New York Energy $martSM Programs

SUNY-ESF SURE Conference
Syracuse, NY
April 4, 2012

Chris Carrick
Energy Program Manager, Central New York Regional Planning & Development Board
CNY Energy $mart Communities Coordinator, NYSERDA
What is NYSERDA?

- Public Benefit Corporation
- Established by the New York State Legislature in 1975
- NYSERDA is tasked to address the State’s energy & environmental challenges

Mission

Advance innovative energy solutions in ways that improve New York’s economy and environment.

Your Partner for Energy Savings
What is the CNY RPDB?

• A public agency established in 1966 by Cayuga, Cortland, Madison, Onondaga, and Oswego Counties

• Provides a range of services associated with the growth and development of Central New York communities with a focus on:
  • Comprehensive Planning
  • Economic Development
  • Environmental Management
  • Information and Research Services
  • Transportation Planning
  • Energy Management

• As an Independent Contractor to NYSERDA, serves as the Coordinator for the Energy $mart Communities Program in Central New York (7 counties)

Your Partner for Energy Savings
WHAT IS AN E$C℠?

- A network of organizations and agencies that contribute to energy-focused projects.
- The program shares economic, environmental and social benefits through energy efficiency and the diversifying of energy resources.
- Regional coordinators facilitate the projects and community partnerships, helping to make the best match between the community’s needs and the partnership’s resources.

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System Benefits Charge (SBC): consumption-based charge on most customers electric and/or gas utility bills.

- Central Hudson Gas & Electric
- Con Edison
- New York State Electric & Gas
- National Grid
- Orange and Rockland
- Rochester Gas and Electric
First address energy efficiency!

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Energy Use in the Residential Sector

Residential use comprises 1/4 of U.S. energy consumption.

NYS total energy cost = $30 Billion.

Residential users cost = 17 Billion (more than 50%)

Many opportunities to decrease this amount.

Share of Energy Consumed by Major Sectors of the Economy, 2008

- Commercial: 19%
- Industrial: 31%
- Residential: 22%
- Transportation: 28%


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The largest users of energy in the home

PV and wind can only address some of these uses!
The Enemy – Infiltration and Exfiltration

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NYSERDA’S Residential Programs

• Home Performance with ENERGY STAR®
• Green Jobs – Green NY Program
• On-bill Financing
• New York ENERGY STAR® Labeled Homes

Program Goal
To help New York State residents live more affordably by providing them with a comprehensive “house as a system” program that delivers savings through quality …

Your Partner for Energy Savings
## Residential Program Incentives

<table>
<thead>
<tr>
<th></th>
<th>&lt;60% Median Income</th>
<th>60-80% Median Income</th>
<th>80-200% Median Income</th>
<th>&gt;200% Median Income</th>
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<tr>
<td><strong>FREE</strong></td>
<td>WAP</td>
<td>Green Jobs-Green NY Audit Program</td>
<td>Green Jobs-Green NY Audit Program</td>
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<td></td>
<td>HEAP</td>
<td>National Grid</td>
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<td>EmPower</td>
<td>Assisted Home Performance with ENERGY STAR</td>
<td>Home Performance with ENERGY STAR</td>
<td>Green Jobs-Green NY Discounted Audit</td>
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<td>Energy Star Loan</td>
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<td>Energy Star Loan</td>
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<td>On-Bill Financing</td>
<td>On-Bill Financing</td>
<td>On-Bill Financing</td>
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<td><strong>TAX</strong></td>
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<td><strong>LOANS</strong></td>
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<td><strong>SUBSIDIES</strong></td>
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<tr>
<td><strong>UTILITIES</strong></td>
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</tbody>
</table>
Energy Use in the Commercial Sector

- Buildings account for over 40% of total energy use and over 70% of electricity use in the U.S.
- The commercial and industrial sectors account for 32% of the net energy consumption in New York State.
- A well-designed energy project can result in a Return On Investment (ROI) of between 15% and 30%.
- Energy use is the single largest operating expense in commercial office buildings, representing approximately 1/3 of typical operating budgets and accounting for almost 20% of U.S. annual GHG emissions.

