



**A Renewable
America**

POWERING UP NEW YORK

A REPORT ON THE ECONOMIC BENEFITS
OF RENEWABLE ELECTRICITY DEVELOPMENT



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EXECUTIVE SUMMARY

Economic growth, energy independence, and new job creation are just a few of the many reasons that a significant majority of Americans consistently support developing renewable electricity.¹ Technological innovations continue to lower costs, and in recent years, several of the renewable electricity sectors have experienced significant growth, attracting billions in new private investment.

Solar, wind, hydroelectric power, biomass, geothermal and waste-to-energy already provide more than 13 percent of U.S. electricity, and renewables are capturing an increasing share of the power grid every year.² In 2013, the major renewable electricity technologies provided well over 527 million megawatt hours of electricity to the utility grid – enough to supply the equivalent of over 43 million average American homes.³ The renewable electricity industries also represent an important source of American jobs, directly employing over half a million people.

This report examines the current and potential economic benefits from developing renewable electricity in New York. The Empire State's existing deployment of renewable energy is already delivering significant economic benefits, as the sector has attracted \$2.7 billion in new investment to bring projects online through 2013.⁴

The state also has considerable untapped renewable electricity potential, and this analysis finds that developing these resources can deliver significant economic gains.

Renewable electricity is **driving economic growth** and creating jobs in communities across New York. The state is already home to more than 266,308 jobs in renewable power industries, energy efficiency, and other conservation services.⁵

Renewable electricity offers an **affordable source of power**, as the cost of renewable electricity has declined dramatically in recent years. Renewable power purchase agreements are typically long-term, fixed cost agreements, helping protect ratepayers from price spikes associated with other energy sources. Wind power costs have fallen over 50 percent in the last five years.⁶ Solar installation costs have fallen nearly 40 percent since 2010.⁷

A **reliable source of power**, renewable electricity can displace the most expensive, least efficient power sources on the utility grid.

While there are many examples of successful New York renewable electricity projects, this report features four case studies that are representative of the current and future potential for the state's renewable power industries. Utility-scale projects, including the Cohocton Wind Farm and the Westchester County waste-to-energy facility, as well as projects that are powering and heating Cornell University and Skidmore College, are featured in greater detail below. The case studies demonstrate that renewable energy is delivering low cost, reliable electricity, while creating jobs and cost-savings for businesses and other institutions.

This report also builds on a scenario from the U.S. Department of Energy's (DOE) 2012 *Renewable Electricity Futures* study, which demonstrates that the U.S. is able to reliably and affordably meet 80 percent of its electricity use by 2050 with renewable electricity.

In a **"High Renewables" scenario**, New York has the potential to deploy as much as 15,290 megawatts (MW) of additional installed renewable electricity capacity by 2030 - enough to supply over 58 percent of overall state electricity use. Our report finds that this deployment would:

- Create nearly 200,000 additional local jobs and nearly \$15 billion more in wages and benefits during construction.
- After construction and during its operation, these new renewable energy projects would create over 3,200 additional annual jobs and over \$250 million in annual wages and benefits. The projects would generate \$134 million in annual tax revenue and \$35 million in annual land leasing revenue.

Even in a **"Low Renewables" scenario**, characterized by low growth in electricity demand and 'Business-As-Usual' with no new policies, about 938 MW of additional renewable electricity capacity would be added by 2030. These additions would be driven by New York's Renewable Portfolio Standard (RPS) and the increasing competitiveness of renewable energy technologies. Our report finds that this deployment would:

- Create over 17,000 additional local jobs and \$1.4 billion more in wages and benefits during construction.
- After construction and during operation, these new renewable electricity facilities would create nearly 325 annual jobs and \$28 million in annual wages and benefits. The projects would generate \$21 million in annual tax revenue and \$1 million in annual land leasing revenue.

Finally, in June 2014, the U.S. Environmental Protection Agency (EPA) proposed a rule, known as the Clean Power Plan, to reduce carbon dioxide emissions from existing power plants. The rule aims to cut national emissions 30 percent from 2005 emissions by 2030, with an interim target of 25 percent on average between 2020 and 2029.⁸ In developing emission reduction targets for each state, EPA assumed a certain level of renewable energy development, energy efficiency improvement, and increased natural gas use in each state.

EPA's proposed rule calls for New York to reduce carbon dioxide emissions by 44 percent by 2030.⁹ Based on our "High Renewables" case, New York could produce twice the renewable energy projected by EPA.¹⁰ Even in the "Low Renewables" case, New York would exceed the EPA assumption of renewable energy development given expected growth in a business-as-usual scenario. As demonstrated in greater detail below, these results imply that the state should be able to easily meet its emission reduction target.



