

Toward a Clean Energy Future

The Vision, the Track Record,
and the Challenge Ahead for
New Jersey's Leaders



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Executive Summary

Over the past decade, New Jersey has taken important steps on the road to a clean energy future, from launching an energy efficiency program to reducing vehicle pollution through a clean cars program. In 2007, state leaders passed the Global Warming Response Act, requiring the state to rapidly and substantially reduce emissions of global warming pollution. The state then mapped out a path toward achieving these ambitious goals in the 2008 Energy Master Plan, building on the success of its innovative clean energy programs. These initiatives are now delivering results – conserving energy, reducing our contribution to global warming, protecting our air and water quality and improving public health.

However, at the beginning of the new decade, the state of New Jersey's commitment to a clean energy future is less certain. Dirty energy companies are once again lining up at New Jersey's doorstep. One company is working to build a new coal-fired power plant in Linden, and utility companies are working intently

to build several new power lines to bring more coal energy to New Jersey from Pennsylvania and the Midwest.

Newly elected Governor Chris Christie faces a choice: follow through on building a 21st century clean energy future for New Jersey, or slide back into the dirty energy patterns of the past. By embracing the state's existing clean energy goals – and by enacting real, concrete policies to make those goals reality – Governor Christie can help the state do its part to stop the worst impacts of global warming and ensure a reliable, affordable electricity supply.

New Jersey is reducing electricity consumption and peak demand for power through successful energy efficiency programs.

- In 2008, New Jerseyans reduced statewide electricity consumption by 4 percent compared to the peak reached in 2007. Electricity consumption in 2009 is likely to be down another 4 percent.



The Liligrund offshore wind farm, located near the south coast of Sweden, generates enough electricity to power about 60,000 homes. Photo: Siemens

- Peak demand for electricity has generally been declining since 2006. In 2009, peak demand was 1,800 megawatts (MW) (or 9 percent) below levels predicted the year before.
- The recession is responsible for much of the reduced need for electric power in 2009. However, New Jersey's ratepayer-funded energy efficiency programs are also playing an important role in this transition. Active since 2001, these programs are now saving on the order of 400 gigawatt-hours (GWh) of electricity per year and reducing peak demand by a total of about 740 MW – reducing the state's electricity consumption and peak demand by about 0.5 percent per year. That amount of electricity is equivalent to the annual needs of about 46,000 New Jersey households, or half the residences in a city the size of Jersey City.
- If New Jersey expands its commitment to energy efficiency, the state can ensure that electricity consumption and peak demand continue to decline, even as the economy recovers from recession and grows. Building on progress achieved to date, the state can meet the goals of the Energy Master Plan, reducing electricity consumption by at least 20 percent below “business as usual” levels by 2020, and reducing peak demand for electricity by 5,700 MW by 2020 – eliminating the need to build dozens of power plants and new power lines.

New Jersey is using an increasing amount of electricity generated from clean, renewable sources of power. The state also plans to increase the amount of renewable electricity generated in-state by building offshore wind farms and installing thousands of solar panels.

- In 2009, New Jersey obtained about 7 percent of its electricity supply from renewable energy sources to comply with the state's renewable electricity standard. The Energy Master Plan calls for New Jersey to obtain 30 percent of its electricity from clean, renewable sources by 2020, powering more than 1 million New Jersey homes with wind, solar and other clean technologies. To achieve this goal, New Jersey will have to raise its renewable electricity standard.
- Less than 1 percent of New Jersey's electricity is generated from in-state renewable resources. To increase the use of local resources and enhance local economic benefits, the Energy Master Plan envisions the construction of 3,000 MW of offshore wind turbines by 2020 – enough to supply about 15 percent of the state's electricity needs. As of the end of 2009, three companies are pursuing wind farms off the coast of Cape May and Atlantic Counties. The first turbines could be operational as soon as 2013 or 2014.
- Another promising source of renewable power local to New Jersey is the sun. By including a requirement for solar power within its existing renewable electricity standard, New Jersey has launched one of the most active solar markets in America. The state now has more solar panels per

square mile than any other state. In January 2010, the state legislature acted to build on this progress, requiring the state to generate more than 2,100 GWh from solar power by 2020 (or close to 3 percent of the state's electricity needs) – and more than double that amount by 2026. To date, New Jersey's clean energy programs have helped to install more than 100 MW of solar capacity, putting the state about one-tenth of the way to the 2020 target.

If the state follows through on the 2008 Energy Master Plan, importing dirty power or building new expensive and polluting coal-fired or nuclear power plants will be unnecessary.

- Although the state has made progress toward achieving the goals laid out in the Energy Master Plan, much more remains to be done over the next decade.
- By achieving the Energy Master Plan goals, New Jersey could deliver a reliable supply of electricity at an affordable price, while helping the state do its part to address global warming. The benefits of a renewed commitment to clean energy include:
 - Reducing annual global warming pollution from the electric sector almost 20 percent below 1990 levels by 2020 – even if the state retires Salem nuclear reactors I and II at the end of their operating licenses this decade.
 - Saving New Jersey consumers a net of nearly \$17 billion through energy efficiency improvements – with benefits exceeding costs by 260 percent.

- Reducing the emission of health-threatening air pollution, both from in-state and out-of state fossil fuel-fired power plants.
- Increasing fuel diversity and insulating consumers from spikes in the price of fossil fuels.
- Creating jobs that can't be outsourced and boosting economic activity around the manufacture and installation of energy efficient equipment, solar panels and off-shore wind farms.

Governor Christie should re-affirm New Jersey's commitment to a clean energy future by embracing the goals of the Energy Master Plan and enacting concrete policies to realize those goals.

- **New Jersey should expand and accelerate its energy efficiency programs.** New Jersey is achieving roughly one third of the energy savings delivered by efficiency programs in leading states such as Vermont and Connecticut. The state should take action to capture more of its vast energy efficiency potential by requiring utilities to capture all cost-effective energy efficiency resources before investing in new supply and meeting specific targets for reducing electricity consumption and peak demand. Additionally, the state should set new building energy codes, adopt energy efficiency standards for appliances like flat screen televisions, and lay out a plan to ensure all new buildings achieve net-zero carbon emissions by no later than 2030, and ideally as soon as 2020.

- **New Jersey should increase its commitment to clean, renewable electricity.** The state should increase its renewable electricity standard to require 30 percent of the state's electricity consumption to come from clean, renewable sources of energy by 2020. Half of the standard could be achieved with local resources by ensuring the successful deployment of 3,000 MW of wind farms off the New Jersey coast. The Christie administration should work to establish a financing mechanism for offshore wind and facilitate a robust, environmentally responsible, and efficient permitting process. Additionally, the state should build on its momentum in the solar market and foster the introduction of emerging renewable energy technologies, such as ocean and geothermal power.
- **New Jersey should limit dirty power imports.** New Jersey should ensure that any new power lines deliver clean, renewable electricity to the state, rather than facilitate the transmission of polluting coal-fired power. A generation performance standard requiring all new power sources to meet or exceed the emissions performance of a combined cycle natural gas plant would achieve this goal. Alternatively, the state could work with other Regional Greenhouse Gas Initiative states to regulate emissions from imported electricity.

Introduction

From reducing vehicle pollution through clean cars to mandating steep, science-based reductions in global warming pollution, New Jersey's leaders have taken bold steps toward a clean energy future over the last decade.¹ In many ways, New Jersey has articulated a vision for a new way to generate and use energy and set an example for the whole nation to follow.

But the road to a clean energy future is long, and continued progress is not a certainty. Much more remains to be done, and the stakes are high.

Our continuing ties to the energy sources of the past – especially fossil fuels such as coal and oil, and wasteful, inefficient energy use – make us vulnerable to the damaging health impacts of dirty air, the risk of expensive power outages, and out-of-control energy costs.² At the same time, the damaging impacts of global warming – from the acidification of the world's oceans to melting glaciers and rising sea levels – are happening even faster than the most eye-opening predictions made by the United Nations' Intergovernmental Panel on Climate

Change just two years ago.³ Scientists are becoming increasingly concerned that critical thresholds are a matter of years or a few decades away – beyond which lay dramatic and irreversible changes to our world and our way of life.⁴

In this report, Environment New Jersey Research & Policy Center surveys the state of the state of New Jersey on clean energy in the electric power sector, reviewing progress achieved in 2008 and 2009, and describing the challenges ahead.