Example: 200,000 SF office building that pays $2/SF in energy costs.
- 10% reduction in energy consumption can translate into an additional $40,000 of NOI.
- At a cap rate of 8%, this could mean a potential asset value boost of $500,000!
NYSERDA’s Commercial / Industrial Programs

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Energy Efficiency Revolving Loan Fund

Structure:
• Administered by the CNY RPDB
• Capitalized through the Energy Efficiency and Conservation Block Grant (EECBG) Program

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Criteria for Business Applicants:

• Existing businesses located in Onondaga County
• Small Business as per SBA definitions
• Specific Energy Efficiency Real Estate Improvements
• Replacement of Machinery or Equipment to Improve Energy Efficiency
• Proposed projects would qualify under existing NYSERDA or local utility incentive programs
Amounts, Rate, and Term:

• Up to 50% of total project cost to a maximum of $100,000
• Ten percent equity investment required
• Current rate is 4.5%
• Term is 5 years or the demonstrated payback period of the funded project, whichever is shorter
Good Reasons to Use Renewable Energy

• You care about sustainability and the future
• You understand that sources of fossil fuel are finite
• You prefer energy that’s generated locally…not imported
• You accept that increasing CO₂ leads to climate change
• You know that distributed generation offsets traditional generation that causes air pollution
• You want to “hedge” against volatile (but generally rising) prices for fossil fuels
• You like to be on the “cutting edge” of technology

Your Partner for Energy Savings
What is Photovoltaics (PV)?

- *Photo* is Greek for Light
- *Voltaic* is defined as electricity produced by chemical action
- Its root is Volts, named for Alessandro Volta, the inventor of the battery (the battery was the first means of generating electricity)
- Photovoltaics (PV) literally means *Electricity from Light*
- Made from high-tech semiconductor materials (i.e., silicon)

*Slide Courtesy of ETM Solar Works, Inc.*

*Your Partner for Energy Savings*
How Does PV Work?

• A typical grid-tie PV system consists of several solar modules connected together to form an array.

• The array can be installed on a roof or on ground or pole-top mounts.

• When sunlight strikes the array, it produces direct current (DC) electricity.

• A UL-listed, utility-grade inverter converts the direct current (DC) power from the PV array into alternating current (AC) power that exactly matches the voltage and frequency of the electricity flowing in the utility line.

• In the event of a power outage, safety switches in the inverter automatically disconnect the PV system from the utility network.

Slide: courtesy of Four Winds Renewable Energy

Your Partner for Energy Savings
How Does a Typical PV System Work?

Solar panels supplied with mounts (as many as desired)

SunnyBoy Inverter (feeds power into home and matches power with the utility)

Clean Power System

Reduces usage of utility power by 20% to 90%
Inverter for Grid Connected System
What is Net Metering?

- Power flows into grid and runs the meter backwards when you generate more electricity than you use.
- Residential PV systems up to 25 kW (non-residential PV systems up to 2 MW or peak load).
- Allows you to use your energy production to offset your electric consumption over a period of time.

Your Partner for Energy Savings
How Does Net Metering Work?

• For residential PV systems up to 25 kW, **net excess generation (NEG)** in a given month is credited to the next month's bill at the utility's retail rate.

• At the end of the annual billing cycle, customers are paid at the **utility's avoided-cost rate** for any unused NEG.

Photo Courtesy of ETM Solar Works, Inc.
Is There Enough Sun for Solar PV in Central New York?

Like all electronic devices, PV systems operate MORE EFFICIENTLY at cooler temperatures!
Sure, But Can Solar PV REALLY Work in Central New York?

It does in Germany!

