Energy and Climate in New Jersey

Energy Sustainability Project Final Report

October 2007

NJSSI

NEW JERSEY SUSTAINABLE STATE INSTITUTE

RUTGERS
Edward J. Bloustein School of Planning and Public Policy

NJSSI Board of Governors

HONORARY CO-CHAIRS:

James J. Florio — *Former Governor, State of New Jersey*
Christine Todd Whitman — *Former Governor, State of New Jersey*

BOARD MEMBERS:

Dr. Clinton J. Andrews (Co-Chair) — *Director of the Urban Planning and Policy Development Program, E.J. Bloustein School of Planning and Public Policy, Rutgers University*
Ms. Dorothy P. Bowers — *Retired, former Vice President of Environmental and Safety Policy for Merck & Co.*
Mr. John Cusack — *Executive Director of the NJ Higher Education Partnership for Sustainability (NJHEPS)*
Ms. Jeanne M. Fox— *President of the NJ Board of Public Utilities*
The Rev. Fletcher Harper — *Executive Director, GreenFaith*
Mr. George Hawkins — *Executive Director of New Jersey Future*
Ms. Lisa Jackson — *Commissioner, NJ Department of Environmental Protection*
Ms. Jane M. Kenny — *Partner, The Whitman Strategy Group*
Mr. Kris Kolluri — *Commissioner, NJ Department of Transportation*
Dr. Mark G. Robson — *Chair of the Department of Environmental and Occupational Health, Associate Dean, UMDNJ School of Public Health*
Dr. Joseph J. Seneca — *Chair, NJ Council of Economic Advisors; University Professor, E.J. Bloustein School of Planning and Public Policy, Rutgers University*
Dr. Daniel Watts (Co-Chair) — *Director of the York Center for Sustainability, New Jersey Institute of Technology*
Mr. Scott A. Weiner — *CEO, NJ Schools Construction Corporation*
Mr. Tom Wright — *Executive VP, Regional Plan Association*

NJSSI Board of Advisors

Dr. Henry Coleman — *Associate Professor and Director of the Center for Government Services, E.J. Bloustein School of Planning and Public Policy, Rutgers University*
Ms. Pamela Frank — *Sun Farm Network*
Mr. Randy Haviland — *Retired, former Director of Environmental, Health and Safety, Johnson & Johnson, Inc.*
Ms. Pam Hersh — *VP, Princeton Health Care System*
Mr. David Moore — *Retired, former Director of the New Jersey Conservation Foundation*
Mr. Matt Polsky — *Director of the Land Trust, Passaic River Coalition*
Mr. John Weingart — *Associate Director, Eagleton Institute of Politics; Chair, Highlands Water Protection and Planning Council*
Dr. Donald Wheeler — *Former Executive Director, NJ Higher Education Partnership for Sustainability (NJHEPS)*

CITATION:

New Jersey Sustainable State Institute, 2007, "The Energy Sustainability Project Report." (New Brunswick, New Jersey: New Jersey Sustainable State Institute) July 2007.

Portions of this report may be quoted for non-commercial purposes if proper citation is made with full source information.

This summary report shares the major findings of the full report. Both of these reports, with additional results and analytical details, can be accessed on the New Jersey Sustainable State Institute website: www.njssi.org.

This report was produced and published by the
NEW JERSEY SUSTAINABLE STATE INSTITUTE
33 Livingston Avenue, Suite 100
New Brunswick, NJ 08901
732.932.5475 x531
www.njssi.org
Copyright 2007, All rights reserved.

Table of Contents

Executive Summary 2

Steering Committee Statement 3

The Future of New Jersey 4

About NJSSI 5

Energy for New Jersey 6

Policies and Technologies 7

ENVIRONMENTAL TARGET: 8

FIGURE 1: CO_2 Emissions from energy 8

FIGURE 2: CO_2 per capita 9

FIGURE 3: Criteria air pollutants 9

FIGURE 4: Percentage of energy derived from renewable sources 9

ECONOMIC TARGET: 10

FIGURE 5: Energy expenditures as a percentage of personal income 10

FIGURE 6: Energy consumption per dollar of Gross State Product 11

FIGURE 7: Energy usage per capita 11

FIGURE 8: Transportation efficiency in fleet miles per gallon 11

SECURITY TARGET: 12

FIGURE 9: Percentage of energy generated from New Jersey Sources 12

FIGURE 10: Percentage of the total electricity consumed in New Jersey that is generated within New Jersey 13

FIGURE 11: Percentage of energy consumed in New Jersey from imported fossil fuels 13

Scenarios for the Future 14

FIGURE 12: Illustrative Policy Bundle 14

Additional Scenarios for the Future 15

A Call to Action 16

Acknowledgments and Project Team ..... INSIDE BACK COVER

The Energy Sustainability Project Report

Executive Summary

IN 2006, NJSSI CONVENED a group of leaders from environment and industry, state and local government, and academia, in a process to understand and reach agreement about the future of energy and climate issues in New Jersey. NJSSI supported the deliberation with advanced research and modeling, and held public conferences and meetings throughout New Jersey to provide public input.

This summary report contains the results of that deliberation in the form of a set of **key energy indicators that track the issues that we must address, and the associated key targets that New Jersey should achieve.** The full project report with references and analytical details is available at www.njssi.org.

A diverse set of stakeholders has endorsed these indicators and targets as a fair representation of what we must achieve in New Jersey's energy sector if we want to sustain our environment and quality of life in the future. Note that the modeled scenarios and policy combinations (p 7) are not endorsed by the stakeholders as specific policy recommendations. Rather, these modeled scenarios are illustrative examples of what can be achieved with existing policy tools. Frank and open debate is now required to select the appropriate policies to achieve our sustainable energy targets. NJSSI will track and report New Jersey's progress toward these targets to ensure we stay on track.

THE THREE INDICATORS AND THEIR TARGETS:

1. Reduce carbon dioxide (CO_2) emissions from the energy sector to their 1990 level by 2020 and by 80% from the 2006 level by 2050. (Assuming a linear annual decline from 2020 through 2050, the 2036 interim goal is a reduction of about 45% from the 2006 emissions level.)
2. The percent of income in New Jersey spent on energy should not rise above 7%, and the percentage of income in New Jersey devoted to energy should not go higher than the average of our peer states in the neighboring states.
3. 10% of New Jersey's energy needs should be derived from New Jersey sources by the year 2036.

The project showed the impact of an illustrative aggressive policy scenario on achieving the targets. This scenario included the following energy policy strategies: advanced bio-fuels, significant energy efficiency gains, and new energy taxes.