NEW YORK RENEWABLE ENERGY SUCCESS STORIES

New York is home to hundreds of companies that either produce renewable electricity or supply the components to build and maintain new projects. These companies employ thousands of workers and contribute billions to the state's economy.

New York's existing deployment of renewable energy is already delivering significant economic benefits, as the sector has attracted \$2.7 billion in new investment to bring projects online through 2013.¹¹

This section features an overview of current renewable electricity generation in New York and includes four examples that illustrate the benefits of renewable power development. Utility-scale projects, including the Cohocton Wind Farm and the Westchester County waste-to-energy facility, as well as projects to power and heat Cornell University and Skidmore College are featured in greater detail below.

More than 22 percent of New York's electricity generation currently comes from renewable sources:¹²

- 1,732 MW of Wind Power
- 295 MW of Solar Power
- 4,314 MW of Hydropower
- 86 MW of Biomass Power
- 359 MW of Waste-to-Energy

DRIVING ECONOMIC GROWTH

Renewable electricity is helping fuel New York's economy.

- The state is home to more 266,308 jobs in renewable power industries, energy efficiency, and other conservation services.¹³
- There are nearly 500 wind and solar companies and suppliers in the state.¹⁴
- There has been \$3.4 billion in capital investments in New York wind energy projects. These projects generate \$5.2 million in annual land lease payments to farmers and landowners.¹⁵

AFFORDABLE SOURCE OF POWER

The cost of renewable electricity has declined dramatically in recent years. Renewable power purchase agreements are typically long-term, fixed cost agreements, helping to protect ratepayers from price spikes associated with other energy sources. In many cases, renewable electricity is now cost competitive with traditional electricity sources. For example:

- According to the New York Independent System Operator (NYISO), responsible for operating the state's bulk electricity grid, for every 1,000 MW of wind on the power grid, consumers save \$300 million in wholesale energy costs.¹⁶
- Wind power costs have fallen over 50 percent in the last five years.¹⁷
- Solar installation costs have fallen nearly 40 percent since 2010.¹⁸

RELIABLE SOURCE OF POWER

Renewable electricity can displace the most expensive, least efficient power sources on the utility grid.

- Every year in New York, wind farms generate enough electricity to power about 327,000 households in the state.¹⁹
- According to NYISO, the addition of new energy generation has "contributed to a surplus of power resources, relieving concerns about a potential 'generation gap' affecting New York's electric system."²⁰ More than 1,000 MW of wind power was generated on July 19, 2013, when the new all-time record peak demand was set, as well as on January 7, 2014, when a new record winter peak was established.²¹

COHOCTON WIND FARM HELPS POWER WESTERN NEW YORK

EXECUTIVE SUMMARY:

The Cohocton wind farm, owned and operated by SunEdison, supported 250 construction jobs during its one-year construction and is projected to contribute approximately \$14.5 million in tax revenue to the town, county, and local school districts over the next 20 years. Operational since 2009, the facility generates 125 megawatts (MW) of electricity, enough to power 35,000 average homes.

BACKGROUND AND CONTEXT

New York has strong policies in place to encourage renewable electricity development. For example, New York's Renewable Portfolio Standard requires state utilities to source at least 30 percent of their generation capacity from renewables by 2015. Wind power is an important part of that portfolio. The state currently generates 1,812 MW of wind power, or about 2.6 percent of the state's total capacity.²²

"SunEdison seeks to develop and operate clean energy projects that deliver renewable energy to homes and businesses in a way that is cost-competitive. The benefit of renewable energy is that it's not only clean, without any harmful emissions, but is being delivered at a price that is in line with other sources of energy. It is absolutely one of SunEdison's goals – to deliver energy that is clean and cost-competitive."

JOHN LAMONTAGNE
DIRECTOR, CORPORATE COMMUNICATIONS,
SUNEDISON

The Cohocton wind farm was developed and built by First Wind, which has since been acquired by SunEdison, a national renewable energy project developer. Located along the rolling hills of Steuben County in western New York, Cohocton is a rural area, with an economy primarily supported by its agricultural production.

The project is comprised of 50 2.5 MW Clipper wind turbines, some of the largest in the world. Although the full project spans across several hundred acres, each turbine takes up less than a quarter acre. Farmers and ranchers are able to use 95 percent of the remaining land for its prior use.

