs and benefits of SG/DA for reliability and resiliency. BPU will initiate a proceeding to work with the four EDCs to further develop and enhance a smarter grid through distribution automation with detailed plans for future development for SG/DA by the EDC.

Goal Status

As required in the Irene Order dated January 23, 2014, the four electric utilities filed their Smart Grid-Distribution Automation (SG/DA) plans by April 24, 2014. The SG/DA plans were focused on storm hardening, improved reliability and resiliency and not "smart" or advanced meters for dynamic pricing. A summary of the resiliency SG/DA plan is as follows:

- ACE has automated sectionalization and reclosures (ASR) to 33 substations, is currently installing ASR in 19 substations and will install a similar amount annually until all ACE substations have ASR.

- JCP&L has installed programmable reclosers at targeted substations and new substations and has added remote switching at 10 additional substations.
- RECO has installed midpoint reclosers on 30 circuits, 30 circuits have automatic loops and 10 circuits have smart loops.
- PSE&G has installed Supervisory Control and Data Acquisition programs (SCADA) at 100 substations and will install 10 per year until all substations have full SCADA.

An evaluation of the SG/DA plan filings in the four areas of storm outage prevention, prediction, restoration and management as prepared by GE Energy Consulting in its final report to the BPU titled *NJ Storm Hardening Recommendations and Review/Comments on EDC Major Storm Response Filings*, dated November 26, 2014, is available at http://www.nj.gov/bpu/pdf/reports/NJ_Major_Storm_Response-GE_Final_Report-2014.pdf.

The development of storm hardening/resiliency SG/DA systems and plans could lead to the development of advanced meters for utilization of dynamic pricing. This could assist in meeting a number of goals in the EMP.

Recommendations

The BPU should require the four EDCs to update their SG/DA plans to detail the progress to date and future plans, including all costs and benefits.

- *Increase the Use of Microgrid Technologies and Applications for Distributed Energy Resources (DER)*

Background

Distributed Energy Resources (DER) are on-site systems, equipment or processes that are small, modular, and decentralized, as compared to larger centralized power plants that also include transmission and distribution systems, and can include DR, EE, and DG. DER can be either grid-connected or off-grid energy systems located in or near the place where energy is used.

DER systems can be designed to function in "island mode," isolated from the grid during a power outage or other event. A system with islanding capabilities would be defined as a microgrid within the larger electric distribution system if it includes blackstart capabilities. Similar to a car engine that requires a battery in order to start, a DER system requires an extra "battery" system, such as a small diesel generator or battery system, to blackstart without assistance from the grid.

The USDOE defines a microgrid as: "An integrated energy system consisting of a group of interconnected loads and DER with clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid and can connect and disconnect from the grid to enable it to operate in both grid connected or island mode." Microgrids can increase reliability with the use of DG, increase efficiency with reduced transmission length, and allow for easier integration of alternative energy sources.

EMP Update Goal
Increase the use of microgrid technologies and applications for DER to improve the grid's resiliency and reliability in the event of a major storm.

Goal Status
As a part of the State's ongoing recovery from Superstorm Sandy, the State of New Jersey has entered into Memoranda of Understanding (MOU) with the U.S. Department of Energy (USDOE) to evaluate the potential to develop microgrids on two key recovery projects: a microgrid within the northeast portion of the NJ Transit system, called NJTransitGrid, and a microgrid within the PSE&G service area in the City of Hoboken.

To test the feasibility of these two projects, the USDOE provided funding directly to Sandia National Laboratories to evaluate measures to improve the resiliency of the NJ Transit energy system and the PSE&G service area in Hoboken when the grid is down.

NJTransitGrid is a first-of-its-kind electrical microgrid capable of supplying highly-reliable power during storms, or other times when the traditional centralized grid is compromised, and will serve as a model for other communities in the State and across the nation.

BPU worked with NJIT to map potential Town Center DER microgrids. This report mapped 24 potential Town Center DER microgrids across the 17 municipalities in the 9 Sandy designated Counties. BPU is working with NJIT to map the remaining 12 counties. A Town Center DER microgrid would have a cluster of critical facilities within the municipality that could include multifamily buildings, hospitals and local and state government critical operations in a small radius and connected to a series of DER technologies that can operate isolated and islanded from the grid when the power is down. The BPU continues to support both Town Center and other opportunities for microgrids.

The State also is seeking to encourage investment in resilient DER technologies through the Energy Resilience Bank. Funded with $200 million of Sandy recovery funds, the first ERB funding products are targeting wastewater treatment plants and hospital systems.

Recommendations
The State should continue its work with the USDOE, the utilities, local and state governments and other strategic partners to identify, design and implement Town Center DER microgrids to power critical facilities and services across the State.

As directed by the Board, BPU staff, based on discussions with stakeholders at four microgrid proceeding meetings is in the process of finalizing a Microgrid Report back to the Board with recommendations for next steps. The Board should consider next steps to assist in reducing barriers in the development and implementation of Town Center DER microgrids.

- *Create Long-Term Financing for Local Energy Resiliency Measures through an ERB and other Financing Mechanisms*

Background

After Superstorm Sandy, the United States Congress appropriated $16 billion to the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Relief (CDBG- DR) Program. (reduced to approximately $15 billion after sequestration) to assist recovery in states affected by Superstorm Sandy. To date, New Jersey has been allocated approximately $4 billion of CDBG-DR funds for Sandy recovery. Most of these funds are supporting housing recovery initiatives, the State's primary focus in recovering from Superstorm Sandy. However, $200 million of CDBG-DR funds have been allocated to the New Jersey Energy Resilience Bank, a first-of-its-kind in the nation energy resilience financing initiatives that seeks to make critical facilities, and by extension, the communities they serve, more resilient by investing in DER technologies that allow the facilities to continue to operate when the electric grid fails. The ERB's first two funding products focus on water and wastewater treatment facilities and hospitals. (Additional energy resilience investments have been made through other Sandy recovery funding streams, including the aforementioned Energy Allocation Program and Lifeline/Life Safety Program, which are funded with FEMA Hazard Mitigation Grant Program funds.)

EMP Update Goal

Use the federal funds provided to New Jersey to improve and increase local energy resiliency through DER microgrid systems that can operate during and after an emergency and to make the local energy systems stronger than they were before the storm.

Goal Status

Water and wastewater infrastructure suffered an estimated $2.7 billion in direct damages during Superstorm Sandy. Sand infiltrated and blocked a number of sewer lines, and other lines were determined to be structurally damaged beyond repair. At the height of the storm, 94 wastewater treatment systems suffered failures or disruptions, including inadequate treatment, broken sewer mains, and other operational issues.

The loss of electrical power rendered many water systems unable to maintain service. Even at plants where backup generation was available, the disruption of the petroleum production and delivery system caused generator fuel supplies to be limited.

The vast majority of New Jersey's community water supply systems were affected: 427 of 604 community water systems experienced power loss during the event. As a direct result of the service interruptions, 362,334 New Jersey residents were placed under a boil water advisory. One month after Superstorm Sandy made landfall, eight drinking water systems in Ocean County, serving approximately 10,000 households, were still subject to a boil water advisory.[20]Additionally, the health, safety and welfare of patients is threatened if hospital

[20] http://www.state.nj.us/dca/announcements/pdf/CDBG-DisasterRecoveryActionPlan.pdf

systems and long-term care facilities cannot continue operations through reliable, resilient power systems when the electric grid fails.