KEY CONCLUSIONS:

- The project selected and endorsed the same greenhouse gas emissions targets as described in the New Jersey Global Warming Response Act.
- Aggressive implementation of policies such as increased energy efficiency of buildings and especially motor vehicles, energy taxes, and the use of advanced bio-fuels, can achieve the 2020 GHG target. But it will take a concerted effort: we must begin now and we must have these strategies largely implemented by 2020.
- After 2020, the gains from known policies will be overtaken by growth in population and economic activity, and GHG emissions will begin to rise. To reach the 2036 and 2050 targets, we must expand the deployment of known policies and develop new and as yet unknown solutions and have them ready to be implemented by 2020.
- Policies addressing climate change are also likely to help address energy security concerns.
- Implementation of an aggressive policy scenario such as that described in this report is unlikely to have a dramatic adverse impact on New Jersey's economic growth.

Statement from the Steering Committee

WE BELIEVE THAT achieving sustainable development in the energy sector is of critical importance to the future of New Jersey.

This will require us to balance the interrelated issues of environmental impacts, economic performance, and energy security.

We believe that the indicators and targets in this report are a fair and balanced representation of what we must achieve in each of these areas.

- The indicators provide a meaningful way to track progress on these critical issues.
- By looking at all of the indicators together, we can better understand the tradeoffs among the key issues we face and the impact of different policy options.
- Achieving the targets identified in this report will require concerted action from everyone in New Jersey including the legislature, state government, the business community, local governments and civic organizations, and citizens from all walks of life.

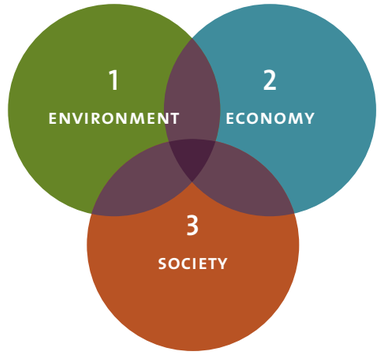
Ms. Sandy Batty, *Association of NJ Environmental Commissions*
Dr. Martin Bierbaum, *Municipal Land Use Center*
Mr. Laurence Downes, *New Jersey Resources*
Mr. William Dressel, *NJ League of Municipalities*
Mayor Meryl Frank, *Borough of Highland Park*
Ms. Pamela Frank, *Sun Farm Network*
Rev. Fletcher Harper, *GreenFaith*
Mr. Richard Johnson, *Matrix Development Group*
Mr. Ralph LaRossa, *PSE&G*
Mr. Anthony Marchetta, *LCOR, Inc.*
Mr. Luis Martinez, Esq., *Natural Resources Defense Council*
Mr. Michael McGuinness, *National Assoc. of Industrial & Office Properties*
Mr. David Moore
Mr. Carlos Rodrigues, *Regional Plan Association*
The Honorable Robert Smith, *NJ Senate*
Mr. Scott Weiner, *Schools Construction Corporation*
The Honorable John Wisniewski, *NJ Assembly*

DRIVING FORCES

Thirty years from now, we expect to have one or even two million more people living in New Jersey. The overall level of economic activity is likely to have at least doubled. This will lead to a greater demand for energy, housing, mobility, and amenities. Now is the time to plan so that we can avoid outages, crowding, congestion, and a poorer quality of life.

Energy Sustainability Project

The Future of New Jersey



WHAT KIND OF NEW JERSEY are we leaving to future generations? "Sustainability," or "sustainable development," means protecting the resources and systems that support us today so that they will be available to future generations. It means preserving our civilization and the things we hold dear in perpetuity while enhancing our quality of life.

The three-ring symbol represents a sustainable state. Each ring represents one of the three systems that support humanity: the economy, the environment, and our society. Each of these rings overlaps the other two. To be sustainable—that is, to have an equitable and prosperous civilization in the future—each of these systems must be healthy and in balance. We cannot degrade any one of the systems that supports us without adversely affecting the other two.

This is the essence of sustainable living. Beautiful beaches mean little if you cannot afford to get there. A good job doesn't mean much if you have to worry about your safety on the walk home. A safe, friendly neighborhood isn't a haven if its air is not breathable.

Sacrificing the future to benefit the present is the opposite of sustainability. Failing to consider the long-term impacts of our decisions can result in unbreathable air, a floundering economy, decaying cities, choking traffic congestion, loss of wildlife and open space, and unsafe neighborhoods. However, if we get serious about living with the future in mind, we have the possibility of passing on to our children a New Jersey that is secure and offers a high quality of life.

Seeing things differently is the first step toward doing things differently.

SEEING THE BIG PICTURE

Unfortunately, it is difficult to understand and track many of the most pressing sustainability issues. One cannot sense if greenhouse gases are accumulating in the atmosphere by sniffing the air. Similarly, without some trusted way to track progress we cannot know if our state is building a dangerously large financial debt, if wildlife is declining too much or if our fellow citizens are struggling economically. If knowledge is power, NJSSI is dedicated to ensuring that all New Jerseyans have the power to act for a better future.

NJSSI created a set of key goals and indicators that tell us how we are doing in achieving each of our environmental, social, and economic goals. These goals and indicators were selected through an open, public dialogue that included leading scientists, environmental and business interests, poverty and education advocates, state government, and over a thousand citizens from all walks of life. Entitled the "Sustainable State Goals and Indicators," they can be found on our website at www.njssi.org and in our signature report *Living With the Future In Mind.* If we want a secure and prosperous future it is imperative that we consider our impact today on these long-term trends when we shop, when we vote, and when we choose where and how to live.

HOW IS NEW JERSEY DOING?

An analysis of our NJ indicators shows results are decidedly mixed.

1 **ENVIRONMENT—**New Jersey's wildlife and natural environment are increasingly stressed by population growth, consumption, and suburban sprawl. New Jersey is producing less local pollution than in the 1970s and the environment we experience every day is, for the most part, cleaner. Unfortunately, since New Jersey residents are consuming more, some of our local gains may be due to exporting our pollution and polluting activities, forcing others to deal with these problems.

2 **ECONOMY—**As a whole, New Jersey is economically better off than it has been in the past. Personal incomes are high. However, the state is less equitable than it was in the 1980s, with a widening gap between richer and poorer residents.

3 **SOCIETY—**Crime continues to generally trend downward since 1980 and schools have sustained a high level of performance as a whole. Despite some gains, the Legislature contains fewer women and minorities than the population overall. Gains in average pay for minorities and women seem to be closing in on those for white men, but progress has slowed. Voter turnout and knowledge of government are near all-time lows.

About the New Jersey Sustainable State Institute

The New Jersey Sustainable State Institute's (NJSSI) mission is to provide decision makers and all New Jersey citizens with a clear picture of where we are, where we are headed, and what we need to achieve to be sustainable. From global warming to urban sprawl to social inequities, most sustainability issues are complex, technical, and manifest slowly over a long period of time. We help New Jersey citizens and communities make sense of the future, and identify actions to ensure our future is a bright one.