Newly elected Governor Chris Christie arrives at a critical time. The decisions our state and our nation make in the next several years will shape our energy future for decades to come.

Governor Christie inherits a vision for a clean energy future built around energy efficiency and renewable energy – a vision largely articulated in the state's 2008 Energy Master Plan. If the new administration chooses to drive this clean energy vision forward, New Jersey will use energy more efficiently and we will dramatically increase generation of clean, renewable energy by building thousands

of wind turbines and putting solar panels on tens of thousands of rooftops. We will invest money to deploy the best new renewable technologies and position New Jersey as one of the nation's 'green jobs' leaders. Under this vision, the state will continue to make progress toward meeting the goals of the Energy Master Plan and reduce emissions of global warming pollution in accord with the targets of the Global Warming Response Act – without the need for more dirty energy to keep the lights on.

Alternatively, if the new administration fails to focus on clean energy deployment, New Jersey could be the home of a new coal-fired power plant whose owners promise to use unproven and risky technology to store its global warming pollution under the ocean – technology that might not be ready for a decade, if ever. New Jersey could be importing more power from dirty power plants in Pennsylvania, West Virginia and points west, undermining the intent of the Regional Greenhouse Gas Initiative, draining money from the local economy, contributing to air pollution drifting over New Jersey, and increasing the vulnerability of our electricity system

Moving forward, leadership from Governor Christie will be critical to drive progress and secure New Jersey's future.

to price spikes and power outages. And New Jersey's businesses and residents will be held hostage to ever increasing electric bills – a problem all too familiar to those who call New Jersey home.

Moving forward, leadership from Governor Christie will be critical to drive progress and secure New Jersey's future. Making a strong and early commitment to energy efficiency and renewable energy will signal that the Christie Administration is ready to modernize New Jersey's economy and help the state take control of its energy destiny.

New Jersey is Moving Toward a Clean Energy Future

When it comes to energy issues, New Jersey is making progress. The state has begun to transition away from fossil fuels and toward a clean energy future, using energy more wisely while developing wind, biomass and solar energy resources.

New Jersey's clean energy advances are the result of a series of state and federal policies designed to promote cleaner sources of electricity – helped along by volatile fossil fuel prices, increased concern about global warming, technological improvements that have reduced the cost of renewable energy over the last three decades, and economic forces such as the 2008-09 recession.

New Jersey is a national leader on state-level clean energy policy. During the past decade, state leaders have advanced a broad suite of clean energy policies and initiatives, including:⁵

- Ratepayer-funded energy efficiency and renewable energy programs;
- A renewable electricity standard, driving growth in electricity generation from wind, biomass, solar and other clean energy sources;
- A Clean Cars policy, reducing automobile emissions of health-threatening and global warming pollutants;
- Incentives to grow the state's market for solar photovoltaic power;
- The Regional Greenhouse Gas Initiative, a policy aimed at reducing global warming pollution from power plants in the Northeast; and
- The Global Warming Response Act, a pioneering law requiring New Jersey to reduce its emissions of global warming pollution to 1990 levels by 2020 and to 80 percent below 2006 levels by mid-century.

Today, at the dawn of a new decade in 2010, these programs are beginning to

deliver substantial results. New Jersey's electric power sector is becoming more energy efficient and less polluting. The state is deriving its power from increasingly diverse sources of energy, including both solar and wind power. As a result, New Jersey is beginning to attract economic investment and jobs that can't be outsourced, while protecting its citizens from the highly volatile costs of fossil fuel.

However, given the scale of the challenge, much more remains to be done. The results New Jersey has achieved to date bring the state just a fraction of the way toward a future with an affordable, reliable supply of electricity that does not contribute to problems such as global warming, health-damaging air pollution, and radioactive waste. The consequences of continuing business as usual are widely recognized as "unacceptable."⁶

In response to these large-scale energy problems, the previous administration recognized "an opportunity for New Jersey to redesign its energy system while establishing a clean energy industry as a major part of our economy."⁷ After years of study and deliberation, the administration put together an Energy Master Plan to guide New Jersey to a better future. The plan emphasizes "strong, thoughtful actions that help us to use energy more efficiently, to reduce the growth in our peak demand for energy, and to produce more clean energy locally."⁸ These actions can deliver competitively priced, reliable power while ensuring that New Jersey meets its targets for reducing emissions of global warming pollution. At the same time, the plan, if fully implemented, would "create jobs, grow clean energy businesses, and establish the clean energy industry as a cornerstone of the State's economy" for the 21st century.⁹

The central goals of New Jersey's Energy Master Plan are to:

- **Increase energy efficiency** by reducing electricity consumption by 20 percent and peak demand for electricity by 5,700 megawatts (MW) below forecast levels by 2020, and to
- **Expand the generation of renewable energy**, obtaining 30 percent of New Jersey's electricity supply from clean, renewable resources by 2020. Under the plan, the state will build wind energy farms with 3,000 MW total capacity in the ocean along New Jersey's coast and grow the state's solar industry, installing enough solar photovoltaic panels to generate 2,120 gigawatt hours (GWh) of electricity in the year 2020, which is enough to power about 250,000 households.

New Jersey has embarked on a course to achieve these goals, given the progress the state has made in the last two years in reducing electricity consumption and peak demand.

However, continued progress is not a certainty. For example, putting profits over public health and the environment, energy companies are lobbying to turn back the clock. One company is seeking to build a new coal-fired power plant in Linden, gambling on unproven technology to limit the global warming impact of coal and ignoring the many other environmental impacts of coal, ranging from the damage caused by destructive mountaintop removal mining to pollution from the toxic byproducts of coal combustion, such as Tennessee Valley Authority's 1 billion gallon coal sludge spill in December 2008.¹⁰ Other utility companies are working to build new power lines that would expand New Jersey's reliance on polluting power from out-of-state coal plants, undermining the state's progress toward cleaner air and a smaller global warming footprint. Finally,

utility companies are lobbying to build new nuclear power plants – despite anticipated costs in the range of \$6 billion per reactor and the fact that no new reactor could be up and running for a decade or more.¹¹

The decisions New Jersey makes in the next decade will determine whether the state succeeds or fails at building a clean energy future.

New Jersey is Developing Clean Energy Resources

In the last several years, New Jersey has achieved significant progress in reducing electricity consumption and peak demand for power, with a strong contribution from successful energy efficiency programs. At the same time, the state is moving to develop local wind and solar energy resources and using more clean, renewable electricity, laying the foundation for a 21st century energy economy. If the state continues to build on this progress, the goals of the 2008 Energy Master Plan will be within reach.

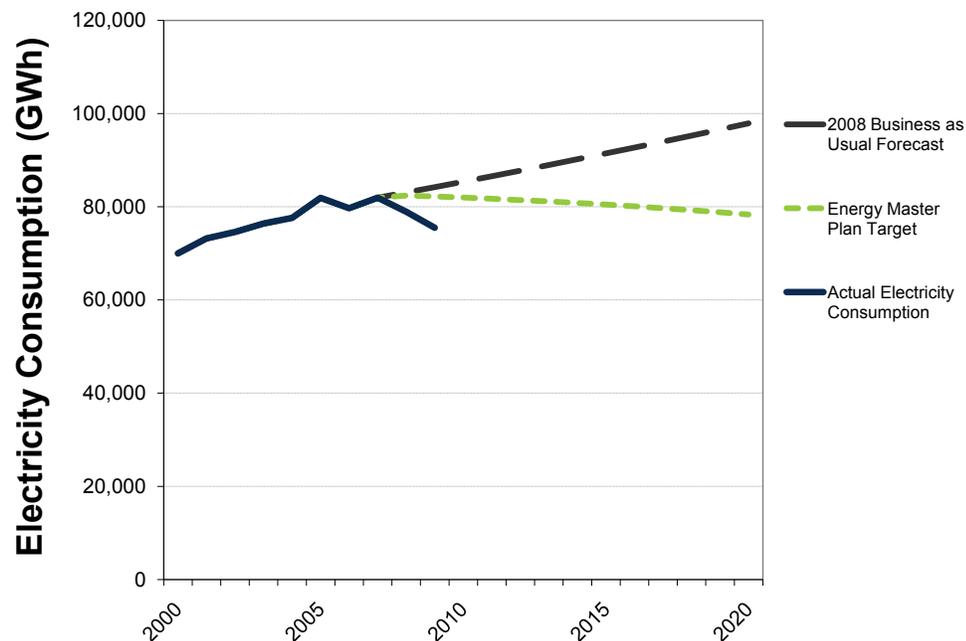
New Jersey Is Reducing Electricity Consumption

New Jersey is turning to energy efficiency and conservation as the cheapest and fastest way to reduce its dependence on fossil fuels. As a result, New Jersey’s annual electricity consumption is declining.