INCREASED LOCAL REVENUE

The Cohocton wind project will contribute approximately \$14.5 million in tax revenue to the town, county, and local school districts over the next 20 years.

COST SAVINGS FOR CONSUMERS

Every 1,000 MW of wind on the power grid generates \$300 million in savings on wholesale energy costs, according to the NY ISO.



The Cohocton wind farm generates 125 MW of electricity, enough to power 35,000 homes. Photo courtesy of SunEdison.

MAKING THE INVESTMENT

The Cohocton wind farm provides numerous economic benefits for the local community. Job creation, tax payments, direct and indirect spending, local investment, and direct land-lease payments to landowners have all resulted from this project.

Over 250 workers contributed to the planning, siting, and construction of the Cohocton wind farm. Over the entire life of the project, the Cohocton wind farm will generate over \$14.5 million in local tax payments which help reduce the overall tax burden for the community, enhance local services and roads, and improve schools.

The Cohocton wind farm is able to generate enough energy to power 35,000 New York state homes and offset an estimated 156,000 tons of carbon emissions annually.

Once constructed, wind power is essentially a free resource, not subject to the price fluctuations of fossil fuels. Using more wind power to generate electricity helps reduce the overall cost of electricity in New York State. According to the New York Independent System Operator, responsible for operating the state's bulk electricity grid, for every 1,000 MW of wind on the power grid, consumers save \$300 million in wholesale energy costs.²³

SOLAR POWER DELIVERING COST SAVINGS AND REDUCED EMISSIONS FOR CORNELL UNIVERSITY

"Solar delivers numerous benefits to Cornell University, including the ability to lock in low electricity prices over the long-term, provide a hedge against further price increases and protect us from volatility in the energy market. With solar pv we are able to save money and reduce our emissions to meet our long-term goal of climate neutrality."

SARAH ZEMANICK,
DIRECTOR OF CAMPUS SUSTAINABILITY,
CORNELL UNIVERSITY

EXECUTIVE SUMMARY:

In September 2014, Cornell University switched on a 2 megawatt (MW) solar array located two miles from the Ithaca campus. The project supported 30 local construction jobs, and did not require an upfront capital investment from the University. This installation is part of an ambitious effort by Cornell University to source 100 percent of its heating and power needs from carbon-free sources.

BACKGROUND AND CONTEXT

In 2007, Cornell University signed the American College and University Presidents' Climate Commitment, kicking off a process that would see the university develop a Climate Action Plan in 2009 with a goal to achieve climate neutrality by 2050. The University recently passed a resolution to move up its climate neutrality target to 2035. To date, Cornell has reduced its emissions by 30 percent compared to a 2008 baseline.

Cornell plans to achieve this long-term goal with an ambitious plan by increasing renewable energy procurement and reducing campus energy demand. To date, this includes powering campus with a run-of-the-river hydroelectric plant, signing a power purchase agreement with Black Oak Wind Farm to bring community wind energy to campus, and exploring opportunities to adopt biomass as a combustion source on campus and to develop an Enhanced Geothermal System hybridized with biogas.

Most recently, Cornell partnered with Distributed Sun LLC, a national solar power project developer and financier, to construct the 11-acre Snyder Road Solar Farm. The 2 MW of generated solar electricity is fed into the grid and credited to Cornell through a remote net-metering agreement, an arrangement that allows for the kilowatt hours (kWh) generated from a renewable electricity system located at a specific site to be credited towards the kWh consumption at a different location. The project supported roughly 30 local construction jobs. The solar farm is Cornell's first megawatt-scale renewable electricity generation project since 1904, when the current 1 MW hydroelectric plant at Fall Creek Gorge went online.

MAKING THE INVESTMENT

The \$4 million Snyder Road Solar Farm project was financed, in part, by a \$1.3 million rebate from the New York State Energy Research and Development Authority and the NY-Sun Initiative. The project was also partially financed through a federal tax rebate for solar. Cornell purchases all electricity generated from the solar array through a long-term, 30-year fixed price contract. This allows Cornell to lock into low-cost electric pricing, which provides a valuable hedge against future price volatility and risk.

The favorable terms of the power purchase agreement (PPA) were, at least in part, the result of a ruling from the New York Public Service Commission that required utilities to credit renewable electricity generation at the same rate that they charge for electricity at the point of generation. The rate of credit and the PPA rate ensured the long-term economic viability of the project for the university.