NJSSI's current activities include:

- Reporting 11 key goals and 41 indicators that show all New Jerseyans where we are, where we are headed, and what we must achieve as a state to be sustainable.
- Assisting municipalities to understand what sustainability means for them in local, regional, and global contexts, and helping them achieve it.
- Developing targets that define what levels of performance are needed to be sustainable in the future.
- Working with state-wide leaders to generate new data and identify and address the greatest gaps in our knowledge of sustainability in New Jersey.
- Conducting analysis for New Jersey state agencies to establish policies for achieving sustainable development, devise indicators to track progress, and create better decision making systems.

NJSSI began in 1995 as a project of the non-profit organization New Jersey Future, working in combination with the State of New Jersey and a coalition of business and public interest groups. They launched a high-profile public process to develop long-term goals and indicators for achieving sustainable development in New Jersey. The process yielded 11 goals and 41 indicators covering economic, social and environmental issues. In 2000 the NJ Department of Environmental Protection took over the effort and produced a report *"Governing With the Future In Mind"* that detailed, agency by agency, what the Government of New Jersey was doing to achieve a Sustainable State.

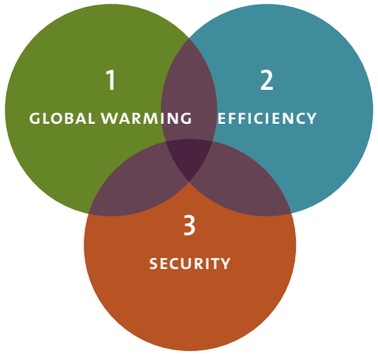
To insulate the effort from the political process, and to ensure the indicators and targets were free of real or perceived bias by state government or an advocacy group such as New Jersey Future, it was decided that the effort needed an independent home. In 2002, with an appropriation from the State Legislature, NJSSI was founded as an independent institute to be housed at the Bloustein School at Rutgers University and co-managed by the York Center for Environmental Engineering and Science at the New Jersey Institute of Technology.

THE R/ECON™ MODEL

The R/ECON model provides quarterly projections of economic conditions in New Jersey for use by public and private decision makers. R/ECON is a computer-based, macro-economic model containing more than 200 econometric equations that are based on 30+ years of state and national trend data. For this project, the R/ECON model was enhanced to incorporate energy consumption and pricing data and the NJ Renewable Portfolio Standard-mandates. The R/ECON model is periodically updated with national economic forecast data from Global Insight, Inc.

Clean, Affordable, Secure

Energy for New Jersey



WE BELIEVE THAT ENERGY is the most pressing issue to be addressed if we want to ensure a sustainable future. Despite increased concern over global warming and rising energy prices, most people do not have a trusted and simple way to understand whether we are heading for an energy crisis, and if so what must be done to avoid it. To provide answers, the NJ Board of Public Utilities (BPU) funded NJSSI to initiate a public dialogue and fact-finding process to create indicators and long-term targets (to the year 2036) of sustainable development for New Jersey's energy sector.

SUPPORT FOR THE ENERGY MASTER PLAN

The effort supports the State of NJ's forthcoming official Energy Master Plan (EMP). In relation to the EMP, this project will educate citizens about our energy future so they can be better stakeholders in the EMP process. The project also provides an independent look at the levels of performance that NJ, and the Energy Master Plan, must achieve. As an independent institute, NJSSI will continue to report our progress toward the targets for the foreseeable future, thereby bringing more consistency to both energy policies, and policy dialogue, on energy and climate.

Indicators are measures for tracking progress on things we care about. Targets specify the indicator levels that we want to reach by certain dates. In other words, the targets tell us what we need to achieve, and by when. The indicators and targets in this report will illuminate the possible outcomes and trade-offs of various actions as well as the consequences of inaction. They are intended to provide an understandable, trustworthy, and scientifically defensible picture of what must be achieved to ensure that our supply and use of energy can support our quality of life for the long term.

Paralleling the three aspects of sustainability on the previous page, we studied the three critical aspects of our energy system that must be balanced if we want to be sustainable: *economy, environment, and security*. Our *economy* depends on affordable energy to power our homes, businesses and cars. Our *security* depends on reliable and stable supplies of oil, natural gas, and electricity. From local air pollution, with its harmful health effects, to dramatic impacts of global warming, no decisions affect the *environment* more than how we produce and consume energy. As represented in the three-ring graphic, to be sustainable, energy must balance security, economics, and the environment.

HOW WE CREATED THE INDICATORS AND TARGETS

To establish indicators and targets, NJSSI convened an open dialogue that included public input, representatives from industry, the environment, state and local government, and scientific experts from many disciplines. Energy issues of concern were initially identified at a kick-off conference in May 2006 and at public meetings in the following weeks. A Steering Committee composed of senior NJ stakeholders oversaw the project. They guided and debated the NJSSI research and modeling efforts, and ultimately selected the indicators and targets that form the core of this report. A list of the Committee members appears on the inside back cover of this report.

FUTURE PROJECTIONS: SCENARIO MODELING

To support the deliberations of the Steering Committee, NJSSI engaged in a major research and modeling effort. NJSSI modeled different future scenarios by adapting a powerful New Jersey-specific econometric model known as R/ECON™, from the Center for Urban Policy Research at the Edward J. Bloustein School of Planning and Public Policy, Rutgers University. The modeling helped the project's participants to think systematically about the future and to see how different policy scenarios performed relative to the targets. The scenarios are described on page 15.

Technical oversight and guidance was provided by energy sector experts, scientists, and academicians through the project's Expert Advisory Board (listed on the inside back cover). This group reviewed the modeling platform and its underlying assumptions and provided quality control and assurance on the modeling results.

An Aggressive Policy Scenario: Understanding the Tradeoffs

This report describes a set of targets toward which New Jersey should strive if we want to achieve sustainability in the energy sector. A problem arises if one target is narrowly pursued at the expense of another target. For example, pursuing cheap energy for economic well-being is not sustainable if it dangerously increases levels of greenhouse gases in the atmosphere. Sustainability means that all the critical issues we face must be balanced and addressed together.

To understand if our targets adequately balance the three facets of sustainable energy, NJSSI developed an illustrative policy scenario in the R/ECON model that represents a very aggressive, but plausible, course of action for New Jersey. This policy scenario is primarily targeted at reducing greenhouse gas emissions. Our modeling projects the impact of implementing this policy scenario on each indicator. We observe the tradeoffs among environmental, economic, and security factors by examining how closely the policy scenario approaches each target.

This policy scenario is not intended to be implemented directly. Rather, it illustrates the impacts of several aggressive yet plausible strategies between now and 2036.