The ERB financing options include grants and low interest loans. The eligible technologies include combined heat and power (CHP), fuel cells, battery storage, and off-grid inverter upgrades. The ERB will not finance emergency backup generators, but they can be included as part of the overall solution to meet the resiliency performance standard. The current program guide and financial offer for wastewater and water treatment facilities is a 20% grant, 20% performance based principal forgiveness grant over 5 years and a 2%, 20-year loan for the remaining project costs of the facilities unmet needs. *[For more information about the ERB visit:* http://www.njerb.com*]*

Additionally, the New Jersey Economic Development Authority recently approved a second ERB funding product that will target ERB funds to make hospital systems more energy resilient through investment in DER technologies. This funding product follows of the heels of the State successfully securing from HUD a waiver that allows ERB financing to be used to promote energy resilience at hospitals.

The ERB, using revolving loan funds, will finance the design, acquisition, construction, and installation of additional DER projects that will improve and increase the energy resiliency at New Jersey critical facilities. The ERB is also exploring ways to leverage private capital to extend the CDBG-DR and BPU NJCEP funds.

Recommendations

In addition to financing energy resiliency measures, the ERB should also be leveraged to assist in achieving the EMP EE and DG goals, as well as introducing customers to New Jersey's Clean Energy Program (NJCEP). The ERB program should work in coordination with the Energy Saving Improvement Program (ESIP) and the NJCEP EE programs to coordinate these two critical needs of energy efficiency and resiliency. BPU will be working in conjunction with the ERB to advance Town Center DER microgrids and assisting in reducing technical and regulatory barriers as the ERB addresses reducing financial barriers.

V. CONCLUSION

This Update to the State's 2011 Energy Master Plan catalogues the many successes New Jersey has achieved over the past three years in advancing the Plan's Five Overarching Goals and carrying out the Plan of Action, as well as those areas where progress is ongoing and where more work needs to be done.

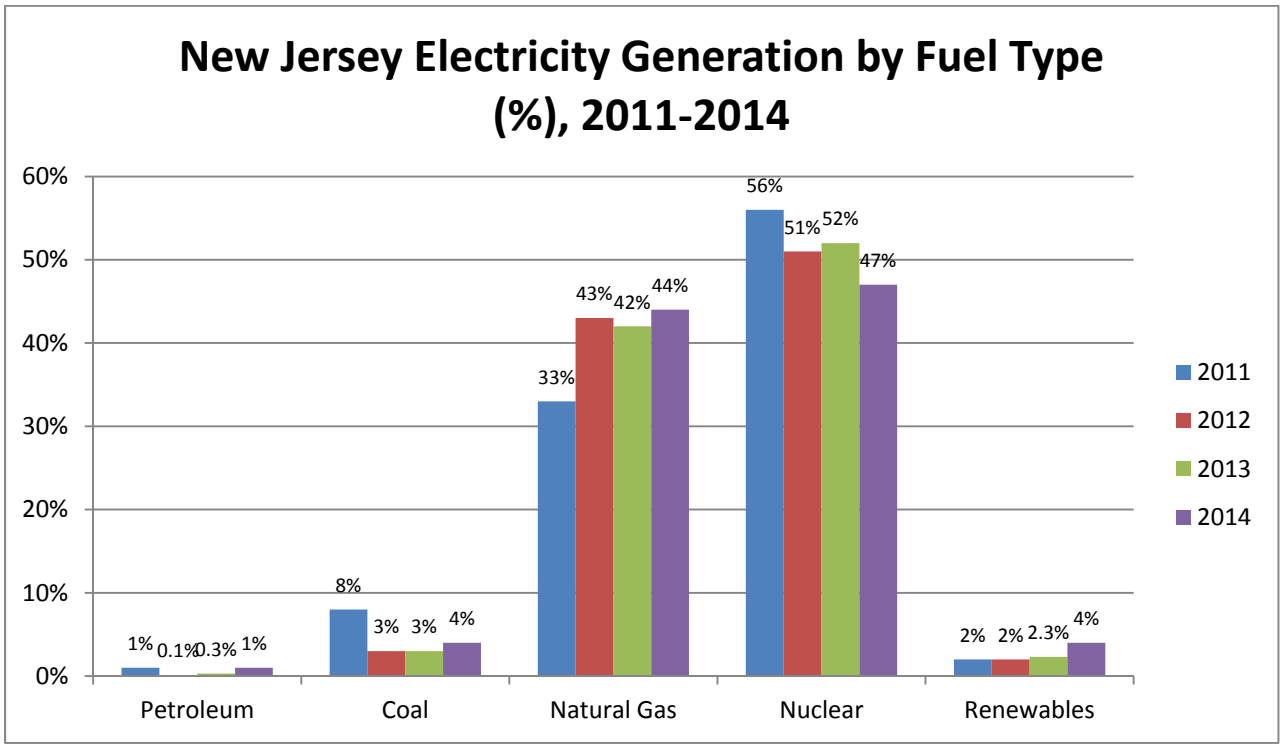
Since the publication of the 2011 Energy Master Plan, the cost of energy is down for New Jersey consumers, our state's in-state energy generation is cleaner than ever before, and New Jersey is on-track to meet the Renewable Energy Portfolio standard goal set for 2020. The State continues to promote energy efficiency and conservation and maintains its strong commitment to encourage the use of emerging technologies for transportation and power production.

This EMP Update also demonstrates the State's ability to refocus its efforts to meet emergent challenges, such as the increased priority that the State is placing on improving the resiliency of our energy infrastructure to respond and recover from significant disruptions caused by severe weather events.

Recognizing the economic and environmental importance of an affordable, reliable, adequate, clean supply of energy to the economic prosperity and the environmental health of New Jersey, the Administration will build on the accomplishments already realized, and will continue to evaluate and assess the State's energy needs and priorities in the years ahead.