• Germany has similar climate and solar radiation as Alaska – much worse than Central New York
• **BUT**, Germany’s **feed-in tariff** requires utilities to pay customers a guaranteed rate for any solar power they feed into the grid
• **SO**, Germany is the world's top PV installer, accounting for almost half of the global market in 2009:
  • Germans installed about 9,800 megawatts of new PV capacity in 2009, up from 1,300 megawatts in 2007
  • Solar power now meets about 2% of Germany's electricity demand, could reach 25% by 2050
  • Total peak power output of Germany's installed solar PV panels hit 12.1 GW -- greater than the total power output (10 GW) of Japan's entire 6-reactor Fukushima nuclear power plant

Your Partner for Energy Savings
U.S. SOLAR 2011 YEAR-IN-REVIEW

2011 annual growth rate of PV installations: ↑109%

Weighted average PV system price: Down ↓20%

Number of PV projects over 10 MWdc completed:
- 2009: 2
- 2010: 8
- 2011: 28

Number of states installing over 50 MW:
- 2009: 2 states
- 2010: 5 states
- 2011: 8 states

Number of Residential PV Installations in 2011: 51,176

Google
June 14, 2011
Google invests $280 million in a SolarCity tax equity fund

SolarWorld and six unnamed partners file anti-dumping/countervailing duty petition in front of the U.S. government against China and Chinese c-Si cell/module manufacturers

Sempra Energy
December 27, 2011
Sempra Generation announces operation of 42 MW of its 150 MW Mesquite Solar project in Arizona

Evergreen Solar
August 15, 2011
Evergreen Solar files for bankruptcy

First Solar
July 26, 2011
First Solar announces world-record CdTe cell efficiency of 17.3%

Solyndra
September 5, 2011
Solyndra files for bankruptcy

GE
October 13, 2011
GE announces it will construct its CdTe manufacturing facility in Colorado

California
November 9, 2011
California reaches 1 gigawatt of cumulative rooftop PV installations

BP
December 20, 2011
BP announces it will shut down its solar business after more than 40 years

Solar Trust of America
August 22, 2011
Solar Trust of America announces that the 1 GW Blythe solar project will now be planned using PV instead of parabolic trough CSP

Section 1705 DOE Loan Guarantee
September 30, 2011
Section 1705 DOE Loan Guarantee program closes, having offered $13.3 billion in full or partial guarantees to solar projects and manufacturing facilities

BP
December 20, 2011
BP announces it will shut down its solar business after more than 40 years

SolarCity
November 29, 2011
SolarCity and Bank of America Merrill Lynch announce the closure of financing for SolarStrong, a ~300 MW portfolio to be built on military housing

Section 1603 Treasury Program
December 31, 2011
Section 1603 Treasury Program expires, forcing the industry to revert back to tax equity financing
Why doesn’t everybody Have Solar?

• First things first: address energy efficiency!
• It’s still expensive (but getting cheaper quickly)
• Need unrestricted site
• Consider purchasing green power from the “grid”
How Much Does PV Cost?

Overall average residential system price: approx $7,500/ kW-DC

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What Incentives are Available?

- Incentive is $1.50/watt
- First-come, first-served
- Won’t be approved for systems already installed
- Must be installed by Eligible Installer
- Capped at 7kW for residential systems, 50 kW for commercial and 25 kW for non-profits, schools and municipalities
- Capped at 40% out-of-pocket customer costs after state and federal tax credits
- PV system capacity cannot exceed 110% of historical electricity usage

Your Partner for Energy Savings
How Are Incentives Paid?

• Paid to approved Eligible Installers

• NOT paid directly to owner of PV system

• Entire incentive MUST be passed on to the owner of the PV system by the Eligible Installer

• Eligible Installers on NYSERDA’s website

Your Partner for Energy Savings
When are Incentives Paid?

• In two installments:
  • 75% paid AFTER the equipment is delivered to the installation site
  • 25% paid when PV system is grid-connected and approved by your utility

• NYSERDA reserves right to review any installation prior to final incentive payment
How Much Will PV Cost YOU?

• **Clean Power Estimator** uses actual utility rates, location, and program incentives to provide customers with a summary of system costs and benefits

• [http://nyserda.cleanpowerestimator.com/nyserda.htm](http://nyserda.cleanpowerestimator.com/nyserda.htm)

*Your Partner for Energy Savings*
Enter INPUTS:
- Zip Code: 12203 (Albany)
- Customer Type: Residential
- Electric Bill: $150/mo
- System Size: 2.5kWdc
What Does Clean Power Estimator Show Me?