Each of the indicators on the following pages shows our *projection of what will happen in New Jersey* in a *"business as usual"* scenario where no new actions are taken, and also in a future where the *"aggressive policy scenario"* is implemented with a ten year phase-in period starting in 2010. The strategies implemented in the illustrative policy scenario are as follows:

FULL-COST ENERGY PRICING—The price of energy is increased by the environmental externality costs associated with the combustion of fossil fuels. These additional costs in current dollars are approximately of $0.03 per kWh of electricity, $0.58/gallon for gasoline, $1.85 per thousand cubic feet of natural gas, and $1.53 per gallon of heating oil.

HIGH TECHNOLOGY AND EFFICIENCY—Building, transportation, and industrial energy efficiency improvements are implemented statewide to reduce energy use.

ADVANCED BIO-FUELS—Advanced bio-fuels replace 30% of all liquid fossil fuels consumed in New Jersey for space heating and transportation. Out-of-state cellulosic ethanol, biodiesel, and similar products replace this percentage of gasoline, fuel oil, and other distillate liquid fossil fuels. Although not currently carbon-neutral, advanced bio-fuels are expected to achieve that status by 2020 in this scenario.

CO_2 Emissions from Energy

GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions from energy use account for most of New Jersey's contribution to global warming. Almost half comes from motor vehicles, with residential, commercial, and industrial energy use responsible for much of the rest. Methane emissions contribute about 7% with half of that from landfills, agriculture, and wastewater treatment. Nitrous oxide from chemical production and fertilizer use, and various fluorine compounds used by industry together contribute less than 5%.

Greenhouse Gas Emissions in New Jersey

Greenhouse gas emissions from the consumption of energy in New Jersey will continue to increase unless we take aggressive policy actions. Energy use accounts for more than 80% of New Jersey greenhouse gas emissions.

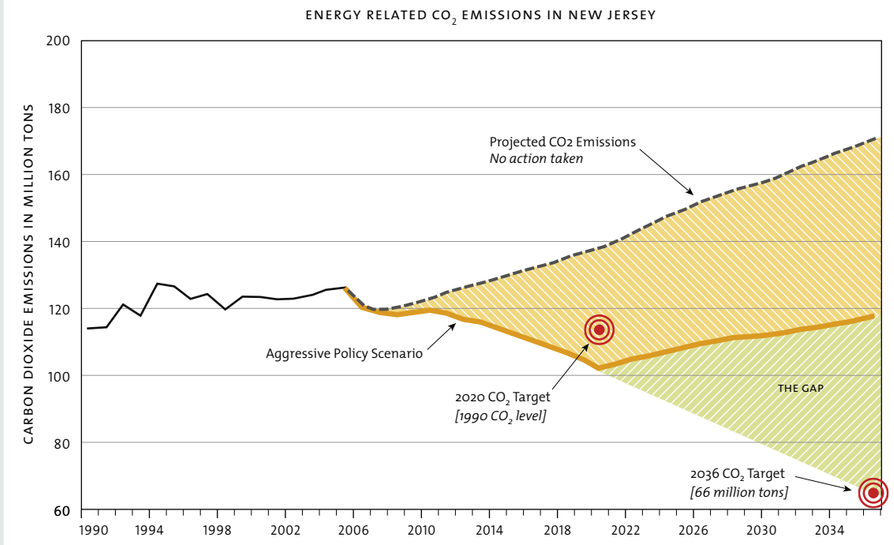


FIGURE 1

THE TARGET

Reduction to 1990 level by 2020 and 80% reduction from 2006 level by 2050.

THE GAP

Aggressive policy scenario

Aggressive implementation of known policies and technologies can reduce emissions sufficiently to achieve the 2020 target. *(see p. 7 for scenario description)*

The unknown future

After 2020, known policies fail to keep up with growth and we still need to reduce emissions dramatically to reach the 2036 and 2050 targets.

IF WE DO NOTHING

Since the industrial revolution, human activity has caused carbon dioxide (CO_2) and other heat trapping gasses to accumulate in the atmosphere, enhancing the now famous "greenhouse effect." If emissions are left unchecked, the Intergovernmental Panel on Climate Change (IPCC) predicts that average temperatures will rise between three and eleven degrees Fahrenheit in the next 100 years. This could be catastrophic. Globally, it could result in crop failures, food shortages, the spread of tropical diseases, invasive species, major floods, sea level rise, more severe storms, and geopolitical conflict. New Jersey will not be spared these impacts, including inland and coastal flooding, mega-storms, spread of new diseases, and invasive species. The full scope of the impact cannot be fully predicted. However, it is safe to say that global warming is a very real threat to quality of life in New Jersey and to the basic sustainability of our civilization.

OUR RECOMMENDED TARGET

To avert the very worst effects of climate change, what scientists refer to as "catastrophic global warming," we are endorsing targets for a reduction in New Jersey carbon dioxide emissions from energy use (measured in metric tons of CO2 equivalent) to 114 million tons per year by the year 2020 and 66 million tons per year by 2036. The 2020 target is consistent with that contained in the NJ Global Warming Response Act when apportioned to the energy sector, and is in line with the recommendations of the Intergovernmental Panel on Climate Change, the authoritative body on such matters.

REACHING THE TARGET

Reaching the target will not be easy. Our illustrative aggressive policy scenario shows that it is possible to achieve the 2020 target with concerted effort. But after 2020, the gains from these policies are overtaken by economic and population growth, so that emissions again begin to rise. To reach the 2036 and 2050 targets, a whole new slate of currently unknown technologies and policies must be identified.

Secondary environmental indicators

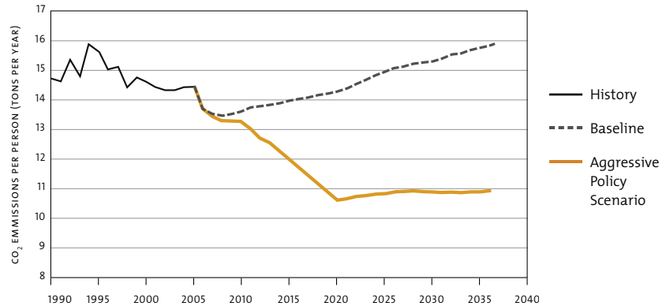


FIGURE 2: **CO_2 PER CAPITA**

Continued population growth in New Jersey is likely, so per capita emissions reductions will be needed to outpace the population growth rate.

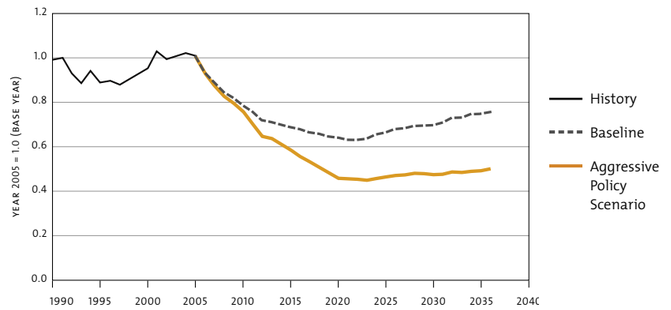


FIGURE 3: **CRITERIA AIR POLLUTANTS**

Local and regional air pollution emissions of nitrogen oxides, sulfur dioxide, particulate matter and other "Criteria" pollutants regulated by the federal government should be reduced to improve human health.