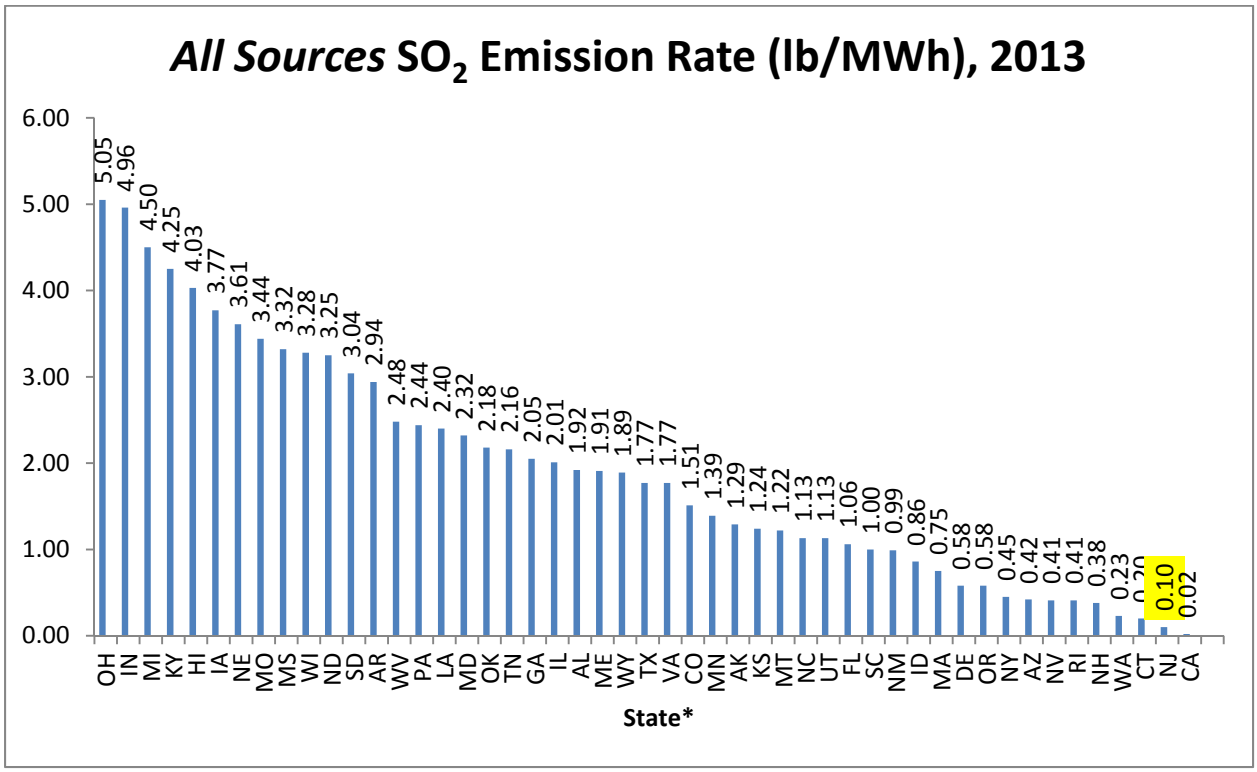
NEW JERSEY ENERGY MASTER PLAN

UPDATE
Appendix



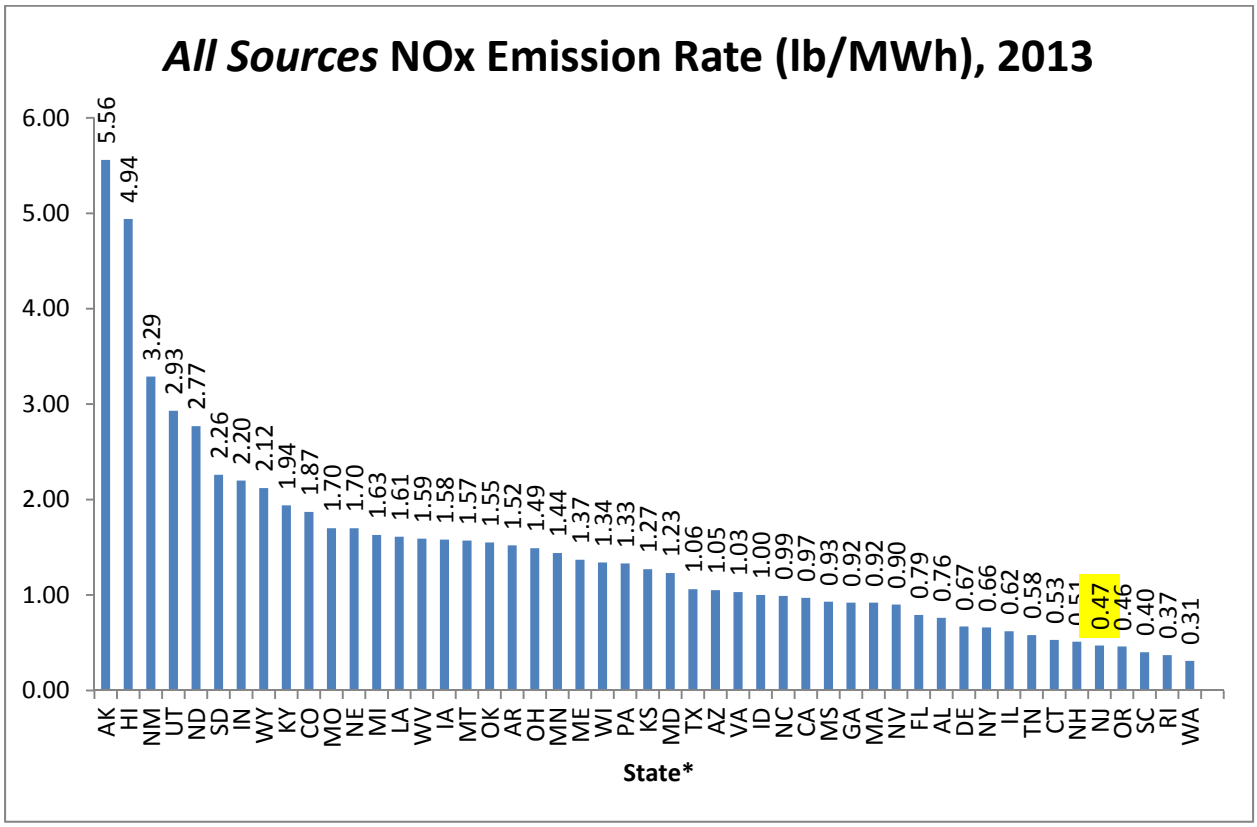
Source of Base Data: EIA State Electricity Profiles – New Jersey

AQES, NJDEP rev. 10/23/15



*(Vermont excluded; limited power sector)
Source of Base Data: 2013 EIA State Historical Tables 1991-2013 (www.eia.gov/electricity/data/state); Emission Rate calculated as: (total emissions in Metric Tons/total generation in MWh) X 2,204.6 pounds/metric ton.

AQES, NJDEP rev. 10/23/15



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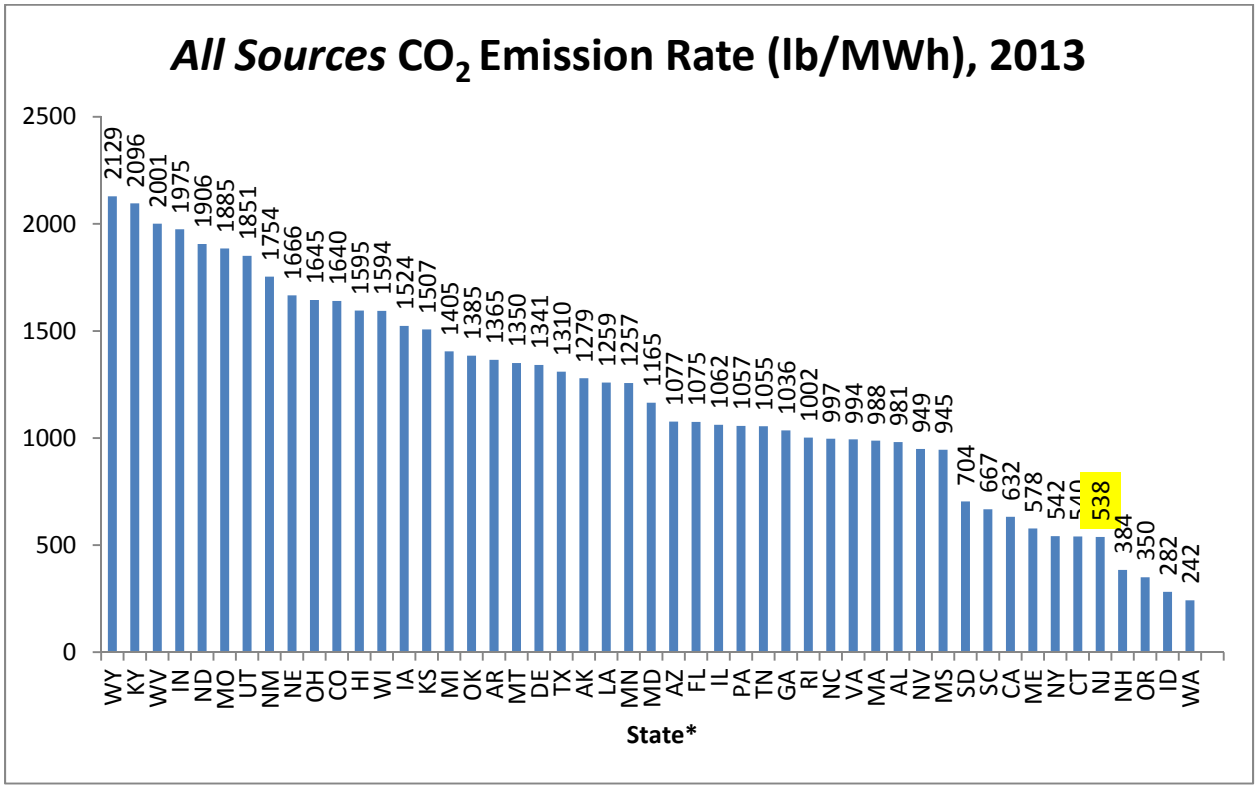