New Jersey’s power plant emissions of global warming pollution depend on how much electricity the state consumes. At the same time, high electricity consumption is a key factor behind high electricity bills. Reducing electricity consumption through efficiency and conservation is a powerful solution to these problems.

From 1990 to 2005, New Jersey’s electricity consumption climbed steadily at an average growth rate of 2 percent per year.¹² Assuming that this trend would continue, experts predicted in 2008 that electricity consumption would continue to grow through 2020, albeit at a slightly slower rate of 1.3 to 1.4 percent per year.¹³

Figure 1: In 2009, New Jersey Reduced Electricity Consumption Well below Forecast Levels¹⁶



However, New Jerseyans actually reduced their overall electricity use in 2008 and 2009. In 2008, New Jerseyans reduced statewide electricity consumption by nearly 4 percent from the peak level reached in 2007.¹⁴ Electricity consumption in 2009 is likely to be down another 4 percent.¹⁵

The 2008 Energy Master Plan set a goal of reducing New Jersey’s electricity consumption by a least 20 percent below a business-as-usual forecast by 2020. If the state continues to build on the progress it has achieved to date, this goal will be within reach. (See Figure 1.)

New Jersey Is Reducing Peak Demand for Electricity

New Jersey is successfully avoiding the need to build new power plants and power lines by reducing the size of the peak load on its electricity system.

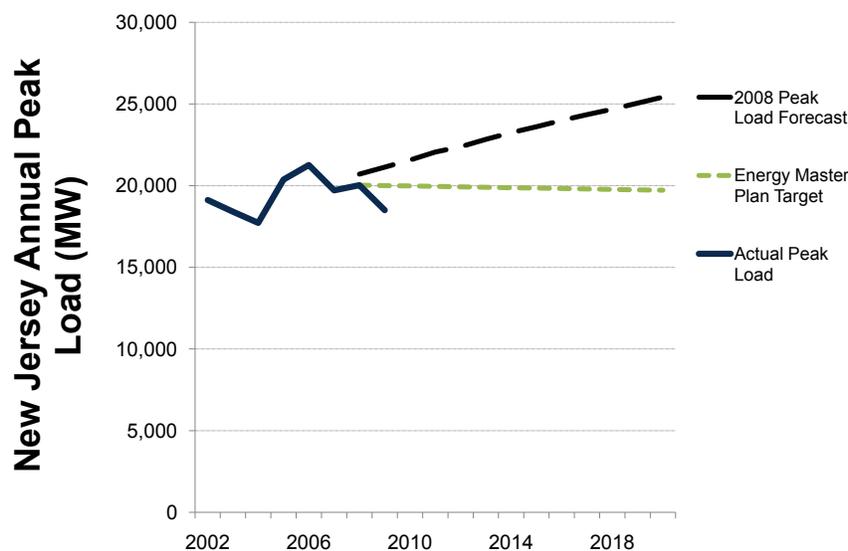
The key factor that shapes decisions about New Jersey’s electric infrastructure is not the total amount of power that is used in a year, but rather the amount of power needed to keep the lights on during periods of peak demand. The demand for electricity varies widely over the course of the year and the course of any given day -

the demand for power on a hot summer day when air conditioners are running can be two to three times as great as in the middle of the night during a time of moderate temperatures.

A central vulnerability of New Jersey’s electric system is that the state as a whole, and areas within the state, do not have enough local generation resources to service demand. As a result, the state must import power from elsewhere and make costly transmission investments to transport that power where it is needed. Reducing demand for electricity is a powerful solution to this problem.

Since 2006, peak demand for electricity in the service territories of New Jersey’s four main electric utilities has been declining.¹⁷ In 2009, peak demand was 1,800 MW (or 9 percent) below levels predicted by the electric system operator the year before.¹⁸ Taking into consideration the impact of weather from year to year, peak demand declined 2 percent from 2008 to 2009 – a smaller but still significant change.¹⁹ If this trend continues, New Jersey will be on track to reduce peak demand for electricity by 5,700 megawatts (MW) by 2020 according to the Energy Master Plan. (See Figure 2.)

Figure 2: In 2009, New Jersey Reduced Peak Electricity Demand Well below Forecast Levels²⁰



The State's Innovative Clean Energy Programs Are Delivering Results

New Jersey's ratepayer-funded energy efficiency programs are playing an important role in this transition. Founded in 2001, these programs are now delivering substantial results.

The recession is responsible for much of the reduced need for electric power in 2009, especially because of a slowdown in manufacturing activity. However, some experts see this decline in energy consumption as an "inflection point" in energy use in America, signaling a long-term and persistent shift in electricity consumption patterns and the structure of the electricity system, leading toward greater efficiency and reduced demand for power.²¹ The primary driver of this shift is the widespread recognition that energy efficiency and demand response programs have huge untapped potential to streamline the electric power system and to improve its functioning. In fact, Federal Energy Regulatory Commission Chairman Jon Wellinghoff said in April 2009, "We may not need any [new nuclear or coal plants], ever."²²

Efficiency and conservation can have a real and lasting impact. For example, utilities' efforts to reduce peak demand in and around Maryland have delayed the apparent need for a new power line from West Virginia, and prompted the line's developer to withdraw its proposal.²³ In 2007, officials expected the line could have been needed as soon as 2012. The impact of the recession pushed the need back to 2014. However, utilities' demand response programs appear poised to keep the lights on until as far out as 2021 without the proposed power line.²⁴

To the extent New Jersey expands its commitment to energy efficiency, the state can ensure that electricity consumption and peak demand actually continue

to decline, even as the state's economy recovers from recession and returns to growth.

Increasing Energy Efficiency

Energy efficiency measures installed through New Jersey's efficiency programs in 2008 save about 400 gigawatt-hours (GWh) of electricity per year, or 0.5 percent of total annual statewide electricity consumption.²⁵ Expressed another way, every year New Jersey's energy efficiency programs save enough electricity to power half of all the residences in a city the size of Jersey City, or about 46,000 households.²⁶ These savings last for a decade or more. As a result, the state's efficiency programs are having an effect similar to building a small new power plant every year.

In total, efficiency measures installed through the state's energy program from 2001 to 2008 will save 22,600 GWh of electricity over their useful lifetimes.²⁷ That amount of electricity could power more than 80 percent of all the residences in New Jersey for one year.²⁸

Reducing Peak Load

In addition to reducing energy consumption, New Jersey's energy efficiency programs also help to reduce demand for power at peak times of the day. The state is also promoting load shifting – in which non-critical uses of electricity are deferred to low-demand hours – and distributed generation technologies – which produce power at or near the location where it is consumed. These efforts reduce the need for power plants and transmission lines.

In 2008, these activities reduced peak load in New Jersey by about 96 megawatts (MW).²⁹ In total from 2001 through 2008, New Jersey's clean energy program has reduced peak load by a total of about 740 MW – the equivalent of several moderately sized natural gas

power plants. This is the equivalent of reducing peak load by about 0.5 percent below forecast levels per year.

Saving New Jerseyans Money

Saving electricity through New Jersey's energy efficiency programs is far cheaper than obtaining power from the state's electric power system. The average kilowatt hour saved by the state's energy efficiency program cost 2 cents per kWh, compared to an average retail electricity cost of 13 cents per kWh.³⁰ As a result, New Jersey electricity customers saved a total of \$75 million in 2008.³¹ Measures installed from 2001 to 2008 will save New Jersey residents and businesses a total of more than \$5 billion over their full lifetime.³²

New Jersey Is Using More Clean, Renewable Electricity

Renewable energy is steadily growing in importance as part of New Jersey's electricity supply. Renewable resources accounted for about 7 percent of the state's electricity consumption in 2009, mostly from trading of renewable energy credits. Less than 1 percent of the state's electric power now comes from local renewable resources.