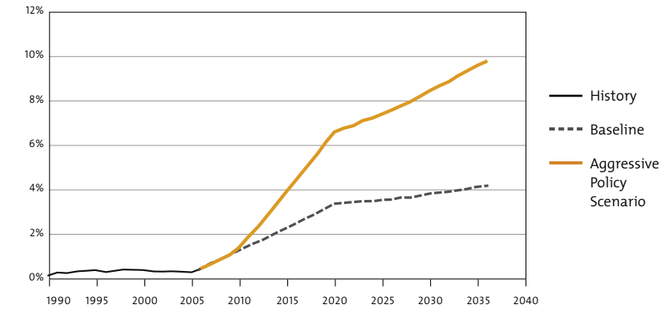


FIGURE 4: **PERCENTAGE OF ENERGY DERIVED FROM RENEWABLE SOURCES**

Renewable energy sources such as sun, wind, and sustainable bio-fuels do not emit greenhouse gases so we should expand their contribution to New Jersey's energy mix.

Energy for a strong economy

Efficiency: The percentage of our income spent on energy

This indicator shows us how much of our collective income we spend on our energy needs and how we compare to the states that are our biggest economic competitors. We are on par with our neighbors in the mid-Atlantic region.

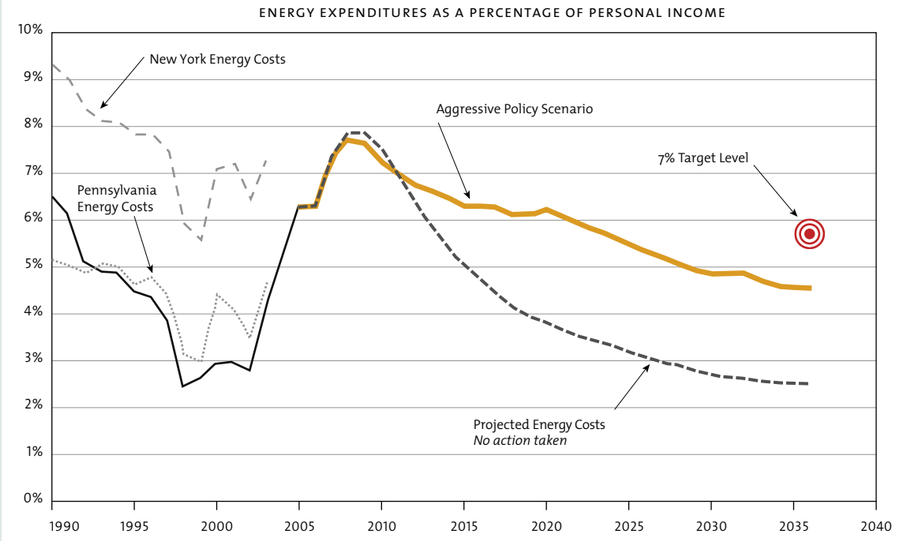


FIGURE 5

THE TARGET

7% of the collective income spent on energy needs.

LEGEND

- NJ HISTORY
- PA HISTORY
- NY HISTORY
- BASELINE
- AGGRESSIVE POLICY SCENARIO

OTHER THINGS TO CONSIDER

Buildings are becoming larger, requiring more energy for lighting, heating, cooling, and gadgets. This makes efficiency improvements to reduce energy use per square foot of floor space very important. Analysis shows that residential buildings are becoming more efficient but commercial buildings are not. This represents an opportunity for public policymaking, because building performance standards are very much within the control of state and local governments, unlike motor vehicle standards which require federal government action.

IF WE DO NOTHING

The principles of sustainable development tell us that our economy, environment, and society should all be functioning and healthy: no one aspect should be sacrificed for the other two. Therefore, reducing carbon emissions or eliminating local smog would be a hollow victory if it plunged New Jersey into economic ruin. At about eight percent of personal income, current energy costs do not appear to be a significant burden on the economy from a historical perspective. On average, energy consumes less of our income (5.9%, 2003) than it does for the neighboring states of New York (6.3%) and Pennsylvania (8.2%). However, this is mostly due to higher incomes, not cheaper energy. New Jersey businesses generally pay a high price for energy compared to other regions of the country.

OUR RECOMMENDED TARGET

We are endorsing two targets for New Jersey. The first is that the percent of our income devoted to energy should not rise beyond 7%. The second target is that the percent of income devoted to energy in New Jersey should not go higher than the average of neighboring states. This means that policies that increase the cost of energy must be balanced with policies that increase efficiency and promote economic growth so as not to overburden businesses or consumers.

REACHING THE TARGET

Although New Jersey currently exceeds the 7% target, our aggressive policy scenario achieves this goal with expected economic growth. As a consequence of our relative wealth, New Jersey spends a relatively low percentage of its income on energy. We were not able to model the economies of our peer states so we cannot show how the aggressive policy scenario changed our status relative to our peers. This is something to monitor in the future as data becomes available.

Secondary economic indicators

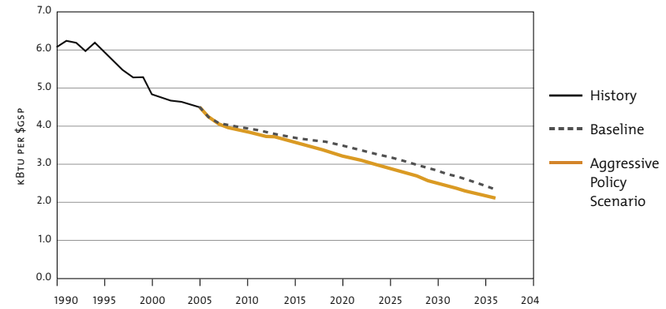


FIGURE 6: **ENERGY CONSUMPTION PER DOLLAR OF GROSS STATE PRODUCT** (IN CONSTANT YEAR 2000 DOLLARS)

The overall energy intensity of the economy should decrease.

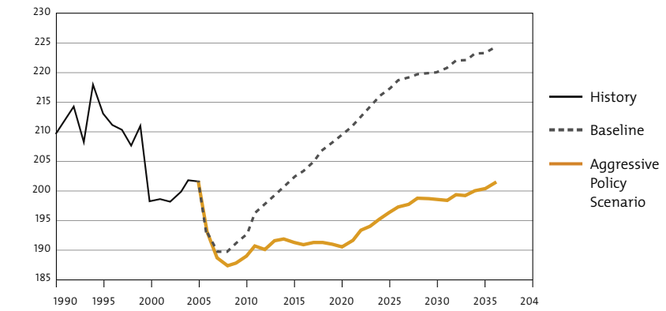


FIGURE 7: **ENERGY USE PER CAPITA** (MILLION BTU PER YEAR)

Energy use per capita should decrease faster than population growth.