RESULTS

Snyder Road Solar Farm also functions as a working laboratory space that allows students to collect real-time energy and weather data for the entire system, and experiment with a dedicated 10-panel educational array and inverter. Many local K-12 programs have visited the site, gaining valuable hands-on experience with solar farms. This solar project has been so successful for Cornell that they hope to invest further into renewable resources. There are plans to build 8 MW of additional off-site solar farms in the Ithaca and surrounding area.

JOB CREATION

The installation of the 2 MW solar array supported 30 local construction jobs.

HANDS-ON TRAINING

The Snyder Road Solar Farm is a working laboratory space that allows students to collect real-time energy and weather data for the entire system, and experiment with a dedicated 10-panel educational array and inverter.



Cornell University is powered by a 2 MW solar array. Photo courtesy of Cornell University.

PROJECT PROFILES

WESTCHESTER WHEELABRATOR WASTE-TO- ENERGY FACILITY TURNS TRASH INTO POWER FOR 67,000 HOMES

“Waste-to-energy is a proven and reliable technology that is crucial to helping counties meet their municipal solid waste needs, reduce carbon emissions, increase recycling, save money, and create a positive economic impact in their communities. The Wheelabrator Westchester facility has been here for more than 30 years and we have actively worked towards the industrial redevelopment of the area by partnering with other industrial companies and providing low-cost, reliable renewable electricity.”

VIN LANGONE
REGIONAL VICE PRESIDENT, WHEELABRATOR
TECHNOLOGIES

EXECUTIVE SUMMARY:

Operational for more than 30 years, the Westchester County-based Wheelabrator Technologies waste-to-energy facility in Peekskill, New York generated more than \$30 million in economic activity in 2013. The facility directly employs 68 people, many of whom live in Westchester County, supports an additional 100 indirect jobs, and processes up to 2,250 tons of post-recycled household and commercial waste per day, generating 63 megawatts (MW) of renewable electricity.

BACKGROUND AND CONTEXT

The Wheelabrator Westchester waste-to-energy facility is located in Peekskill, New York. Wheelabrator Technologies designs, builds, owns and operates waste-to-energy facilities all over the country, building the first commercially successful waste-to-energy facility in the U.S. in 1975. The Westchester County facility has been integral to the industrial revitalization of the area after large industrial facilities had left the state. The facility, opened in 1984, can process 2,250 tons of post-recycled everyday household and business waste a day or about 700,000 tons per year. Waste-to-energy facilities have an incredibly compact footprint in comparison to a landfill. The Westchester facility is only 27 acres.

The Westchester County facility now sells 55 MW of generated power to the New York Independent System Operator, following the expiration of the facility's 25-year power-purchase agreement in 2009. The facility turns trash into power for 67,000 homes.

INCREASED ECONOMIC ACTIVITY

The Westchester Wheelabrator facility generated more than \$30 million in economic activity in 2013.

JOB CREATION

This facility supports 68 full-time jobs and nearly 100 indirect jobs.



The Westchester waste-to-energy facility generates 63 MW of clean, reliable electricity. Photo courtesy of Wheelabrator Technologies.

MAKING THE INVESTMENT

Waste-to-energy (WTE) facilities require large upfront capital cost investments. Depending on capacity, each new facility can generate between \$150 million to \$1 billion in total direct and indirect spending with an estimated 700 to 1,000 construction jobs created over the average two and a half year construction time span.²⁴ The total estimated economic impact of the Wheelabrator Westchester WTE facility in 2013 was \$30 million, including tax payments, direct payroll expenditures, and indirect and induced spending. The facility supports 68 full-time jobs and nearly 100 indirect jobs.

WTE facilities provide a clean, reliable source of power, and act as compliment to local recycling program's efforts to reduce landfill usage. The Westchester County facility has maintained a 98 percent reliability rate and over 90 percent generation capacity. Also, since opening the Wheelabrator WTE facility nearly 30 years ago, Westchester County has seen its recycling rates almost double to 51 percent of total waste generated, well above the national average of 35 percent.²⁵

TECHNOLOGY SPOTLIGHT: WASTE-TO-ENERGY IN U.S.