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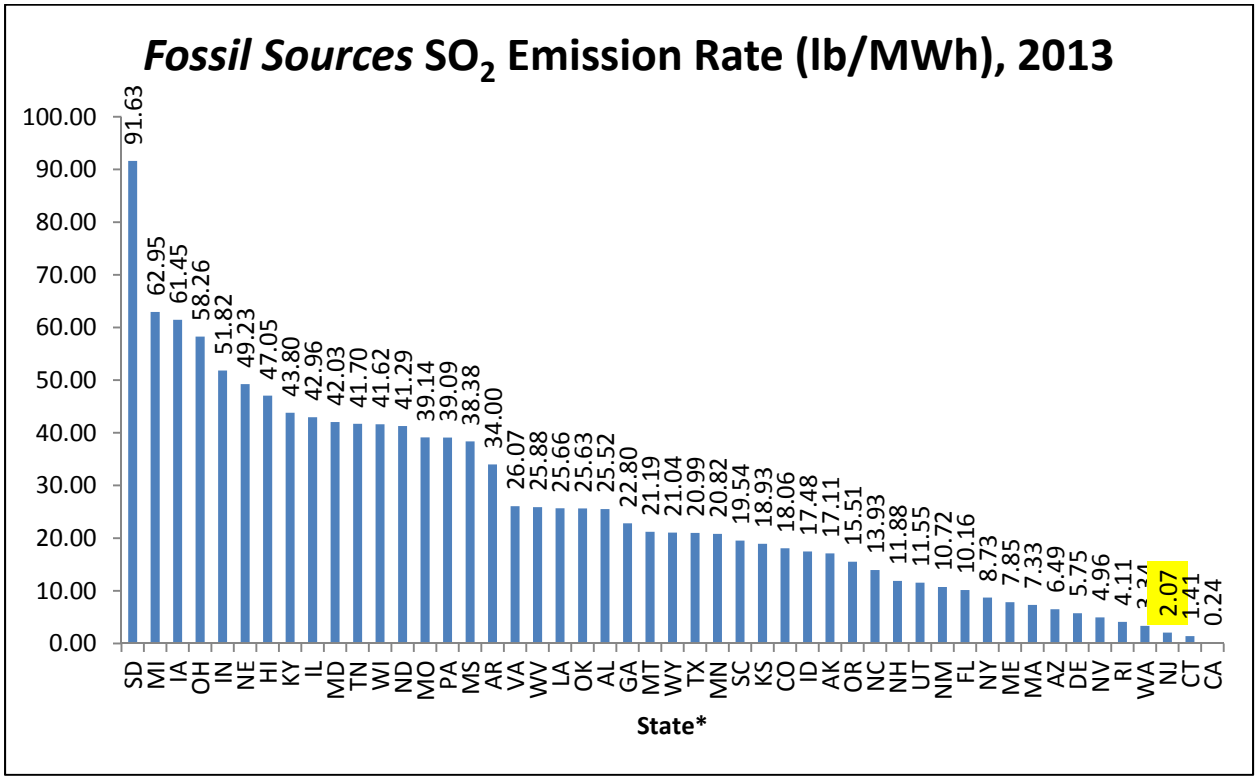

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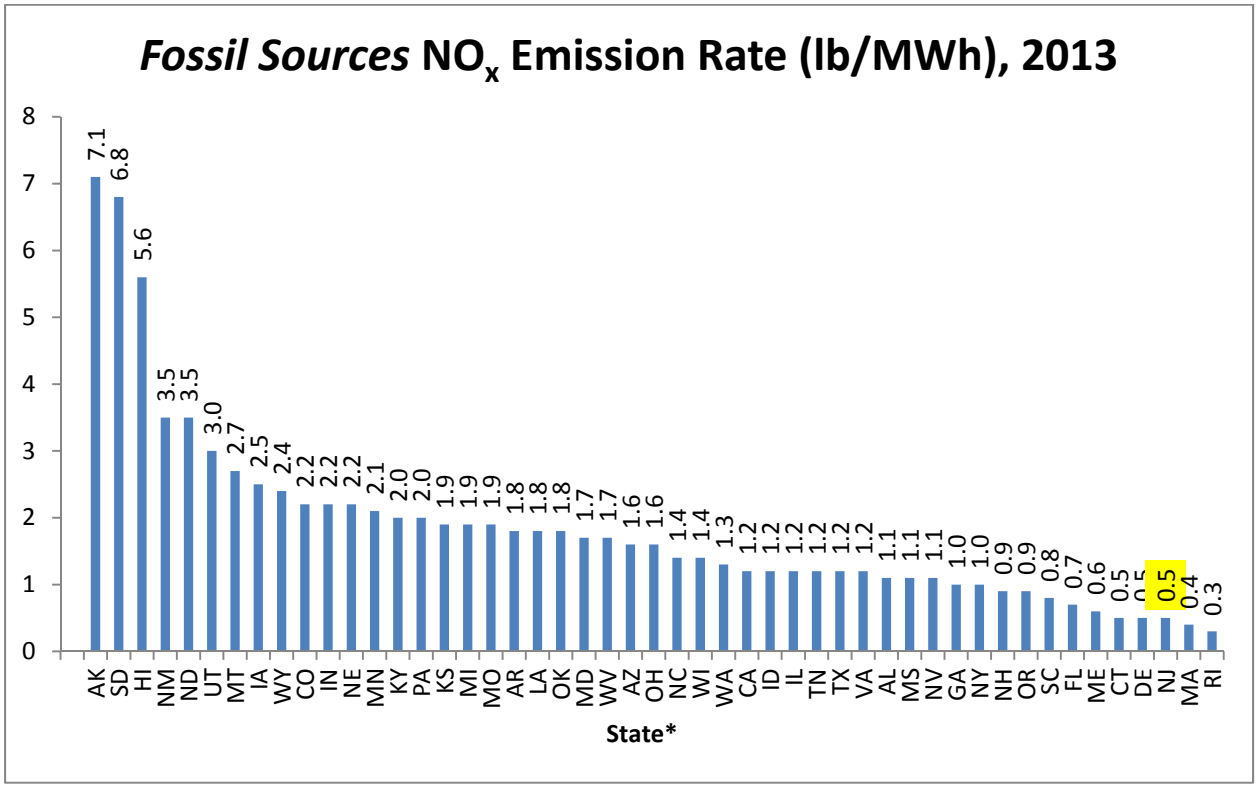

