



New Jersey's Clean Energy Program

Municipal Technical Training

Wind and Biopower Resource Assessment

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New Jersey Board of Public Utilities, Office of Clean Energy



Agenda



- New Jersey's Profile
- Wind System Evaluation through Construction
- Wind Market Basics
- Wind EPBB Program
- Wind Turbine Information
- Wind Model Ordinance
- Wind Myth Busting
- Biomass Project Development
- Biomass Feedstocks and Technologies
- BioPower Technology issues
- Feedstock Aggregation
- CORE Program



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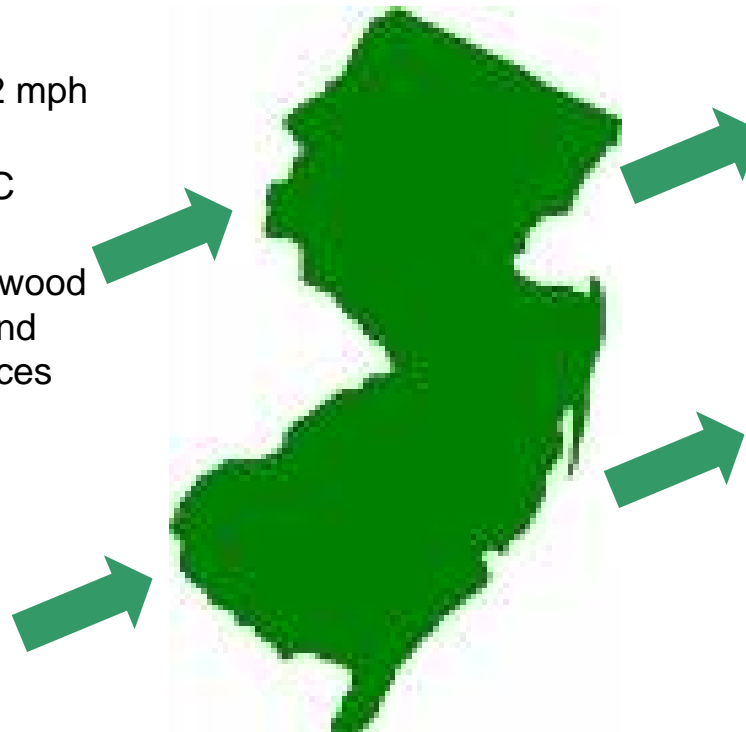
New Jersey Profile

Renewable Resources

- Wind:
 - Shore, highlands
 - Sustained winds of 12 mph
- Solar:
 - Output ~1200 kWh AC
- Biomass
 - Includes LFG, WWT, wood residue, food waste and aggregation of resources

Government Activism

- “20/20” RPS plan
- Energy Master Plan
- BPU commitment
- RGGI



Today

- 46.6 MW PV solar
 - 2950 installs,
- 3 MW Biomass
- 2.6 MW Wind
- 1.1 MW Fuel Cells

Tomorrow

- 1,500 MW Solar
- 1,000 MW Offshore Wind
- 200 MW Onshore Wind
- 900 MW Biomass



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Wind Project Development

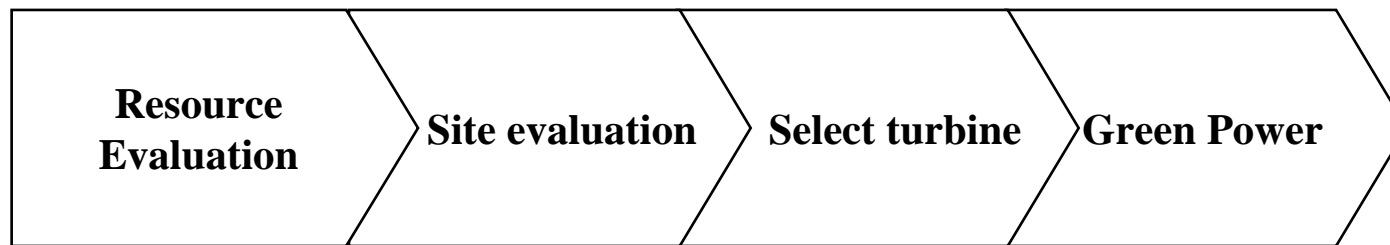


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Components of a Wind Generation System Evaluation



- Determination of average annual wind speed

- Location of turbine
- Verification of obstructions
- Site assessment or engineering evaluation
- Verify on-site electric consumption