Nationwide, the waste-to-energy sector employs approximately 5,400 Americans with direct labor earnings estimated at \$459 million in wages, salaries, and benefits. Waste-to-energy generated approximately 14.5 million megawatt hours of electricity in 2012, enough to power 1.3 million U.S. homes.²⁶

RENEWABLES WORK TOGETHER TO PROVIDE COST SAVINGS AND RELIABLE POWER AND HEAT FOR SKIDMORE COLLEGE

EXECUTIVE SUMMARY:

Skidmore College in Saratoga Springs recently brought on-line a 2.6 megawatt (MW) solar array, as well as retrofitted and upgraded an aging, and previously unused, 3 MW small hydro facility on Chittenden Falls. The solar project represents 12 percent of the college's total energy use and as a result of this investment, Skidmore College anticipates saving hundreds of thousands of dollars in energy expenses. The hydropower facility generates an estimated \$150,000 in annual property and payroll taxes. Together, these two projects are able to generate 30 percent of all campus electricity needs. In addition to these renewable electricity resources, geothermal power meets 40 percent of the College's heating and cooling needs.

"The sizing of these different renewable electricity projects was strategically linked. Skidmore College wanted to diversify its energy mix. We could have focused solely on any one of these renewable electricity sources, but we wanted several sources so as to keep costs as consistent and reliable as possible while being able to meet the growing energy needs of the campus. Hydroelectric and solar power have allowed us to leverage two different sources with great success."

DAN RODECKER

DIRECTOR OF FACILITIES, SKIDMORE COLLEGE

BACKGROUND AND CONTEXT

The original Chittenden Falls dam was built in 1810 and then converted into an electric generating facility in 1979. However, over the years the Chittenden Falls dam fell into disrepair. In 2012, Skidmore College, about 60 miles north of the dam, was looking for ways to reduce its carbon footprint by bringing more renewable electricity into its portfolio. Working with Gravity Renewables, a national small-hydro project developer, Skidmore College agreed to a 20 year power-purchase agreement (PPA) for the 3 MW of generated electricity. The site has three generators, all of which needed significant upgrades, repairs, and retrofits, which amounted to a \$300,000 investment.

The agreement between Gravity Renewables and Skidmore College is the first hydroelectric project in the country to take advantage of "remote net metering," an arrangement that allows for the kilowatt hours (kWh) generated from a renewable electricity system located at a specific site to be credited towards the kWh consumption at a different location. The Chittenden Falls facility generates 18 percent of the college's electricity needs, reducing carbon emissions by an estimated 3,000 tons per year.

In October of 2014, Skidmore cut the ribbon for a 2.6 MW solar array that supplies 12 percent of the College's electricity needs. As a result of this investment in solar power, Skidmore College anticipates saving hundreds of thousands of dollars in energy expenses. This project spans eight acres and consists of 6,950 ground-mounted panels, and is currently the largest solar array in the state. Owned and operated by Washington Gas Energy Systems, the project was built by Dynamic Energy, and the college purchases the electricity it produces through a long-term PPA.

Currently, about 40 percent of the campus' heating and cooling needs are provided by ground-source geothermal pumps that take advantage of the relatively constant temperatures just below the ground's surface.

MAKING THE INVESTMENT

By partnering with Skidmore College, Dynamic Energy was able to provide the capital investment and expertise necessary to retrofit and upgrade the deteriorating hydroelectric plant at Chittenden Falls. The Chittenden Falls hydro plant created dozens of jobs during the yearlong upgrade and retrofit in 2012, and three full-time jobs thereafter. In addition, the facility contributes an estimated \$150,000 to \$200,000 a year in local property and payroll taxes.

The 2.6 MW solar array represented a \$4 million investment including a \$2.3 million grant provided by the New York Energy Research and Development Authority (NYSERDA). Construction took six months and created around a dozen construction jobs in the area.

Skidmore College knew that they wanted to reduce their carbon footprint, ensure steady long-term electricity prices, and build a diversified energy portfolio. Small hydroelectric power, solar, and geothermal have all helped them reach their goal and the college has plans to further expand their renewable electricity portfolio in the coming years.

COST SAVINGS

Skidmore College anticipates saving hundreds of thousands of dollars in energy expenses as a result of its investment in solar power.

INCREASED TAX REVENUE

The upgraded small-scale hydro facility generates an estimated \$150,000 in annual property and payroll taxes.



The Chittenden Falls dam generates 18 percent of electricity needs at Skidmore College. Photo courtesy of Gravity Renewables.



NEW YORK'S RENEWABLE FUTURE

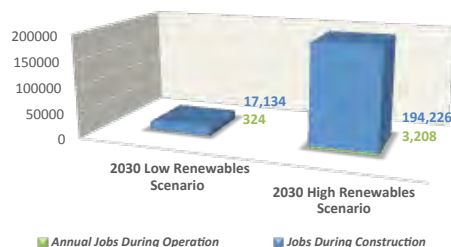
Our key findings are listed in the summary tables below (see Methodology section for data sources and methods used).