Among the most important factors encouraging the development of renewable energy is New Jersey's renewable electricity standard. This policy requires utilities to obtain 22 percent of the electricity supplied to consumers from renewable resources by 2020.³⁷

The Energy Master Plan Goal for Combined Heat and Power

Combined heat and power (CHP) units capture waste heat from industrial operations to generate electricity – or use excess heat from the generation of electricity to provide space heating or cooling for homes and businesses. Putting this excess energy to use improves the efficiency of electricity generation and greatly reduces emissions compared to traditional coal- or natural gas-fired power plants. While the average American power plant operates at a thermal efficiency of about 35 percent, CHP plants can achieve efficiencies of 80 percent or greater, meaning that more of the energy that goes into the plant is available for useful work.³³ Hospitals, schools and other large institutions often use combined heat and power to guarantee that power will be available, even when the larger electricity grid fails. Combined heat and power can offer similar reliability benefits for many types of buildings and industries.

Under New Jersey's Energy Master Plan, the state has a goal of fostering the development of 1,500 MW of additional combined heat and power capacity in the state by 2020, bringing the state total to 4,500 MW.

From 2005 to 2008, New Jersey's clean energy programs helped to install more than 20 MW of combined heat and power capacity, which will generate 1.5 million MWh of electricity over its useful lifetime.³⁴ A variety of New Jersey companies and organizations have taken advantage of the program, including Bristol-Myers Squibb, Ortho-Clinical Diagnostics and Raritan Valley Community College.³⁵

A great deal of additional potential for combined heat and power remains untapped. In 2004, KEMA, Inc. identified market potential for approximately 2,100 MW of additional CHP, which could be realized with a reduction of "stand-by" power charges (fees charged to CHP owners to pay for the ability to draw power from the grid when their CHP units are not operational) and an incentive for new CHP of \$1/Watt.³⁶

In the future, the Energy Master Plan envisions an even larger role for renewable power, and for local New Jersey resources. The plan calls for New Jersey to obtain 30 percent of its electricity from clean, renewable power sources by 2020, powering more than 1 million New Jersey homes with clean energy. Additionally, the plan envisions the construction of offshore wind farms to harness the abundant power of the wind blowing over the ocean along New Jersey's coast, meeting about half of the state's total goal for renewable power.³⁸ The plan also calls for an expansion of the state's solar power capacity to generate close to 3 percent of the state's electricity needs by 2020.

Wind Power

Wind power is making a valuable contribution to New Jersey's electricity system, with significant potential to expand over the coming decade. By capturing the energy in the wind through high-tech wind turbines, wind power can provide substantial amounts of electricity from an inexhaustible resource—and the fuel is free.

Nationwide in 2008, wind turbines accounted for more than 40 percent of all electric generating capacity added to the grid, a greater share of new capacity than any other type of generation except perhaps natural gas-fired power plants.³⁹

“We need a new way to generate power, and offshore wind is essential to our future energy demands.”

– Jeanne Fox, President of the New Jersey Board of Public Utilities, quoted in the *Bergen Record*, September 2008⁴⁹

The past decades have seen dramatic advances in the technology of wind turbines, enabling turbines to generate more power at lower cost. The cost of wind power projects has been cut by about two thirds over the past two and a half decades, and technological advances have made it possible to build turbines that are more efficient at generating electricity from the wind.⁴⁰

New Jersey has one utility-scale wind farm, the 7.5 MW Jersey Atlantic Wind Farm in Atlantic City, built in 2005.⁴¹ This wind farm is capable of generating enough electricity to supply the needs of about 2,300 households.⁴²

The state has limited capacity for land-based wind farms, with a densely populated land area and relatively little space available for utility-scale wind turbines compared to neighboring states like New York and Pennsylvania. As a result, offshore areas hold the greatest potential for future wind power development in New Jersey.

Offshore Wind

New Jersey is moving to develop substantial amounts of offshore wind energy generation capacity.

As a part of the energy master planning process, state officials recognized that offshore wind could be exceptionally valuable as a hedge against future spikes in the price of fossil fuel and as a way to prevent health-damaging pollution and reduce global warming.⁴³ In October 2008, the Corzine administration announced plans to build 3,000 MW of offshore wind generating capacity by 2020.⁴⁴ At this scale, offshore wind could supply 13 percent of New Jersey's annual electricity needs, or more.⁴⁵

As a first step toward these goals, New Jersey officials chose three developers to build the state's 3,000 MW offshore wind project. Garden State Offshore Energy, a joint project of PSEG and Deepwater

Wind, plans to build their offshore wind farm approximately 16 to 20 miles off the coast of Cape May and Atlantic counties.⁴⁶ Fishermen’s Energy of New Jersey is pursuing a 70-turbine wind farm 10 miles from Atlantic City, and Bluewater Wind New Jersey has proposed a 116-turbine wind farm in the range of 16 to 19 miles off Atlantic City.⁴⁷ All three companies are in the process of installing weather towers to gather wind speed data.⁴⁸

in this region could supply all of the electricity needs for every coastal state from Massachusetts to North Carolina – while also replacing all of the gasoline used in motor vehicles, and all of the fuel oil and natural gas used for heating and industry – with energy to spare.⁵³ (Achieving such a high wind energy penetration would likely require the use of an energy storage

New Jersey’s Massive Offshore Wind Energy Resource

New Jersey’s offshore wind resources are, by any measure, immense. The U.S. Department of the Interior estimates that wind energy resources off the coast of the continental United States could provide more electricity over the course of a year than the nation currently uses.⁵⁰ Moreover, the largest concentration of resources in shallow ocean waters, accessible with current technology, is located along the Atlantic coast.⁵¹ Finally, winds blowing above the ocean are typically stronger and more consistent than winds over land, and thus are well-suited for power generation.⁵²

In 2007, a group of researchers from the University of Delaware and Stanford University estimated the wind energy resources available in the Mid-Atlantic Bight (a region from Cape Cod, MA to Cape Hatteras, NC), out to an ocean depth of 100 meters. (See Figure 3.) The group excluded from consideration areas inappropriate for development, including bird flyways, shipping lanes, and visual space for major tourist beaches. The researchers found that wind energy resources