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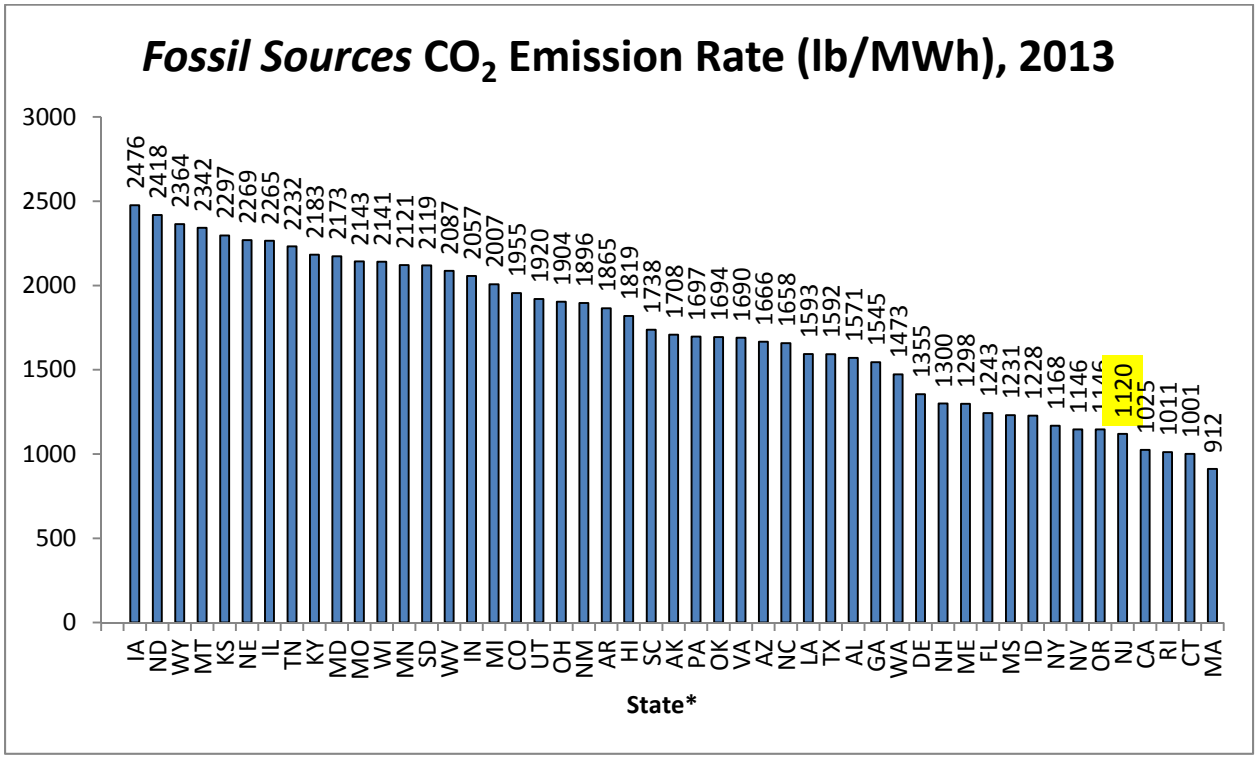

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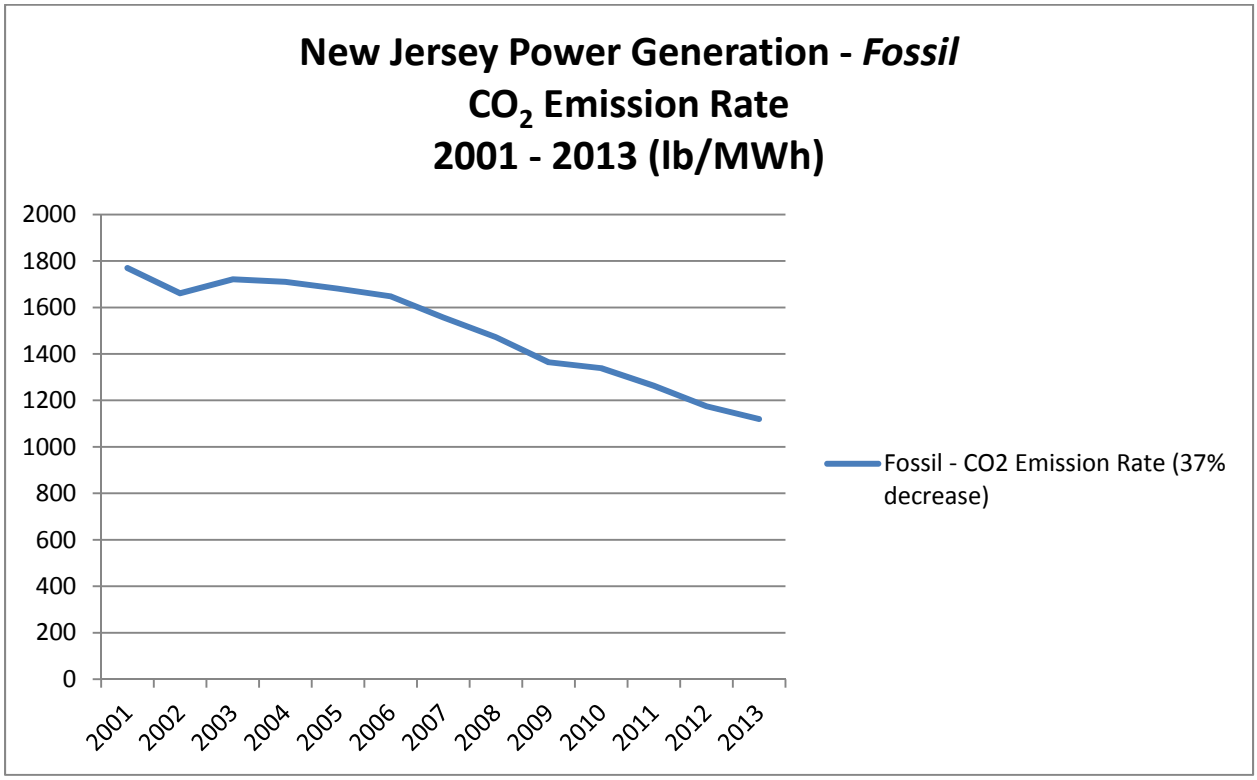

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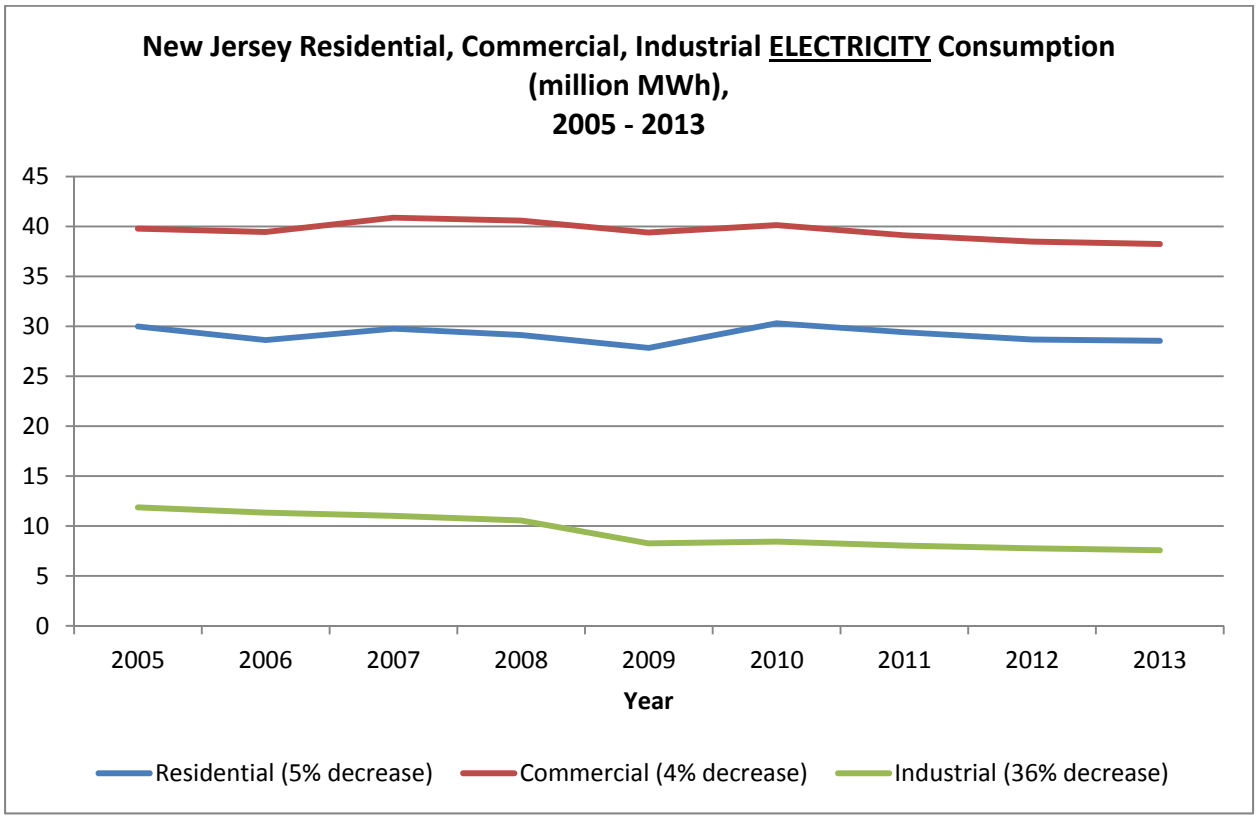