Get OUTPUTS:

System Summary

Net system cost after all incentives: $7,093
PV system electricity production: 3,296 kWh/year
Electricity production supplied by system: 25%
Carbon dioxide emission reduction: 2,991 lbs per year
Internal rate of return: 6%
Net present value: -$1,487
Years to payback: 17.5

<table>
<thead>
<tr>
<th>SELECT...</th>
<th>NET COST YEAR 1</th>
<th>MONTHLY ELECTRIC BILL</th>
<th>DAILY PV PRODUCTION</th>
<th>DAILY ELECTRICITY USE</th>
<th>MONTHLY PV OUTPUT</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>NET CASH FLOW</td>
<td>CUM NET CASH FLOW</td>
<td>CUM DISC CASH FLOW</td>
<td>NET CASH FLOW DETAIL</td>
<td>POLLUTION PREVENTION</td>
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</tbody>
</table>

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Will PV Work for Me?

• 80-90 square feet of PV modules will produce approx. 1000 watts of power, so a 3 kilowatt array (3000 watts) will require about 270 square feet of area

• Each kilowatt of roof mounted PV (in most of NY State) will produce about 1,000-1,100 kWh per year

• Solar modules do not like high heat – proper installation to provide maximum cooling is very important!

• Solar modules love the cold – at -40 F the voltage can be up to 25% higher than rated

Slide courtesy of Four Winds Renewable Energy LLC

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Why Should I Participate in NYSERDA’s Program?

MORE THAN JUST A GRANT!

• NYSERDA reviews system design, incentive applications, customer purchase agreement
• Includes easy-to-read digital meter to monitor system performance
• Systems monitored for energy production twice/year for two years
• Installers will inspect system if it’s not operating at specified performance goals
• Full five-year parts and labor warranty
NYSERDA-funded PV Systems

PV Systems by County

Color Scale:
- Red: 295
- Orange: 236
- Yellow: 177
- Green: 119
- Blue: 60
- Dark Blue: 1
NYSERDA PV Program Status

Program Summary

<table>
<thead>
<tr>
<th>Total Costs</th>
<th>Cost</th>
<th>Sector</th>
<th>Systems</th>
<th>Utility</th>
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</thead>
<tbody>
<tr>
<td>$400M</td>
<td>57%</td>
<td>14505 kW-DC</td>
<td>9 Technical</td>
<td>National Grid</td>
</tr>
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<td>$350M</td>
<td>Consumer Investment</td>
<td>5391 kW-DC Gov't/Non-profit</td>
<td>3245 Installation Complete</td>
<td>NYSEG</td>
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<tr>
<td>$300M</td>
<td>15526 kW-DC Commercial/Industrial</td>
<td>309 Approved for Installation</td>
<td>ConEd</td>
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<td>$250M</td>
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<td>Central Hudson</td>
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<td>$150M</td>
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<td>$0M</td>
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</tbody>
</table>
Other Ways to Defray Cost of PV

Federal Renewable Energy Tax Credit

- Credit of 30% of qualified expenditures with no maximum
- Does not have to be installed at the taxpayer’s primary residence
- Expenditures are treated as made when the installation is completed – if installation is on a new home, the "placed in service" date is the date of occupancy by the homeowner
- Expenditures include labor costs for installation
- Systems must be placed in service before December 31, 2016
- If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year
Other Ways to Defray Cost of PV

**NY State Residential Solar Tax Credit**
- Credit is equal to **25% of expenditures up to $5,000**
- Maximum system size is 10kW (50kW for condo associations).
- Excess credit may be carried forward five years
- Electricity generation systems must be grid connected and net metered

**NY State Residential Solar Sales Tax Exemption**
- 100% exemption from state sales tax
- Local governments may also grant an exemption from local sales taxes

**NY State Residential Solar Property Tax Exemption**
- 15-year real property tax exemption for solar energy systems
- Exemption is valid unless a government opts out of the exemption