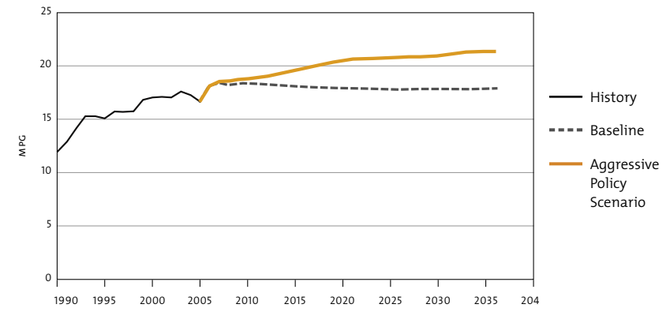


FIGURE 8: **TRANSPORTATION EFFICIENCY IN FLEET MILES PER GALLON**

MPG should increase faster than vehicle miles traveled increases.

Securing NJ's Energy Supplies

Security: Percentage of our energy generated from New Jersey sources

How much of the energy that we consume in New Jersey comes from dependable, controllable, local sources like solar, wind, and bio-fuels? Not much.

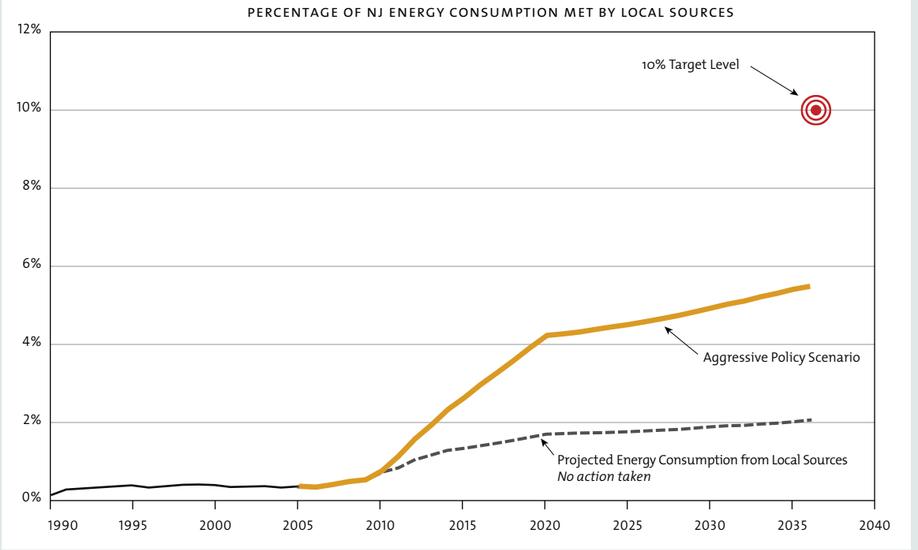


FIGURE 9

THE TARGET

10% of energy from local sources.

LEGEND

HISTORY
BASELINE
AGGRESSIVE POLICY SCENAR

New Jersey's growing population and economy will place increasing burdens on the state's energy supply and delivery infrastructure. If we do not ensure the future security and adequacy of this infrastructure, we leave New Jersey vulnerable to painful, costly disruptions.

OTHER SECURITY MEASURES:

Another way that New Jersey can enhance its energy security is to increase its energy storage capabilities. Storage can help us cope with short interruptions due to hurricanes, for example. Currently New Jersey has a very large heating oil reserve, as well as significant oil refining capacity to turn petroleum into motor fuel and other products. However, the state's storage capacity for natural gas is relatively small and the proposed liquefied natural gas (LNG) facility is currently awaiting the outcome of litigation. Electricity storage is not currently cost-effective on a large scale: New Jersey has a small pumped storage (water) facility which is located at Yards Creek.

IF WE DO NOTHING

New Jersey's quality of life depends upon uninterrupted access to reasonably priced, clean energy. Energy vulnerability results when local energy supplies are inadequate or when the sources of imported energy are insecure. New Jersey has no coal, oil, gas or uranium reserves—it is an energy consumer state rather than a producer state. Our only strictly local sources of energy include solar, wind, tidal, hydroelectric, geothermal, and biomass. This makes New Jersey and its economy highly dependent on interstate flows of electricity and natural gas and petroleum flows from around the world. Instability in the Middle East and Africa has made oil prices and supplies volatile. Natural gas and petroleum interruptions following Hurricane Katrina in 2005 have shown that domestic supplies are also vulnerable. Our nuclear power plants require new fuel from outside New Jersey. And our hot summer days show that even the electricity grid is not immune.

OUR RECOMMENDED TARGET

NJSSI endorses a target of 10% of energy derived from local primary sources by the year 2036. Currently less than 1% of energy used in New Jersey comes from local sources. The New Jersey Renewable Portfolio Standard mandates a 2.12% solar contribution of electricity by 2020 and we believe that an order of magnitude increase from 2006 represents an appropriate target for 2036.

REACHING THE TARGET

Reaching the target will require concerted effort. Currently the local sources of energy, mostly renewable, are growing in response to an aggressive state policy. However, even though our illustrative policy scenario is overlaid on top of current policies, it does not achieve the 10% target. After 2020, continued aggressive efforts will be needed to achieve the 2036 target. The table on page 15 includes an alternate scenario featuring super-high efficiency technology that more closely achieves the 10% target. The good news is that activities to increase our local energy security can also benefit the environment.

Secondary security indicators

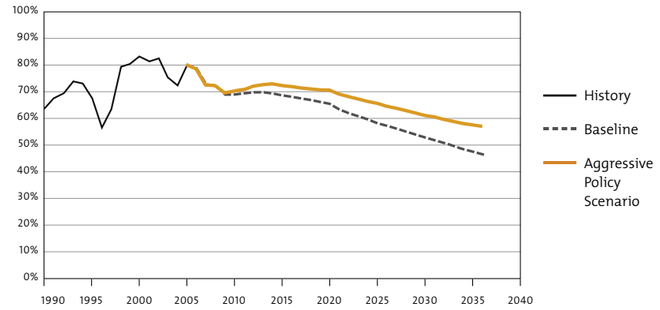


FIGURE 10: **PERCENTAGE OF ELECTRICITY CONSUMED IN NEW JERSEY THAT IS GENERATED IN NEW JERSEY**

Locally generated electricity is more reliable and less vulnerable to weather problems affecting the power grid. This chart shows that New Jersey today has to import roughly 20% of its electricity and that percentage is expected to increase in the future unless power plant siting difficulties are overcome.