Source of Base Data: EIA State Energy Data System (SEDS)
http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_use/res/use_res_NJ.html&sid=NJ ;
http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_use/ind/use_ind_NJ.html&sid=NJ
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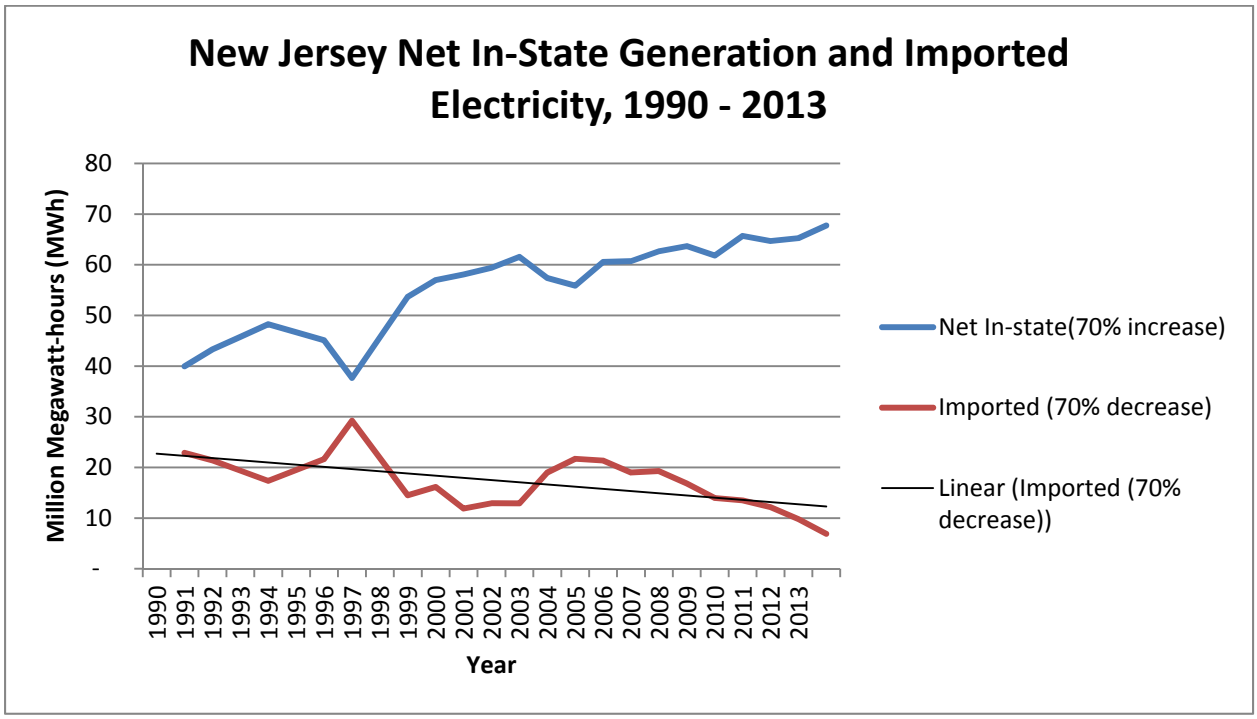

*In 2013, NJ imported approximately 9% of its electricity needs (Source: NJDEP)
Source of base data: **USDOE/EIA,** 30 September 2015 **(http://www.eia.gov/electricity/state/newjersey/)**

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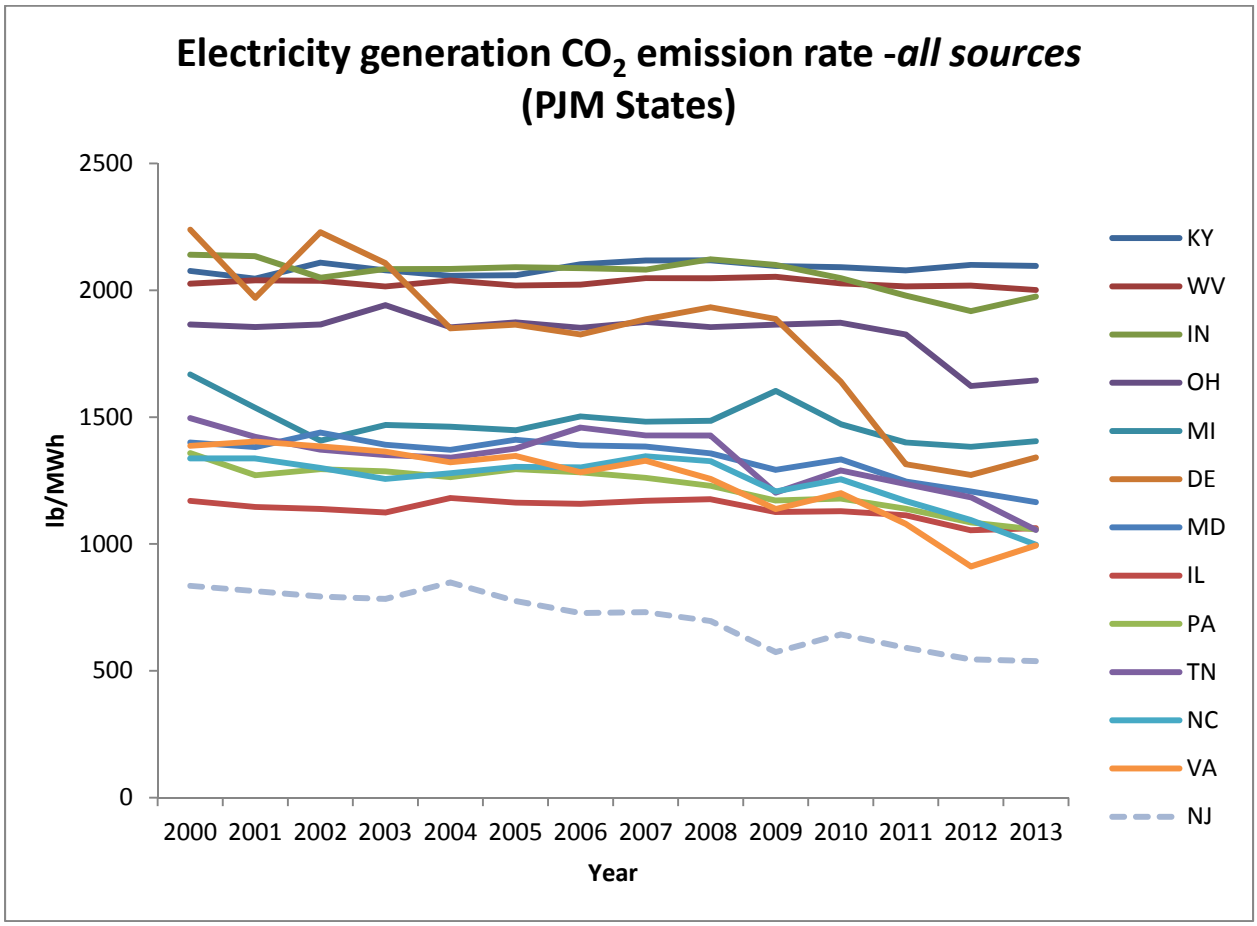