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Things to Remember

• Must be grid-connected to receive NYSERDA incentive
• Battery backup adds to the cost
• Larger systems cost less/watt
• Roof mounts are less expensive than ground-mounts
• Some contractors are less expensive than others
• Some contractors are better qualified than others
RPS Policies with Solar/DG Provisions

www.dsireusa.org / March 2012

- WA: double credit for DG
- OR: 20 MW solar PV x 2020; double credit for PV
- NV: 1.5% solar x 2025; 2.4 - 2.45 multiplier for PV
- CO: 3.0% DG x 2020; 1.5% customer-sited x 2020
- UT: 2.4 multiplier for solar-electric
- AZ: 4.5% DG x 2025
- NM: 4% solar-electric x 2020; 0.6% DG x 2020
- TX: double credit for non-wind (non-wind goal: 500 MW)
- MI: triple credit for solar-electric
- OH: 0.5% solar-electric x 2025
- IL: 1.5% PV x 2025; 0.25% DG by 2025
- WV: various multipliers
- NH: 0.3% solar-electric x 2014
- MA: 400 MW PV x 2020
- NY: 0.4092% customer-sited x 2015
- NJ: 5,316 GWh solar-electric x 2026
- PA: 0.5% PV x 2021
- DE: 3.5% PV x 2026; triple credit for PV
- MD: 2% solar x 2022
- DC: 2.5% solar x 2023

16 states + DC have an RPS with solar/DG provisions

- Solar water heating counts toward solar/DG provision
- Delaware allows certain fuel cell systems to qualify for the PV carve-out
State Tax Credits for Solar

22 states offer tax credits for solar projects

- Incentives for Residential Projects
- Incentives for Commercial Projects
- Incentives for Residential and Commercial Projects
- Applies to Solar Electric only
State Property Tax Incentives for Solar

www.dsireusa.org / February 2012

- Property Tax Incentive
- Local Option for Property Tax Incentive
- State Property Tax Incentive and Local Option for Property Tax Incentive

31 states + PR offer property tax incentives for solar projects

- Applies to Solar Water/Space Heating Only
- Applies to Solar Electric Only
Financial Incentives for Solar PV

www.dsireusa.org / February 2012

46 states + DC, PR & USVI offer financial incentives for solar PV
Third Party Solar PPAs

- Authorized by state or otherwise currently in use, at least in certain jurisdictions within the state
- Apparently disallowed by state or otherwise restricted by legal barriers
- Status unclear or unknown

Note: This map is intended to serve as an unofficial guide; it does not constitute legal advice. Seek qualified legal expertise before making binding financial decisions related to a 3rd-party PPA. See following slides for additional important information and authority references.
**Property Assessed Clean Energy (PACE)**

**www.dsireusa.org / February 2012**

- **PACE financing authorized by the state**
  - HI: Existing Authority

*The Federal Housing Financing Agency (FHFA) issued a statement in July 2010 concerning the senior lien status associated with most PACE programs. In response to the FHFA statement, most local PACE programs have been suspended until further clarification is provided.*

**28 states + DC authorize PACE (27 states have passed legislation and HI permits it based on existing law)**
Net Metering

43 states + DC & PR have adopted a net metering policy

State policy
Voluntary utility program(s) only

* State policy applies to certain utility types only (e.g., investor-owned utilities)

Note: Numbers indicate individual system capacity limit in kW. Some limits vary by customer type, technology and/or application. Other limits might also apply. This map generally does not address statutory changes until administrative rules have been adopted to implement such changes.
Interconnection Policies

43 States + DC & PR have adopted an interconnection policy

Notes: Numbers indicate system capacity limit in kW. Some state limits vary by customer type (e.g., residential/non-residential). “No limit” means that there is no stated maximum size for individual systems. Other limits may apply. Generally, state interconnection standards apply only to investor-owned utilities.
Solar Contractor Licensing Requirements

12 states + PR have solar contractor licensing requirements.
What is Wind Energy?

- Wind is moving air
- “Wind is recycled solar energy”
- Wind is the fuel for your generator
- Everyone will tell you they have a great site for a wind turbine
- Turbulence is a change in direction or speed
- Doubling the wind speed yields eight times the power!