Figure 3: Ocean Depths in the Mid-Atlantic Bight⁵⁵

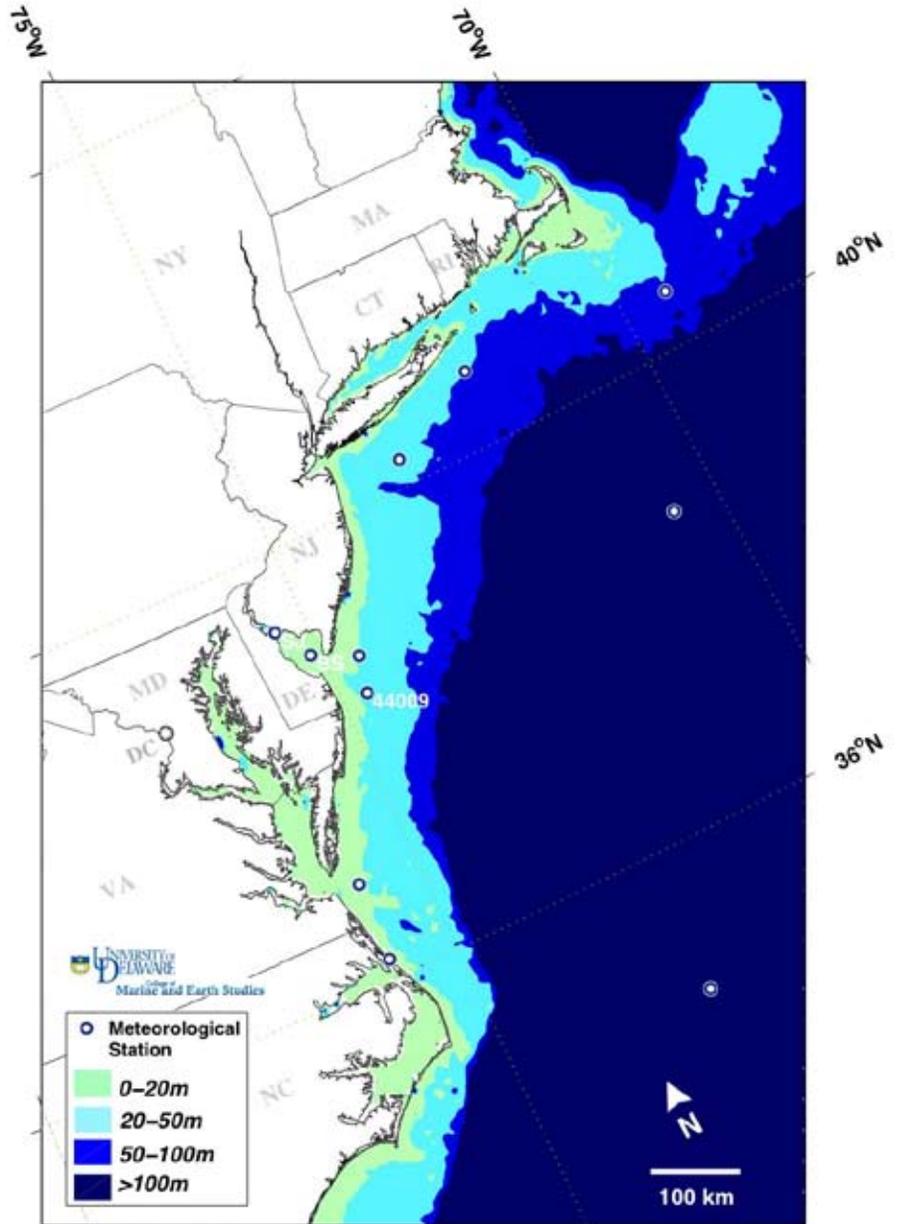
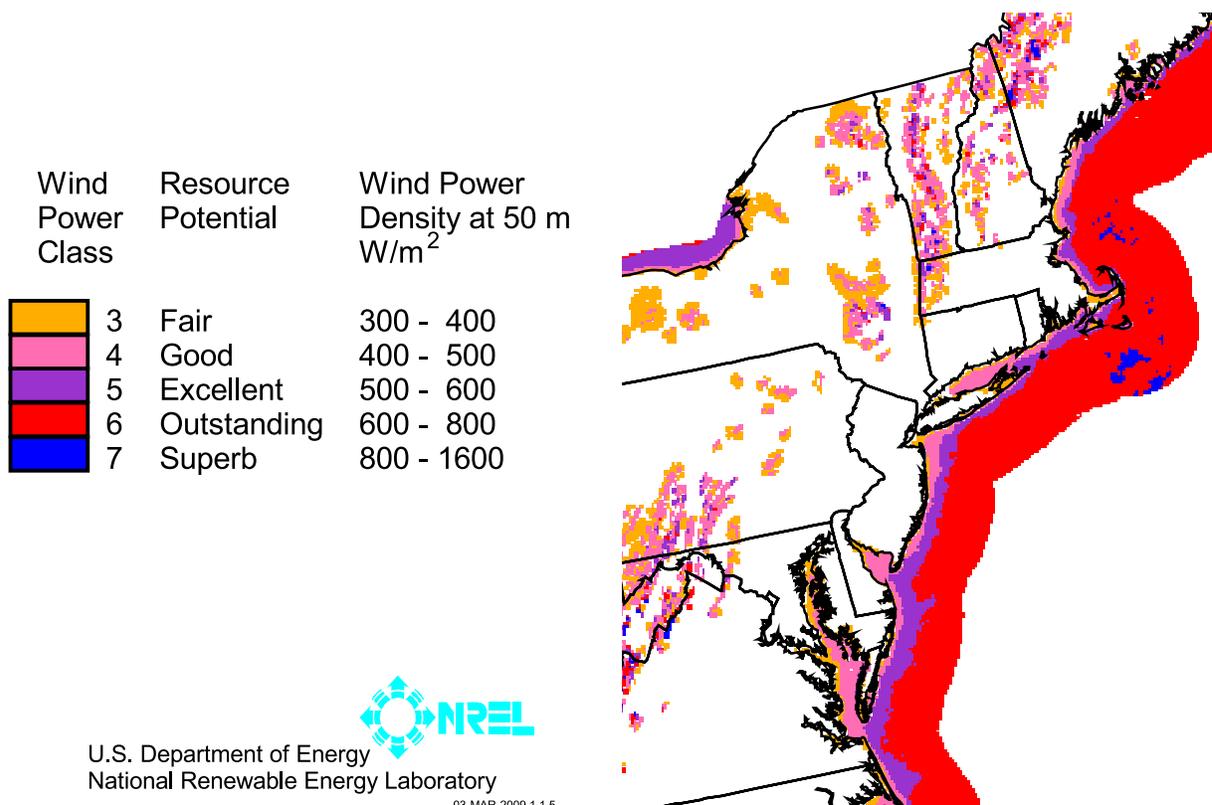


Figure 4: Mid-Atlantic Coastal Wind Energy Resources at a Height of 50 meters⁵⁶



system – such as a network of batteries in plug-in hybrid or electric vehicles.) In comparison, the oil and gas resources in federal waters along the Mid-Atlantic Bight amount to only one-tenth of the wind energy potential of the same region – and the oil and gas would be gone in about 20 years.⁵⁴

With today’s technology, wind turbines can be installed in ocean waters up to a depth of about 30 meters. In shallow depth areas in the Mid-Atlantic Bight (at an ocean depth of 20 meters or less), 60 GW of power could be installed. That’s enough to meet more than one-third of the region’s need for electricity.⁵⁷

New Jersey’s wind energy resources offshore far exceed its land-based resources. (See Figure 4.) Strong winds blow over shallow ocean waters along the entire Atlantic coast. Moreover, New Jersey’s off-

shore wind energy resources are relatively close to where the electricity will be used – minimizing the amount of energy that would be lost during transmission.⁵⁸

A Bright Spot for Solar Power

By including a requirement for solar power within its existing renewable electricity standard and enacting complementary policies, New Jersey has launched one of the most active solar markets in America.⁵⁹ The state now has more solar panels per square mile than any other state. To date, New Jersey’s clean energy programs have helped to install more than 100 MW of solar capacity.⁶⁰ As of the end of 2009, the state has helped more than 4,500 homeowners, businesses and institutions install solar electric systems.⁶¹

The Energy Master Plan envisions expanding the state's solar energy market to generate 2,120 GWh of electricity from solar panels by 2020 – or about 3 percent of the state's electricity needs. Progress to date puts the state about one-tenth of the way to this target.

In January 2010, the New Jersey Legislature passed a bill that will codify the Energy Master Plan goal as state policy.⁶² The law directs New Jersey utilities to generate 2,164 GWh of solar power in the year 2020, rising to 5,316 GWh by 2026.⁶³ This policy will help to ensure that New Jersey remains a national leader in solar power through the coming decade and beyond.

Emerging Renewable Energy Technologies

New Jersey also has the potential to take advantage of emerging renewable energy technologies. For example, New Jersey could capture power from the waves or the tides in the ocean. Federal officials estimate that capturing power from ocean waves in the Mid-Atlantic could generate as much as 13,000 GWh per year (about 17 percent of New Jersey's current annual electricity consumption).⁶⁴ New Jersey is already home to a company called Ocean Power Technologies that is working to commercialize wave power technology, with initial installations off the coasts of Spain and the United Kingdom.⁶⁵ Another regional company, Verdant Power, is already deploying underwater turbines near the mouth of New York's East River to capture the energy in the daily flux of the ocean tides.⁶⁶ Finally, future technologies such as enhanced geothermal power promise the potential to generate stable, round-the-clock renewable electricity anywhere in the state.⁶⁷

Yesterday's Dirty Energy Sources Continue to Threaten New Jersey's Progress

At the beginning of the new decade, the state of New Jersey's future commitment to a clean energy future is less certain. Dirty energy companies are once again lining up at New Jersey's doorstep, waiting to sell the state more polluting power.

Utility companies in New Jersey and points west want to build several new power lines to bring more coal energy to New Jersey from underutilized coal-fired power plants and planned coal plant expansion in Pennsylvania and the Midwest. Additionally, one company is planning to build a new coal-fired power plant within New Jersey.

If the state allows these projects to go forward instead of aggressively pursuing the clean energy vision largely outlined in the 2008 Energy Master Plan, the state risks failure in limiting the consequences of global warming. These projects will not help New Jersey meet its obligations under the Global Warming Response Act to reduce emissions to 1990 levels by 2020, and by 80 percent by midcentury. Moreover, they add to the state's vulnerability to fossil fuel price spikes and supply disruptions.

Importing Coal-Fired Power Will Raise Pollution

Several utility companies have proposed building high-voltage power lines to transmit electricity into and through New Jersey – enabling more power to be imported into the region from out-of-state power plants, many of which burn polluting coal for fuel. The utilities claim

that the lines are necessary to ensure the reliability of electric service and keep the lights on.