Current Investment and Potential Future Opportunities for Renewable Electricity in New York



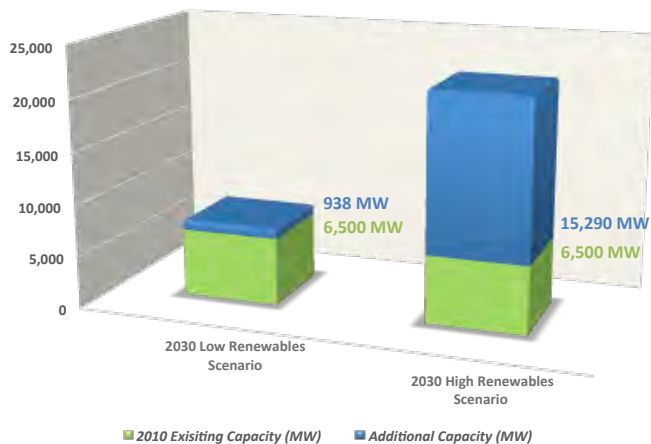
In a “High Renewables” scenario, New York has the potential to attract nearly \$15 billion more in wages and benefits during construction in addition to annual land leasing and tax revenue.

Jobs During Construction and Operation



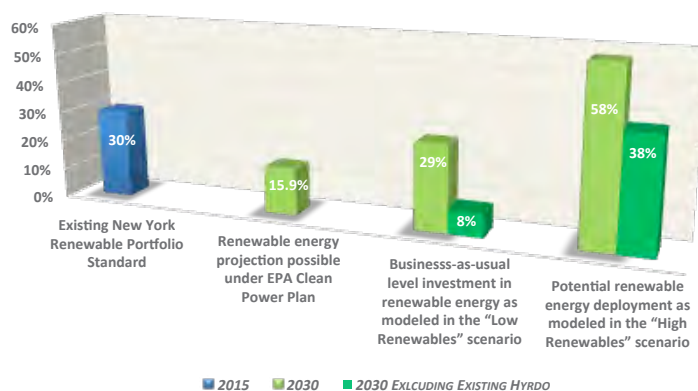
In a “High Renewables” scenario, New York has the potential to create nearly 200,000 additional local jobs during construction and 3,200 additional annual jobs committed to operations and maintenance.

Additional Installed Capacity (MW)



In a “High Renewables” scenario, New York has the potential to supply over 58 percent of overall state electricity use from renewable electricity.

Potential Renewable Electricity Capacity



In our “High Renewables” case, renewable energy development (excluding existing hydroelectric power) would produce twice the renewable energy projected by EPA.

NEW YORK'S RENEWABLE ELECTRICITY DEVELOPMENT POTENTIAL FAR EXCEEDS THE PROPOSED CLEAN POWER PLAN

The EPA Clean Power Plan calls for New York to reduce carbon dioxide emissions by 44 percent by 2030.²⁷ EPA based New York's target on cuts through the following measures:

- A 0.8 percent reduction through increased efficiency of coal plants
- A 14.5 percent reduction through increased use of low-emitting natural gas combined cycle plants where excess capacity is available
- An 18 percent reduction through the use of more zero-emitting power sources such as renewable energy and nuclear power, and
- A 10.5 percent reduction through energy efficiency improvements to reduce electricity demand.²⁸

New York has a great deal of flexibility in developing its compliance plan, and may choose these or other carbon reduction strategies. A state could select a different balance among the approaches than EPA used to set the proposed emission reduction target.

Analysis from the Union of Concerned Scientists (UCS) demonstrates that even under a conservative growth scenario, states can achieve twice the renewable energy proposed by the EPA. According to UCS analysis, the Clean Power Plan does not sufficiently consider existing renewable energy deployment rates or the falling costs of renewable energy.²⁹

Another recent analysis based on modeling by ICF International, a business management consulting firm, concludes that the EPA utilized outdated renewable energy cost considerations, including "levelized costs for both wind and solar energy that are 46 percent above current average costs".³⁰ The recent price drops in renewable energy will likely make the proposed rule less expensive to meet, and provide even greater opportunity for renewable energy development.

Our analysis shows that New York could meet almost the entire EPA emissions reduction target through the increased use of renewable energy.

Indeed, New York also has the potential for significant renewable electricity development far beyond what is likely under the proposed standards. Developing those resources would attract substantial investment to the state and create thousands of new jobs.