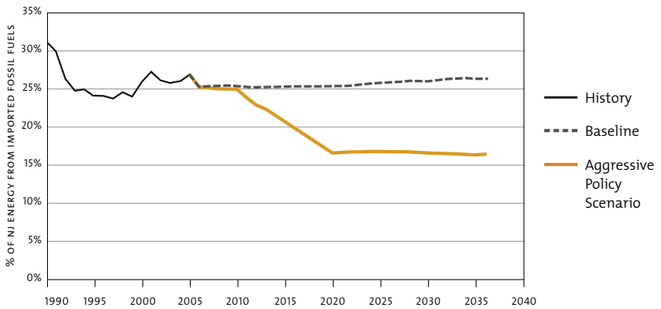


FIGURE 11: **PERCENTAGE OF ENERGY CONSUMED IN NEW JERSEY THAT COMES FROM IMPORTED FOSSIL FUELS**

Oil imports from politically unstable regions are an especially vulnerable part of New Jersey's energy supply. The chart shows that about 25% of New Jersey's energy now comes from imported fossil fuels. That pattern is likely to persist into the future unless we take policy actions aimed at reducing import dependence.

THE NUCLEAR ISSUE

New Jersey's nuclear power plants generate almost half of the electricity that we consume with no GHG emissions. The electricity that we import from the out-of-state grid results in 50% more GHG emissions on average than locally-produced electricity. What role should nuclear power play in New Jersey's energy mix? What would be the impacts on New Jersey if the Oyster Creek power plant were not re-licensed in 2009? Research and public dialogue are needed to address the nuclear issue.

Scenarios for the Future

Illustrative Policy Bundle

Clearly the greatest driver of new energy policy is the threat of global warming. The following graph illustrates the components of the Aggressive Policy Scenario presented on page 7 and shows the impact each of the three main strategies has on greenhouse gas emissions.

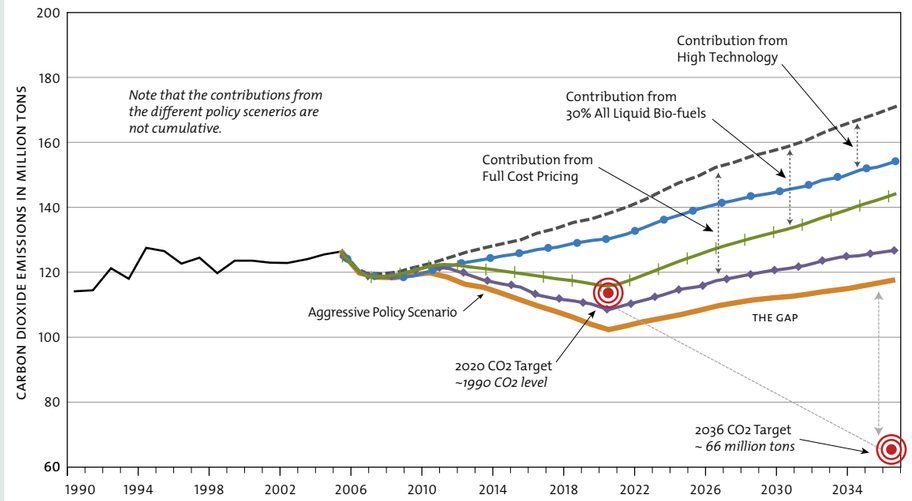


FIGURE 12: IMPACT OF THE AGGRESSIVE POLICY SCENARIO STRATEGIES ON CO_2 EMISSIONS.

THE TARGET

10% reduction below current levels by 2020, 45% reduction by 2036, and 80% reduction by 2050.

LEGEND

- HISTORY
- BASELINE
- 30% ALL LIQUID BIO-FUEL
- HIGH TECHNOLOGY
- FULL COST PRICING
- AGGRESSIVE POLICY SCENARIO

ADDITIONAL SCENARIOS FOR THE FUTURE

In addition to the policies and technologies included in the illustrative aggressive policy scenario, we explored several others. Many of them provided interesting insights. The impact of these alternate policy scenarios on each of our key indicators is summarized in the chart on the facing page.

New Jersey's economy is tightly linked to the national economy and to the trajectories of population and economic growth, and energy prices. Most of the scenarios shown here assume that by 2036, New Jersey's population will grow to over 10 million people, the Gross State Product will grow 2.8% annually, gasoline prices will roughly double, and the existing nuclear power plants will be re-licensed. The R/ECON model may not fully capture the impacts of the imposed state-level energy policies because of the strong influence of the national trend data in the model.

RECOMMENDATIONS FOR FUTURE RESEARCH

As with most research efforts, our investigation identified gaps in our knowledge and suggested a number of areas for further inquiry.

The transportation sector is a major contributor to GHG emissions yet vehicle efficiency (MPG) remains low and vehicle miles travelled are increasing. The interaction of land use patterns, smart growth policies, transportation issues, and energy usage need greater study. Liquid biofuels present an attractive alternative to petroleum products. Are they really the panacea they seem or will we be trading the problem-that-we-know for a new one?

And what of the energy technologies that are now only dreams? Who will fund the basic energy research and development that is required now in order to develop "disruptive," game-changing energy solutions in a timely manner?

The answers to these questions are critical to the sustainability of New Jersey, its neighbors, and the world.

Further details for the scenarios, the modeling process, and all aspects of the project may be found in the full report at www.njssi.org.

Additional Scenarios for the Future

This table summarizes the year 2036 impacts on the indicators for the scenarios that were modeled in this study. Note that no one scenario achieves the desired target: success requires political commitment on a broad policy front.

SCENARIO	DESCRIPTION	ENVIRONMENTAL INDICATOR VALUE (*Units: Million tons of CO2*) *2036 Target: 66 or less*	ECONOMIC INDICATOR VALUE (*Units: Energy as % of Income*) *2036 Target: 7% or less*	SECURITY INDICATOR VALUE (*Units: % of energy from local sources*) *2036 Target: 10% or more*
Base case	Business as usual, keep current policies	**170**	**4.8%**	**2.0%**
Low growth	Base case but with high energy prices, low inmigration	**151**	**5.3%**	**2.1%**
High growth	Base case but with low energy prices, high in-migration	**186**	**4.7%**	**2.0%**
Full cost energy pricing	Using taxes and fees, internalize the external environmental costs of using fossil fuels	**126**	**6.6%**	**5.1%**
Medium carbon tax	Impose a tax of $50 per ton of CO_2 emitted	**131**	**4.9%**	**5.1%**
High carbon tax	Impose a tax of $200 per ton of CO_2 emitted	**81**	**5.3%**	**5.1%**
High efficiency	Using regulations, improve energy use in buildings, industry and transportation to cost-effective levels (about 10%)	**153**	**4.3%**	**2.1%**
Super high efficiency	Using regulations require the use of best available energy efficiency technologies	**98**	**3.1%**	**5.4%**
Advanced biofuels	Replace 30% of current liquid fossil fuel use with biofuels	**143**	**4.9%**	**3.5%**
Super advanced biofuels	Replace 85% of current liquid fuel use with biofuels	**92**	**5.3%**	**3.5%**
Smart growth	Hold vehicle miles traveled per capita constant	**146**	**4.3%**	**4.0%**
No more NIMBY	Meet all growth in electricity demand from power plants built in New Jersey	**131**	**4.3%**	**3.4%**
Illustrative aggressive policy bundle	Full cost, high efficiency, 30% biofuels	**117**	**6.1%**	**5.5%**
Super-aggressive policy bundle	Super high efficiency, smart growth, 30% biofuels	**72**	**2.9%**	**8.4%**