Currently proposed lines include:

- PSE&G's Susquehanna-Roseland line, which would cross 45 miles of northern New Jersey, from the Delaware Water Gap in Pennsylvania through Warren, Sussex and Morris counties before ending in Roseland in Essex County. The proposed route crosses 26 miles of New Jersey's most beautiful and pristine natural areas in the Highlands.⁶⁸ The route is already occupied by an existing transmission line with towers as high as 90 feet tall, which would be replaced by a much larger line with towers twice as high.⁶⁹
- A supplement to the Susquehanna-Roseland line, proposed by PSE&G to travel 50 to 70 miles through a yet-to-be determined route from Branchburg Township in Somerset County, north to Roseland and then east to Jersey City.⁷⁰
- A power line proposed by Pepco Holdings that would stretch 230 miles from Northern Virginia, through Maryland (and potentially under the Chesapeake Bay), to Delaware, ending in southern New Jersey.⁷¹
- American Electric Power's PATH line, which would connect the coal-fired John Amos power plant in West Virginia to Maryland, where existing and proposed lines could transmit the power to New Jersey.⁷²

The proposed PATH line and Pepco lines have been delayed by new electricity demand forecasts that suggest the lines will not be necessary for years. The forecasts take into account the im-

pact of available demand response and energy efficiency resources.⁷³ However, PSE&G continues to maintain that the Susquehanna-Roseland line is needed by 2012.⁷⁴ On January 8, 2010, the New Jersey BPU delayed its decision on this power line in order to allow time to examine the new electricity demand forecasts and their implications for New Jersey.⁷⁵

Were these lines to be built, they could add to New Jersey's emissions of pollution that contributes to global warming and threatens human health. Power plants located in Pennsylvania, Ohio and West Virginia are not covered by New Jersey's policies limiting global warming pollution – and they emit pollution that contributes to New Jersey's unhealthy air quality. Without adequate policy safeguards, new power lines could enable more power to be imported into New Jersey from coal-fired power plants, increasing New Jersey's contribution to global warming.

According to the Union of Concerned Scientists, the excess generating capacity in coal plants to the west and south of New Jersey is the equivalent of 15 new coal plants. If the northeast region taps into this excess capacity for cheap – but dirty – power, it could offset any gains under the Regional Greenhouse Gas Initiative (RGGI) by more than three times.⁷⁶ The excess pollution would be the same as adding 9 million extra cars to the road.⁷⁷ Six more coal plants are now under construction or under consideration in the region, adding to the potential for a larger carbon footprint for New Jersey.⁷⁸ Building new power lines would only add to the potential for more emissions.

Additionally, importing more fossil-fired power could expose New Jerseyans to price escalation as a result of future global warming regulations or as a result of volatility in the price of fuel.⁷⁹

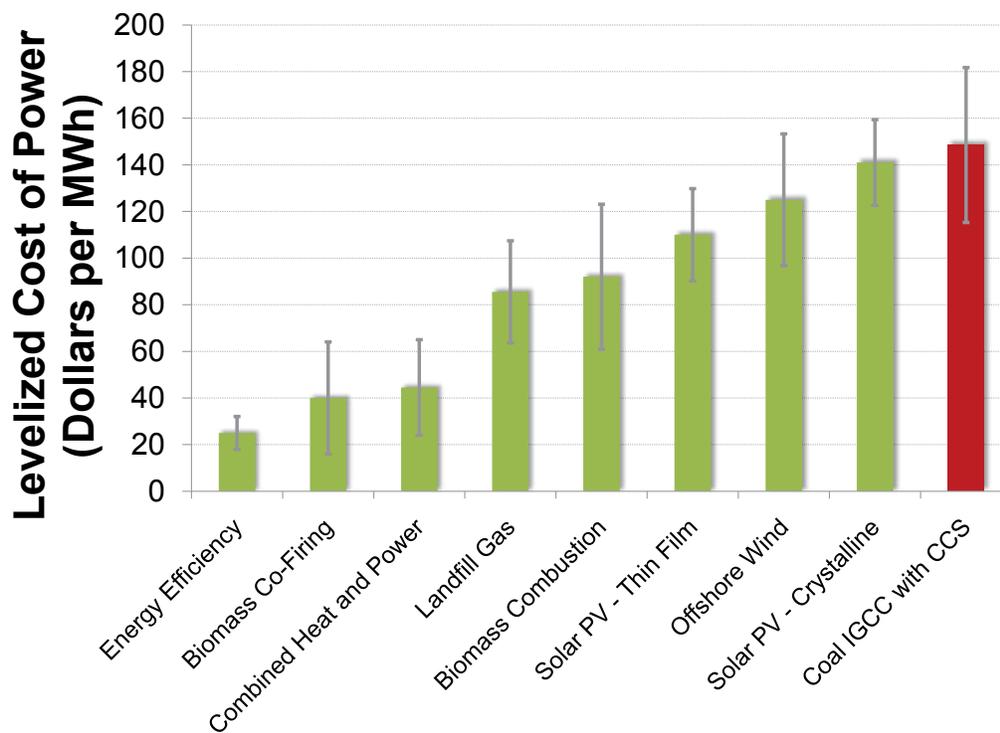
A Proposed Coal-Fired Power Plant Would Be Costly and Risky

Massachusetts SCS Energy has proposed a new 750 MW coal power plant on Grasselli Point in Linden, along the Arthur Kill waterway. The company is promoting gasified coal as an environmentally responsible way to use coal to generate electricity. The company claims that the plant, known as “PurGen,” would

capture 90 percent of its waste carbon dioxide, liquefy it, and pipe it deep under the floor of the Atlantic Ocean for long-term storage.⁸⁰

However, high costs and technological hurdles make this a less than ideal solution for the global warming pollution that the plant will produce. Just because the owners of the Linden power plant envision a way to make a profit doesn’t mean that it would be in the best interests of New Jersey electricity customers.

Figure 5: Various Types of Clean Energy Are More Cost Effective than Coal with Carbon Capture and Storage⁸¹



This figure compares estimated costs of electricity generation from different low-carbon generation technologies, levelized (or averaged) over the lifetime of the technology to enable a meaningful comparison. The error bars represent a possible range of costs, which could vary with the type of technology used, the quality of the natural resource, and also the precision of cost estimates. Each bar includes estimated transmission interconnection costs, but not distribution costs. IGCC with CCS stands for integrated gasification combined cycle with carbon capture and sequestration, the type of technology proposed for the Linden power plant.

Coal gasification is more expensive than cleaner and more sustainable ways of addressing New Jersey's energy-related and environmental problems. Electricity produced by coal gasification with carbon storage would be about 4 times as expensive as electricity saved through efficiency measures and on the order of 25 to 50 percent more costly than electricity from a good offshore wind resource. (See Figure 5). Power from the PurGen plant would be expensive because at least 10 percent of the power produced by the plant would be diverted to power the carbon capture and storage process.

Moreover, carbon capture and storage—on the scale at which it must be implemented to fight global warming—is an immature technology with serious questions about its viability.⁸²

Storing any quantity of carbon dioxide presents problems. As with nuclear waste, carbon dioxide stored in geological formations must be guaranteed to remain underground for hundreds or thousands of years to prevent re-release to the atmosphere and to avoid accidental, large-scale releases of carbon dioxide, which can be fatal to humans and wildlife. Recent studies indicate that carbon dioxide acidifies saline aquifers, which can degrade some of the concrete-like minerals that seal holes in the rock or concrete plugs in old oil and gas wells, raising questions about the permanence of storage.⁸³ Even a small leakage rate would make the project have essentially the same unacceptable global warming impact as a traditional coal-fired power plant.⁸⁴

Moreover, the plant would emit hazardous air pollution and produce hazardous solid waste. North Jersey is already overburdened with air pollution from nearby power plants and industrial facilities. Local air pollution grossly exceeds federal standards for smog, soot, and health-based goals for cancer risk. PurGen would be more polluting than a combined cycle natural gas plant, and add 7.5 million pounds of air pollution to Union County each year, including volatile organic compounds (VOCs), nitrogen oxides (smog / ozone), sulfuric acid mist (SOx) and soot (fine and ultra-fine particles).