Renewable energy projection possible under EPA Clean Power Plan ³¹	15.9% by 2030
Existing New York Renewable Portfolio Standard	30% by 2015
Business-as-usual level investment in renewable energy (excluding existing hydroelectric power) as modeled in the "Low Renewables" scenario	8% by 2030
Business-as-usual level investment in renewable energy as modeled in the "Low Renewables" scenario	29% by 2030
Potential renewable energy deployment (excluding existing hydroelectric power) as modeled in the "High Renewables" scenario	38% by 2030
Potential renewable energy deployment as modeled in the "High Renewables" scenario	58% by 2030

In the proposed Clean Power Plan, the EPA proposed a 2030 target emissions rate for each state. This target is based on EPA estimates of how each state could leverage a mix of measures, including adding new renewable electricity generation. States are not required to achieve EPA's renewable projections in order to comply with the proposed Clean Power Plan, or they may exceed them if cost-effective for the state. For New York, EPA projects 15.9 percent renewable energy generation under the proposed rule by 2030. The "High Renewables" scenario modeled here and in the NREL *Renewable Electricity Futures* study would exceed the EPA proposed target twice over.³²

In fact, New York already meets the EPA proposed target and is on track to exceed it before 2030, due to the state's Renewable Portfolio Standard of 30 percent by 2015.

RESEARCH METHODOLOGY

PURPOSE OF STUDY

David Gardiner and Associates (DGA) conducted this study for the Wind Energy Foundation and the A Renewable America campaign to assess the overall opportunity for renewable energy-based economic development in New York.

METHODOLOGY

DGA modeled the economic effects of a renewable electricity future in 2030 for New York based on two trajectories from the 2012 National Renewable Energy Laboratory (NREL) Renewable Electricity Futures (REF) study, the most comprehensive analysis of high-penetration renewable electricity in the United States to date.³³ That study involved a collaboration of more than 100 experts from 35 institutions representing national energy labs, academia, utilities, grid operators, industry, financial institutions, environmental groups and renewable energy businesses. It found that the United States could reliably meet at least 80 percent of its electricity needs from renewable energy resources by 2050, at a cost comparable with other scenarios for reducing harmful carbon dioxide (CO₂) and other power plant pollutants.

DGA features a “Low Renewables” and a “High Renewables” scenario based on updated 2014 results of the NREL Regional Energy Deployment System (ReEDS) model, completed by authors of the original REF study.³⁴

- The “Low Renewables” scenario in this study is based on the “Low Demand Baseline” in the REF study. It assumes that electricity demand grows very slowly, and that no new renewable energy policies are enacted. Existing federal policies are assumed to expire as scheduled.

- The “High Renewables” scenario in this study is based on the REF “Core 80% RE scenario ‘80% RE-ITI’”. It assumes that policies are enacted to achieve 49 percent of total contiguous U.S. electricity generation from renewable sources in 2030 and 80 percent in 2050, without specifying which of many policies could enable achieving that goal. It also assumes low electricity demand growth, and only incremental technology improvement (ITI) that reflects partial achievement of the future technical advancements that may be possible for each technology.

DGA did not utilize the scenario from REF that assumed a higher rate of “Evolutionary Technology Improvement”, or scenarios that assumed “No Technology Improvement” or that assumed various potential constraints on renewable energy development, such as inadequate available renewable resources, inadequate transmission, or inadequate flexibility technologies, such as energy storage, needed to balance electricity demand with supply.³⁵ DGA also did not utilize REF scenarios with high energy demand, which would have produced higher levels of renewable energy development.

ReEDS calculates the mix of renewable energy and other technologies in each state that could meet the national renewable energy goals at the lowest total system cost.

DGA then calculated the economic development impacts of the five major renewable electricity technologies (biomass, geothermal, hydroelectric power, solar, and wind) using the NREL Jobs and Economic Development Impact (JEDI) model, with its generic default cost assumptions. JEDI was initially designed to estimate economic impacts of renewable energy to state economies, and later refined to focus on specific renewable energy projects. It includes both direct employment in the projects and their supply chains, and indirect and induced employment including wages and benefits spent in the state or local region.

The JEDI model is not a macroeconomic model, and does not calculate any offsetting reduction in employment in other parts of the economy, such as extracting fossil fuels. Many previous studies have found, however, that renewable energy technologies yield more employment per dollar or per megawatt than fossil fuel technologies, and thus lead to net increases in employment.³⁶

DGA has also not calculated the economic benefits of other investments needed to enable the “High Renewables” scenario, such as upgrades to transmission and distribution systems, or the development of energy storage or other flexibility resources. ReEDS calculates that the “High Renewables” scenario would also be accompanied by 2,165 MW of electricity storage technologies by 2030.