A Call to Action

THE FUTURE WILL BE CREATED by active and concerned citizens, consumers, businesses, workers, and investors in New Jersey. NJSSI's job is to help people understand what the future may hold, and how their actions will influence the future. The rest is up to you.

The scenarios explored in this report illustrate a range of possibilities for New Jersey's future. It is clear that energy efficiency for transportation and buildings, energy production from renewables, and basic energy research are necessary components of any New Jersey energy future. And the debate over the role of nuclear power will continue as it should. We hope that this report has sparked your imagination and interest, and perhaps firmed your resolve to work for a better future. The real work of crafting a shared vision and implementing it begins now. NJSSI will do its part to keep everyone informed of New Jersey's progress, or lack thereof. But New Jersey's success or failure depends on the daily decisions of regular citizens in grocery stores, auto dealerships, and real estate brokerages, and as we go to the polls to hold our leaders accountable for making progress.

The stakes are high: New Jersey will only become sustainable if we work hard together to create a clean, affordable, and secure energy future.

Additional Information
This summary report shares the major findings of the full project report. Both of these reports with additional results, analytical details, and full citations can be accessed on the New Jersey Sustainable State Institute website: www.njssi.org.

Emissions Source Data Disclaimer:
Emissions data for greenhouse gases and their constituent parts are available from a number of sources. As reporting procedures and measuring techniques improve, these numbers can change. Not all sources update their data at the same time, potentially leading to apparent discrepancies between the data sources. For this study, we have used emissions data from the U.S. Energy Information Administration.

Acknowledgements

Our special thanks to the New Jersey Board of Public Utilities for its funding of this project. Through their vision and leadership, the Board's executives and staff have demonstrated their commitment to results-based management and to a sustainable future for the people of New Jersey.

The Project Team

Prof. Clinton Andrews: *Principal Investigator, E.J. Bloustein School of Planning & Public Policy*
Mr. Randall Solomon: *Project Manager, NJSSI*
Mr. Skip Jonas: *Project Coordinator, NJSSI*
Dr. Nancy Mantell: *Chief Modeler, Rutgers Center for Urban Policy Research*

The Project Steering Committee

Ms. Sandy Batty: *Association of New Jersey Environmental Commissions*
Dr. Martin Bierbaum: *Municipal Land Use Center*
Ms. Sara Bluhm: *New Jersey Business & Industry Association*
Mr. Joseph Carpenter: *New Jersey Department of Environmental Protection*
Mr. Laurence Downes, *New Jersey Resources*
Mr. William Dressel: *New Jersey League of Municipalities*
Mr. Paul Flanagan, Esq.: *Office of the Ratepayer Advocate*
President Jeanne Fox: *New Jersey Board of Public Utilities*
Mayor Meryl Frank: *Borough of Highland Park*
Ms. Pamela Frank: *Sun Farm Network*
Rev. Fletcher Harper: *GreenFaith*
Mr. Karl Hartkopf: *New Jersey DCA, Office of Smart Growth*
Ms. Kimberly Holmes, Esq., *Ratepayer Advocate*
Commissioner Lisa Jackson: *New Jersey Department of Environmental Protection*
Mr. Richard Johnson: *Matrix Development Group*
Commissioner Kris Kolluri: *New Jersey Department of Transportation*
Mr. Ralph LaRossa: *PSE&G*
Ms. Suzanne Leta-Liou: *Environment NJ*
Mr. Anthony Marchetta: *LCOR, Inc.*
Mr. Luis Martinez, Esq.: *Natural Resources Defense Council*
Mr. Michael McGuinness: *National Association of Industrial & Office Properties*
Mr. Lance Miller: *New Jersey BPU*
Mr. Robert Miller: *New Jersey DOT*
Mr. David Moore: *NJ Conservation Foundation*
Ms. Dena Mottola: *Environment NJ*
Ms. Anne-Marie Peracchio: *New Jersey Natural Gas*
Mr. Carlos Rodrigues, *Regional Plan Association*
Ms. Seema Singh: *Ratepayer Advocate*
The Honorable Robert Smith: *New Jersey Senate*
Dr. Mark Stout: *New Jersey DOT*
Ms. Felicia Thomas-Friel, Esq.: *Office of the Ratepayer Advocate*
Mr. Scott Weiner: *New Jersey Schools Construction Corporation*
Ms. Melanie Willoughby: *New Jersey Business and Industry Association*
The Honorable John Wisniewski: *New Jersey Assembly*
Mr. Adam Zellner: *New Jersey DEP*

The Expert Advisory Board

Prof. Richard Brail: *E.J. Bloustein School of Planning & Public Policy*
Mr. Tim Evans: *New Jersey Future*
Prof. Frank Felder: *Center for Energy, Economics, and Environmental Policy*
Dr. Panos Georgopoulos: *Environmental & Occupational Health and Safety Institute*
Dr. Davood Ghasemzadeh: *Independent Consultant*
Mr. Steve Herling: *PJM Interconnection*
Prof. Ben Hobbs: *Johns Hopkins University*
Prof. Radha Jagannathan: *E.J. Bloustein School of Planning & Public Policy*
Mr. Edward Linky, Esq.: *US Environmental Protection Agency*
Dr. Colin Loxley: *PSE&G*
Mr. Bill Mates: *New Jersey Department of Environmental Protection*
Mr. Robert Miller: *New Jersey DOT*
Dr. Bharat Patel: *New Jersey Board of Public Utilities*
Mr. Darren Port: *New Jersey Department of Community Affairs*
Prof. Michael Rothkopf: *Rutgers University*
Prof. Joseph Seneca: *E.J. Bloustein School of Planning & Public Policy*
Ms. Jennifer Senick: *Rutgers Center for Green Building*

REPORT DESIGNED BY BUSY BEE PRINTING PRESS

NJSSI

NEW JERSEY SUSTAINABLE STATE INSTITUTE
33 Livingston Avenue, Suite 100
New Brunswick, NJ 08901
732.932.5475 x531
www.njssi.org