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Turbulence is

Obstruction of the Wind by a Building or Tree of Height (H)

Region of highly turbulent flow

Your Partner for Energy Savings
Wind Speed vs. Height

• Taller is always better
  ▪ “More tower; more power”
• Wind speed increases with height
• Obstructions and ground drag decreases with height
• Turbulence decreases with height
• Less turbulence = less turbine wear
• Sound decreases with height
How Does Wind Work?
Utility-Scale vs. On-Site Wind Power

Relative Sizes of Wind Turbines - proportionally scaled

<table>
<thead>
<tr>
<th>Model</th>
<th>Rotor Diameter</th>
<th>Hub Height</th>
<th>Average Homes</th>
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</thead>
<tbody>
<tr>
<td>Jacobs 31-20</td>
<td>3.1 ft</td>
<td>120 ft</td>
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<tr>
<td>Vestas V15-65</td>
<td>49.22 ft</td>
<td>110 ft</td>
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<tr>
<td>Vestas V17-90</td>
<td>55.8 ft</td>
<td>140 ft</td>
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<tr>
<td>Vestas V47-660</td>
<td>154.2 ft</td>
<td>213.64 ft</td>
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</tr>
<tr>
<td>G. E. 1.5 MW</td>
<td>252.6 ft</td>
<td>262.5 ft</td>
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</tbody>
</table>
Why Small Wind Power?

- Personal decisions vs. public policies...

...speed & level of conversion

Your Partner for Energy Savings
Bergey Excel on a 100’ Tower

Your Partner for Energy Savings
NYSERDA-funded Wind Systems
NYSERDA’s Wind Incentive Program

• The program offers incentives for qualified equipment installed by eligible installers.

• The list of Eligible Installers and Qualified Turbines can be found at: http://www.nyserda.ny.gov

• No Paperwork for Customers

• NYSERDA has funding for a wind program until 2015

Your Partner for Energy Savings
Eligible Wind Turbines

• Only commercially available wind turbines with a proven record for power performance, reliability, safety, and acoustics will be considered for funding

• 26 turbines on NYSERDA’s list of Eligible Turbines

• List includes AWEA Capacity Rating (kW) and Size of Rotor (Ft)
  - kW rating does not indicate annual kWh performance

• Claims that a turbine will generate at 2 mph may be true, but it will be producing less than 1% of the power it will produce at 10 mph

• NYSERDA does not make any representations of any kind regarding the results to be achieved by the wind energy systems or the adequacy or safety of such measures

Your Partner for Energy Savings
Wind Incentive Program

- Incentive based on estimated on-site production based on NYS Small Wind Explorer
  - Annual wind speed from 8 mph to 10 mph doubles production.

- $3.50/ kWh up to 10,000 kWh
  - $1.00/kWh after the first 10,000, up to 125,000.
  - $.50/kWh over 125,000 kWh.

- Incentive cap of 50% of cost and $400,000

- Need local approval

- “Wind Energy and Cell Towers are part of our fabric now”
Customer Report  
Land Owner: NYSERDA  
Location: 17 Columbia Circle Albany, NY

Wind Energy Potential

- Very Poor
- Below Average
- Average
- Above Average
- High

Recommended Wind Resource and Annual Net Energy

<table>
<thead>
<tr>
<th>Wind Resource</th>
<th>Average Annual Wind Speed</th>
<th>Annual Net Energy</th>
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<tr>
<td>80 ft (24.4 m)</td>
<td>6.89 mph</td>
<td>100 kWh - 200 kWh</td>
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<tr>
<td>100 ft (30.5 m)</td>
<td>7.47 mph</td>
<td>100 kWh - 300 kWh</td>
</tr>
<tr>
<td>120 ft (36.6 m)</td>
<td>7.96 mph</td>
<td>100 kWh - 400 kWh</td>
</tr>
</tbody>
</table>

100ft Wind Resource Map

Wind Rose

NYSERDA's parking lot

Not a good location

Need professional report to determine incentive
How Do I Get Started?

• See if you have wind (NYS Small Wind Explorer)
  • http://nyswe.awstruepower.com/

• Ask if your community will allow you to install

• Contact multiple installers
Funded by the U.S. Department of Energy, the Database of State Incentives for Renewables & Efficiency is an ongoing project of the North Carolina Solar Center and the Interstate Renewable Energy Council.
Thank You for Your Attention

For Further Information Contact:
Chris Carrick
CNY Energy $mart Communities Coordinator
(315) 422-8276 ext. 213
ccarrick@cnyrpdb.org

Central New York Regional Planning & Development Board

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