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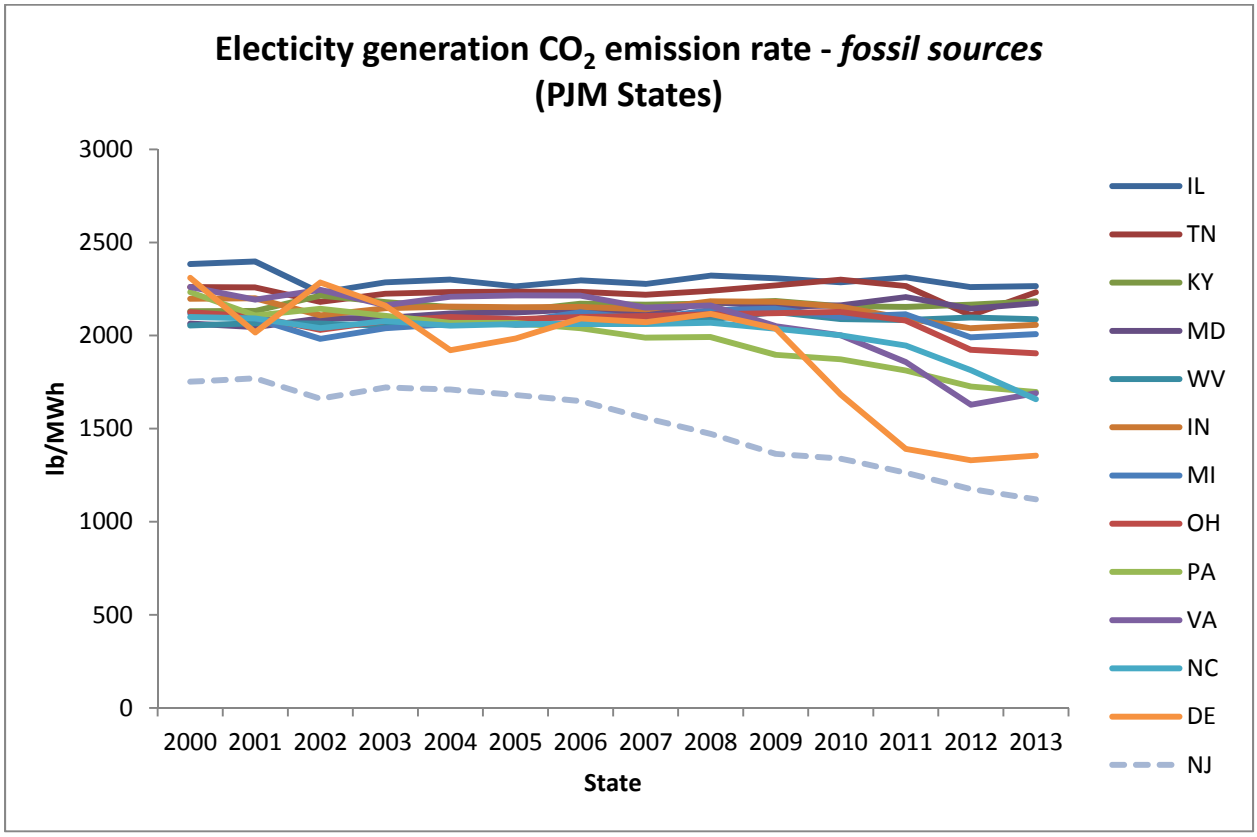

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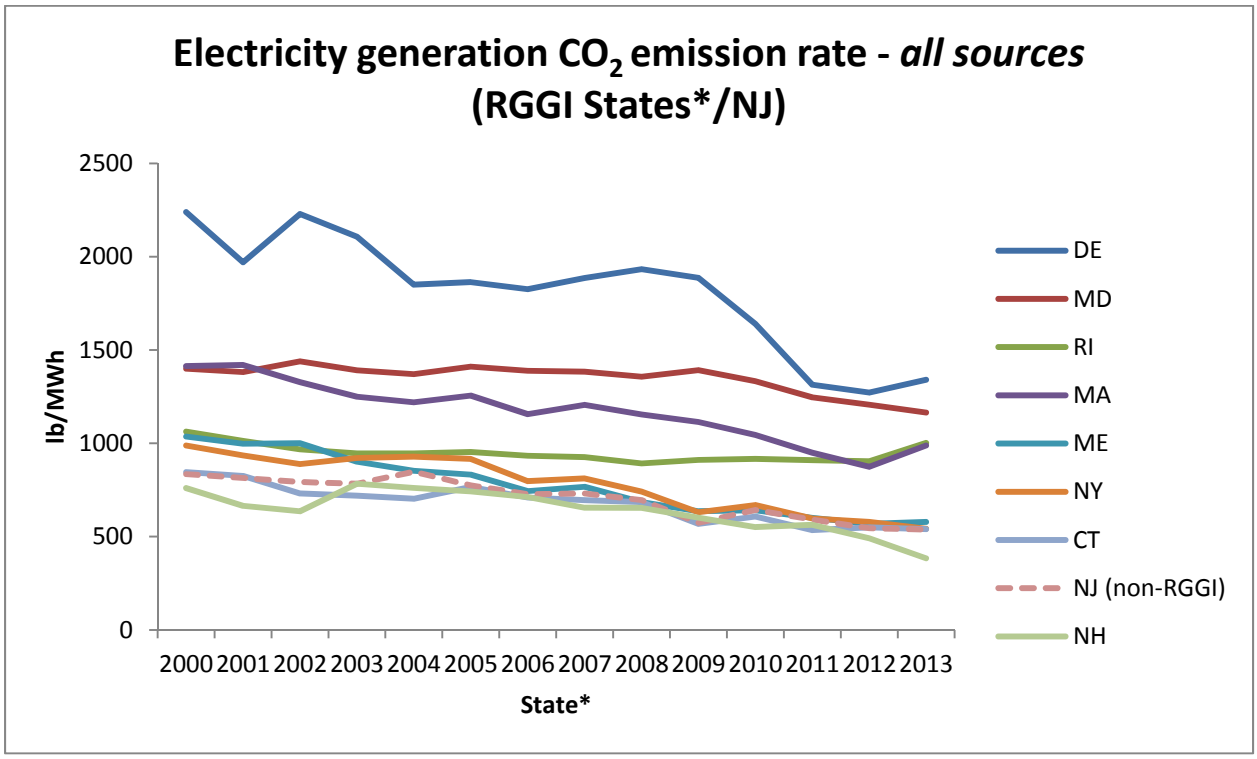