Extending the Lifetimes of Dirty and Dangerous Power Plants Expands Their Impact

At the same time, power companies are working to extend the operating lifetimes of dirty and dangerous power plants. For example, Oyster Creek is the oldest operating nuclear power plant in the country. Exelon recently won a bid to relicense the facility for another 20 years of operation. Just a week later, workers discovered a radioactive tritium leak that had penetrated into a local aquifer.⁸⁵ PSE&G's Mercer and Hudson generating stations, built in the 1960s, continue to be the state's largest sources of global warming pollution. Coal, oil and gas burned in these plants in 2007 produced as much global warming carbon dioxide as more than 1 million cars.⁸⁶

Keeping Our Eyes on the Clean Energy Prize

If New Jersey hangs its energy future on renewable energy and energy efficiency, the expansion of generation from problematic energy sources such as new in-state fossil-fired power plants or Midwestern power lines will be unnecessary. Following through on the commitments in the 2008 Energy Master Plan will obviate the need for any new coal-fired or nuclear power plants and begin to give the state the flexibility to retire old and dirty power plants.

Energy efficiency, conservation and load management efforts can ensure that New Jersey uses no more electricity – and has about the same peak demand for electricity – in 2020 as it does today. Moreover, the addition of substantial amounts of clean, renewable electric generating capacity can allow the state the flexibility to replace imports of dirty energy or even retire problematic energy sources within the state’s borders.⁸⁷

Achieving the goals of the Energy Master Plan will help New Jersey de-

liver a reliable supply of electricity at an affordable price, while helping the state do its part to address global warming. The benefits of a renewed commitment to clean energy include:

- Reducing annual global warming pollution from the electric sector below 1990 levels – even if the state retires reactors I and II at the Salem nuclear power plant at the end of their operating licenses this decade.
- Saving New Jersey consumers a net of nearly \$17 billion through energy efficiency improvements – with benefits exceeding costs by 260 percent.⁸⁸
- Cutting the emission of health-threatening air pollution, both from in-state and out-of state power plants.
- Increasing fuel diversity, adding offshore wind power and solar power – which have zero fuel costs and can

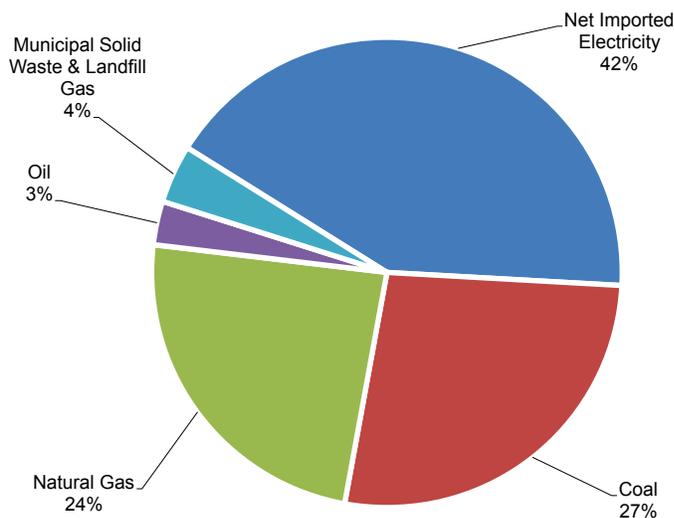
help insulate consumers from spikes in the price of fossil fuels – and

- Creating jobs that can't be outsourced and economic activity around the manufacture and installation of energy efficient equipment, solar panels and offshore wind farms.

New Jersey Has Committed to Fight Global Warming

When New Jersey enacted the Global Warming Response Act, it became the third state to establish official economy-wide limits on the emission of global warming pollution – and the first to extend such limits to 2050. Under the act, New Jersey must reduce its contribution to global warming to 1990 levels by 2020 and 80 percent below 2006 levels by mid-century. The law covers every sector of New Jersey's economy, from transportation to electricity consumption.

Figure 6: Sources of Global Warming Pollution due to Electricity Consumption in New Jersey, 2005⁹⁷



Current and Projected Future Carbon Dioxide Emissions

As a part of the implementation of the Global Warming Response Act, the New Jersey Department of Environmental Protection (NJDEP) has prepared a draft inventory of the state's emissions of global warming pollution, including imports of energy from out of state. This inventory shows that transportation, electricity consumption, and energy use in our homes, businesses and industries are responsible for the bulk of current emissions.⁸⁹ Moreover, NJDEP estimates that statewide emissions could rise by more than 10 percent by 2020 if past trends continue.⁹⁰

Past Trends

In 2005, New Jersey's economy emitted 145 million metric tons of carbon dioxide (or its equivalent – MMTCO₂e).⁹¹ About a quarter of those emissions were attributable to electricity consumption. Fuel consumption in vehicles, homes, businesses and industry accounted for two-thirds of all emissions.⁹²

New Jersey is highly dependent on electricity imports from out of state to keep the lights on.⁹³ However, electricity imports tend to come from relatively inexpensive but highly polluting power plants in places like Pennsylvania, West Virginia and Ohio. As a result, electricity imports account for a disproportionate amount of New Jersey's global warming emissions from electricity consumption. (See Figure 6.)

Emissions from imported electricity made up 42 percent of New Jersey's emissions from electricity generation in 2005, despite the fact that imported electricity accounted for only 26 percent of the state's electricity consumption.⁹⁴ On average, each megawatt-hour (MWh) of imported electricity caused 1,528 pounds of carbon dioxide pollution.⁹⁵

The remainder of electricity sector emissions in 2005 came from in-state sources, including coal-fired power plants (27 percent), natural gas-fired power plants (24 percent), oil combustion (3 percent), and municipal solid waste combustion (4 percent).⁹⁶

Future Projections

In the draft emissions inventory, the New Jersey Department of Environmental Protection (NJDEP) evaluated possible future global warming pollution levels. If past trends were to continue unabated, the agency forecast that total state global warming emissions could continue to rise at an average rate of 0.83 percent

per year, reaching 164 MMTCO₂e in 2020.⁹⁸

In the electricity sector, if past trends continue, NJDEP forecasts that New Jerseyans could consume 110,000 GWh of electricity in 2020, with emissions from electricity consumption rising to 43 MMTCO₂e. NJDEP expects the greatest increases in emissions to arise primarily from imported electricity, and secondarily from increased use of natural gas for in-state electricity generation.⁹⁹ (See Figure 7.)

Meeting the goals of the Global Warming Response Act will require additional action.

The Role of the Electricity Sector in Reducing Global Warming Pollution

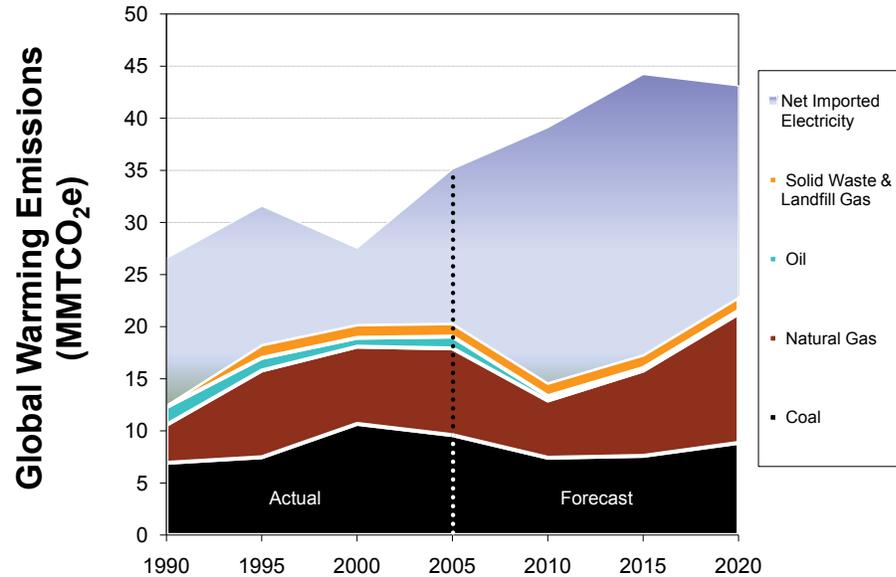
Since the electricity sector is now responsible for about one-quarter of New Jersey's total contribution to global warming, it must provide – at minimum – an equally proportional share of total required emissions reductions. Electricity consumption should cause no more than 30.7 MMTCO₂e of global warming pollution in 2020.