While distributed generation solar photovoltaics are exogenous to the ReEDS model, which focuses primarily on utility-scale solar opportunities, the REF study utilized a separate model to represent rooftop solar PV deployment.

The REF study and JEDI model do not include specific estimates for waste-to-energy technology. We include an estimate of the technical potential for waste-to-energy expansion in the key findings section of the report, based on a recent study from Columbia University.³⁷ The growth assumptions for waste-to-energy in this report are based on the percent of municipal solid waste (MSW) used at waste-to-energy facilities in Europe (which process 25 percent of MSW using waste-to-energy facilities, as opposed to 7.6 percent in the United States). Unlike the ReEDS modeling for other technologies, that estimate is not based on any assessment of the economic competitiveness of waste-to-energy relative to other electricity generation technologies. Other studies, such as the U.S. Energy Information Administration Annual Energy Outlook, have found that significant expansion of waste to energy is unlikely under business-as-usual or with modest renewable energy or greenhouse gas reduction policies. Expanded use of waste-to-energy is possible under policies favorable to that technology, however.

APPENDIX

Total Renewable Electricity (Biomass, Hydroelectric, Solar, and Wind)		2030 High Renewables Scenario	2030 Low Renewables Scenario
Additional Installed Capacity		15,290 MW	938 MW
Local Jobs During Construction		194,226	17,134
Wages and Benefits During Construction		\$14.8 billion	\$1.4 billion
Annual Jobs During Operation		3,208	324
Annual Wages and Benefits During Operation		\$253 million	\$28 million
Annual Tax Revenue		\$134 million	\$21 million
Annual Land Leasing Revenue		\$35 million	\$1 million
Wind (1,274 MW in 2010)		2030 High Renewables Scenario	2030 Low Renewables Scenario
Additional Installed Capacity		11,778 MW	364 MW
Local Jobs During Construction		43,109	1,330
Wages and Benefits During Construction		\$3.3 billion	\$101 million
Annual Jobs During Operation		1,739	54
Annual Wages and Benefits During Operation		\$138 million	\$4 million
Annual Tax Revenue		\$100 million	\$3 million
Annual Land Leasing Revenue		\$35 million	\$1 million
Biomass (468 MW in 2010)		2030 High Renewables Scenario	2030 Low Renewables Scenario
Additional Installed Capacity		41 MW	2 MW
Local Jobs During Construction		66	3
Wages and Benefits During Construction		\$6 million	\$0.25 million
Annual Jobs During Operation		53	2
Annual Wages and Benefits During Operation		\$4 million	\$0.15 million
Solar (37.8 MW in 2010)		2030 High Renewables Scenario	2030 Low Renewables Scenario*
Additional Installed Capacity		2,369 MW	39 MW
Local Jobs During Construction		120,682	1,116
Wages and Benefits During Construction		\$9.1 billion	\$81 million
Annual Jobs During Operation		883	10
Annual Wages and Benefits During Operation		\$63 million	\$0.7 million
Hydroelectric (4,722 MW in 2010)		2030 High Renewables Scenario	2030 Low Renewables Scenario
Additional Installed Capacity		1,103 MW	533 MW
Local Jobs During Construction		30,369	14,684
Wages and Benefits During Construction		\$2.5 billion	\$1.2 billion
Annual Jobs During Operation		533	258
Annual Wages and Benefits During Operation		\$48 million	\$23 million
Annual Tax Revenue		\$28.9 million	\$14 million

Both scenarios estimate an extremely limited deployment of geothermal in New York.

*NREL assumed no growth for distributed generation solar PV in the Low Renewables scenario.

Separately, this report also reviewed the technical potential for waste-to-energy in New York.

Waste-to-Energy (359 MW in 2014)	2030 Additional Capacity Potential
	300 MW



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Page 2: Solar photovoltaic panels installed at the East Greenbush wastewater treatment facility.

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Page 14: Windmills near Wales NY 11 August 2012, found on Flickr.

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ABOUT THE ORGANIZATIONS

A RENEWABLE AMERICA

A project of the Wind Energy Foundation, a 501c3 nonprofit organization, *A Renewable America* provides education about the many benefits of American-made renewable electricity. A Renewable America raises public awareness of how each of the six major U.S. renewable electric technologies – biomass, geothermal, hydro, solar, waste-to-energy, and wind power – are already providing a substantial amount of clean, affordable, and reliable electricity.

For more information, visit www.arenewableamerica.org.

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