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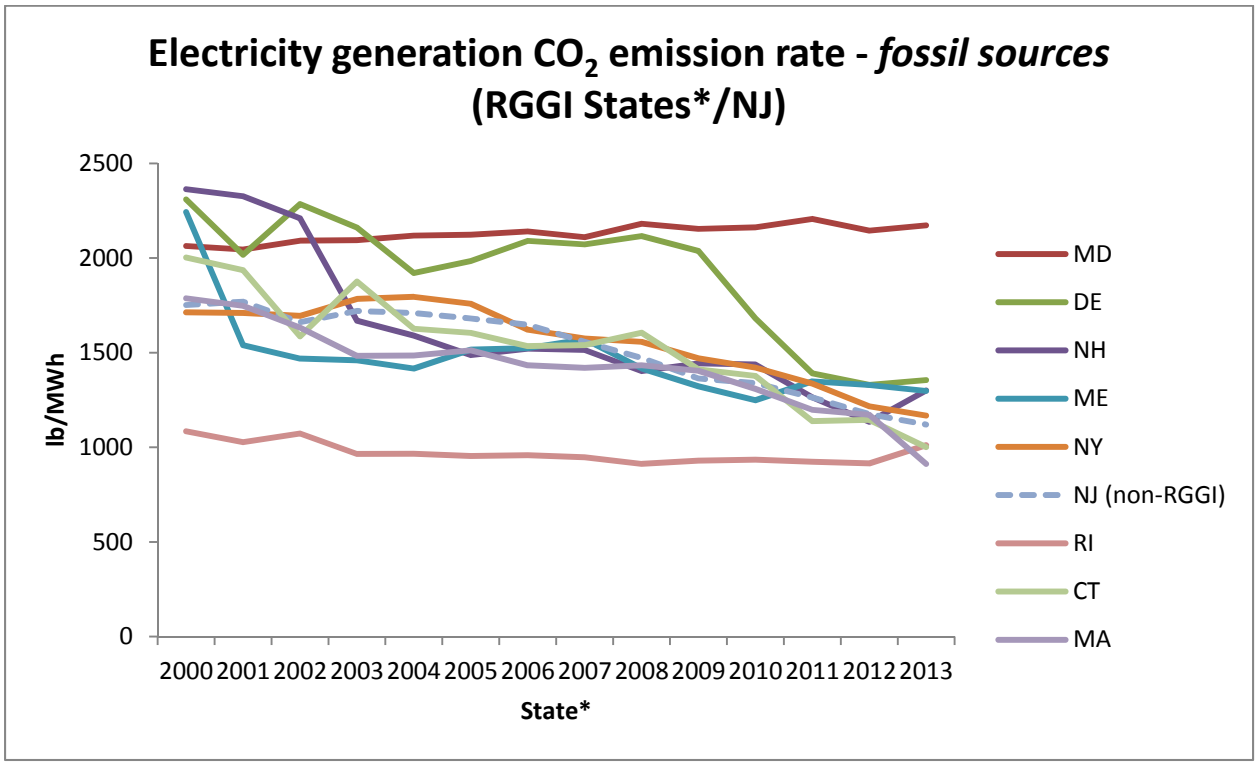

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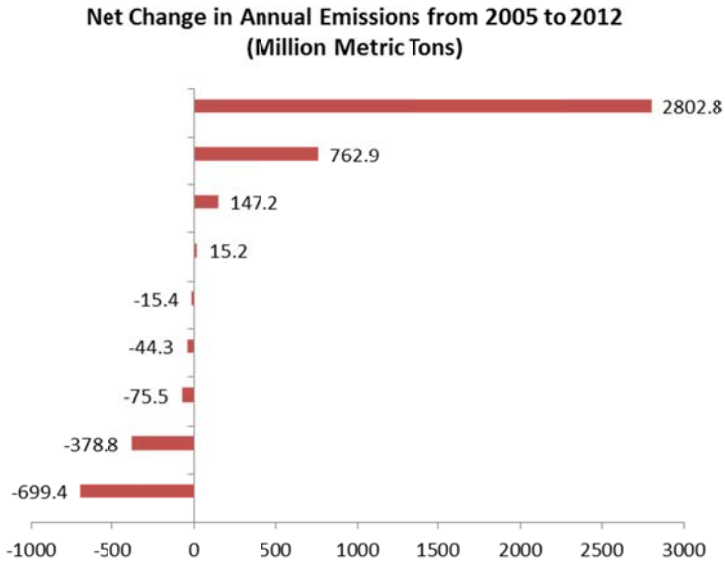
Global energy-related CO_2 emissions* - net change, 2005 to 2012

Country/Area	2012 Emissions (million metric tons)
China	8,205.9
India	1,954.0
Russia	1,659.0
Japan	1,223.3
Canada	533.7
Germany	755.3
U.K.	457.5
Europe	3,716.8
U.S.	5,074.1



Source: **International Energy Agency (IEA),** 13 March 2015, http://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustionHighlights2014.pdf

*Economy-wide CO_2 emissions from fossil fuel combustion.

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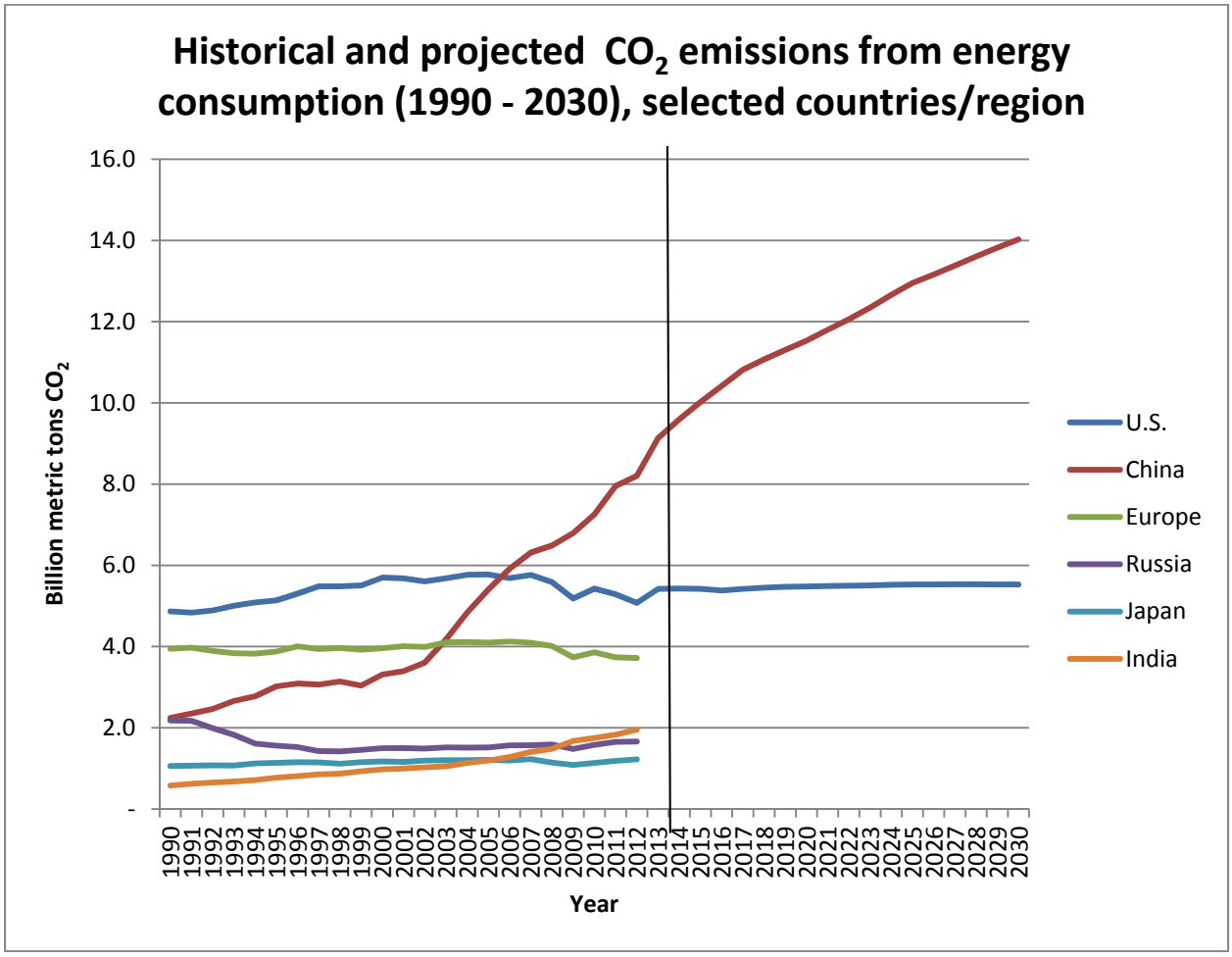

Source: **IEA** (historical data); World **Resources Institute** (projections 2013 – 2030).

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