However, to meet the emission targets laid out in the Global Warming Response Act, the electricity sector will likely have to do more than its fair share.

For example, consider the transportation sector. Capturing and storing emissions from automobiles would be highly impractical, but switching to electricity for fuel instead of gasoline would yield zero tailpipe emissions. If that electricity were to come from zero-carbon energy sources, transportation emissions of global warming pollution would fall precipitously. Should the state choose to achieve a cleaner transportation system using electric or plug-in electric hybrid vehicles, effectively the electricity sector must shoulder some of the emissions obligations from the transportation sector.

As a result, achieving a visionary, low-carbon electricity system will be even more critical in bringing the long-term emissions targets laid out in the Global Warming Response Act within reach.

Figure 7: NJDEP Actual and Forecast of Emissions of Global Warming Pollution from New Jersey Electricity Consumption, 1990 - 2020



Achieving the Goals of the Energy Master Plan will Reduce Global Warming Pollution

Taken together, the planks of the New Jersey Energy Master Plan will work effectively to bring New Jersey's electric sector emissions of global warming pollution well below 1990 levels by 2020.

Assuming that reactors I and II at the Salem nuclear power plant retire at the end of their operating licenses this decade – and assuming that new energy efficiency, combined heat and power, and renewable electricity replace out-of-state electricity imports:¹⁰⁰

- Reducing energy consumption 20 percent by 2020 would prevent the emission of 10 MMT of carbon dioxide pollution in that year. Electric sector emissions would be just 5 percent higher than 1990 levels through this policy alone.

- Building 1,500 MW of combined heat and power plants would prevent 3.5 MMT of carbon dioxide pollution in 2020, bringing the state 30 percent of the way to the minimum emissions target.
- Increasing the state's renewable electricity standard to 30 percent by 2020 would prevent 4.7 MMT CO₂ in 2020, achieving 40 percent of the minimum electric sector emission cuts.

Achieving all three of these goals together would prevent a total of 17 MMT of CO₂ pollution in the year 2020.¹⁰¹ That would reduce the global warming emissions of the electric sector 19 percent below 1990 levels – exceeding the minimum cuts required of the power sector under the Global Warming Response Act, even with the retirement of two nuclear reactors.

Policy Recommendations for a Clean Energy Future

During his campaign, New Jersey's new governor Chris Christie articulated that a future powered by clean energy is essential to the state's economic success. It's also critical to our health and quality of life here in New Jersey. New Jerseyans can neither afford to pay the costs of global warming nor continue to be held hostage by the rising cost of energy generated by fossil fuels. We need to make a major transition to clean energy and we need to make it quickly.

The international community of scientific experts warns that the next decade is *the* critical time to deploy serious solutions to global warming.¹⁰² If we are going to position New Jersey at the forefront of America's clean energy transition, grow our economy with jobs that can't be outsourced, and make the major cuts in global warming pollutants that scientists tell us are necessary, Governor Christie must be a bold leader for clean

energy. To reduce emissions in time to make a difference, we must transition to clean energy for nearly 100 percent of our energy needs and thereby cut our dependence on fossil fuels dramatically by mid-century.

That's a tall order – and Governor Christie must act swiftly and decisively if New Jersey is to meet this challenge.

The policies laid out in the previous administration's 10-year Energy Master Plan would get us on the path to a future powered solely with clean energy. The plan sets some of the strongest goals in the nation for wind, solar and renewable energy. However, a great deal of work remains to make this vision a reality.

Governor Christie should re-affirm New Jersey's commitment to a clean energy future by embracing the goals of the Energy Master Plan and enacting policies to realize those goals. Priority actions include:

Expand and accelerate New Jersey's energy efficiency programs.

- The performance of New Jersey's energy efficiency programs, while significant, is roughly one third of what leading states such as Vermont and Connecticut are achieving. Governor Christie and the New Jersey Board of Public Utilities (BPU) should take broad action to capture more of the state's vast potential for energy efficiency. A strong menu of policies can be found in a 2009 report prepared for the BPU by the non-profit Northeast Energy Efficiency Partnerships, entitled *An Energy Efficiency Strategy for New Jersey: Achieving the 2020 Master Plan Goals*. This strategy would deliver \$16.8 billion in net savings for New Jersey consumers – with benefits exceeding costs by 260 percent.¹⁰³ Key steps to capture the state's energy efficiency potential include:
 - The Christie administration and the state legislature should require all electric and gas utilities to procure all cost-effective energy efficiency resources before investing in new supply, and require utilities to reduce electricity consumption and peak demand on the order of 2 percent per year below forecast levels.
 - The Department of Community Affairs should complement these efforts by adopting new statewide building energy codes, requiring new buildings to be at least 30 percent more energy efficient than those built to current codes. The state's codes should update automatically when the national model codes are changed, and the state should provide training and resources to builders and code inspectors to ensure compliance. Additionally, the state should establish a building energy rating program for existing buildings, and encourage energy efficiency retrofits.¹⁰⁴
 - The state legislature should adopt energy efficiency standards for appliances not covered under federal law, such as flat screen televisions. The Christie administration, together with state leaders, should conduct an annual review of appliances not covered under federal energy efficiency rules, and adopt state standards for the most inefficient products on the market.
 - The Christie administration and the state legislature should lay out a plan for all new buildings to achieve net-zero carbon emissions by no later than 2030, and ideally as soon as 2020.
 - The Christie administration and the state legislature should make it easier for buildings and institutions to install combined heat and power systems, providing incentives to ensure that the state builds 1,500 MW of new CHP capacity in the next decade.
- Make a greater commitment to clean, renewable energy.**
- Governor Christie and the BPU should increase the state's renewable electricity standard to require 30 percent of state electricity consumption to come from clean, renewable sources of energy by 2020.
 - Half of the state's new renewable energy standard could be achieved

with local resources by ensuring the successful deployment of 3,000 MW of wind farms off the New Jersey coast. The Christie Administration should work to establish a financing mechanism for offshore wind and facilitate a robust, environmentally responsible and efficient permitting process at the state and federal levels.

- The state legislature should build on the momentum it has already created in the solar energy market. Specifically, the state should implement community net metering that would promote community solar installations, facilitate larger-scale solar arrays and allow all New Jersey citizens to invest in clean solar energy.
- Governor Christie and the state legislature should accelerate the emergence of new renewable energy technologies in New Jersey, includ-

ing wave, tidal, and enhanced geothermal power.

Limit dirty power imports.

- Much of New Jersey's global warming pollution from electricity consumption stems from the state's dependence on out-of-state power plants fired by coal. New Jersey should ensure that any new power lines serve to deliver clean, renewable electricity to the state, rather than facilitate the transmission of polluting coal-fired power. A generation performance standard requiring all new power sources to meet or exceed the emissions performance of a combined cycle natural gas plant would achieve this goal. Alternatively, the state could work with other Regional Greenhouse Gas Initiative states to regulate emissions from imported electricity.

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a whole, “coincident” peak load - the load in a particular service territory at the time of maximum load on the entire system - is generally used for system planning purposes. The system operator (PJM) does not estimate coincident peak load for individual utility service territories beyond 2010. In 2007, for example, PJM projected that the coincident peak load in the three major New Jersey utility service territories will be approximately 3 percent lower than the sum of the non-coincident peak loads.

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100. Additionally assuming that the Oyster Creek nuclear reactor continues operation through the decade; that in-state coal-fired generation remains constant at 11,000 GWh per year and produces 825 Kg of CO₂ per MWh; that generation from existing natural gas-fired power plants remains constant at 15,500 GWh per year and produces 547 Kg of CO₂ per MWh on average; that generation from municipal solid waste and oil remain constant at 1,130 GWh per year and produces 1,030 Kg of CO₂ per MWh for oil and 2,000 Kg of CO₂ per MWh for solid waste; and that electricity consumption will increase according to forecasts outlined on page XX without additional efficiency programs. Additionally, we assume in the base-case that the state's renewable electricity standard remains at 22 percent by 2020, and that the carbon intensity of imported electricity is equivalent to the average carbon intensity of power generated in the MAAC and ECAR regions, according to U.S. Department of Energy, Energy Information Administration, *An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook*, SR/OIAF/2009-03, April 2009. Finally, assuming that the output of each reactor at Salem is 8,800 GWh per year, subtracted from a current annual nuclear generation of 32,000 GWh in 2016 and 2020, at the end of the reactor operating licenses.

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