- Select from approved turbines
- Submit request to evaluate new turbine type

- Off set onsite consumption
- Generate Renewable Energy Credits (REC)

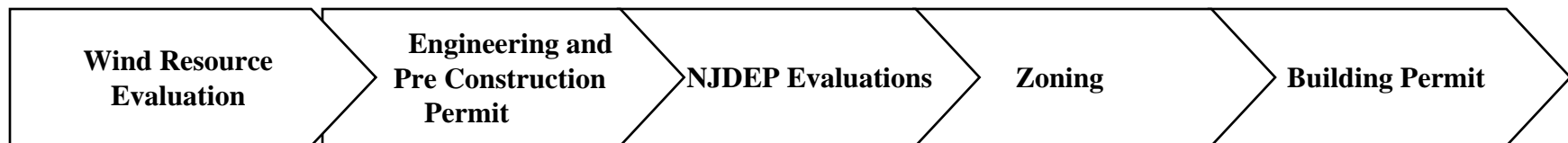


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Wind Generating Facility: Pre Construction and Permitting process



- Determine Wind Resource and direction
- Site specific evaluation (project owner)

- Engineering- design and seals required
- Equipment Selection
 - Turbine
 - Tower
 - Inverter
- Pre-Construction Permit (owner)
 - Site Evaluation
 - Facility
 - Equipment
- Turbines
 - Some turbines have up to a two year lead time

- Facility Pre-Construction Permit process (NJDEP CAFRA review if applicable)
- NJDEP is working to streamline the permitting process

- Engineering drawings
- Site Map
- Ownership
- NJDEP certifications
- Local Land Use Permit
 - Seals & Stamps
- Restrictions and variances

- Building Permit
- Electrical



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CORE Program - Wind Market

- The required wind resource (>11mph) is along the shore and highlands.
- Best example of installed project is at ACUA, similar interest building among at other coastal municipalities
- Small wind projects have run into home rule issues; First model ordinance adopted by Ocean Gate.
- \$5 million in 2008 funds set aside for wind (and biopower) projects; 2009 program plans are currently be developed with substantial increases in funding
- Rule changes required to support Group Net Metering and Community Wind
- CORE supports Behind the Meter (BTM) projects
- Offshore wind evaluation is underway (summary on NJCEP and NJDEP websites)



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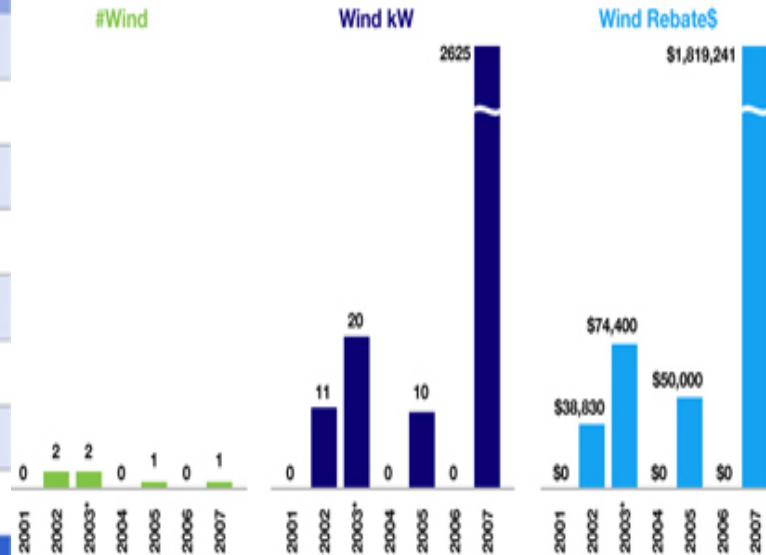


Wind Installed Projects

New Jersey Wind Installation Projects (CORE) (2001 - Aug. 31, 2007)			
	#Wind	Wind kW	Wind Rebate\$
2007	1	2,625	\$1,819,241
2006	0	0	\$0
2005	1	10	\$50,000
2004	0	0	\$0
2003	2	20	\$74,400
2002	2	11	\$38,830
2001	0	0	\$0
Total	6	2,666	\$1,982,471

2007: preliminary results as of 8/31/07.

**All New Jersey Wind Installation Projects (CORE)
(2001 - Aug. 31, 2007)**



*Total NJCEP + Utilities
CORE program managed by utilities 2001 through mid-2003
2007 includes Check Requests Pending Payment; preliminary results as of 8/31/07.

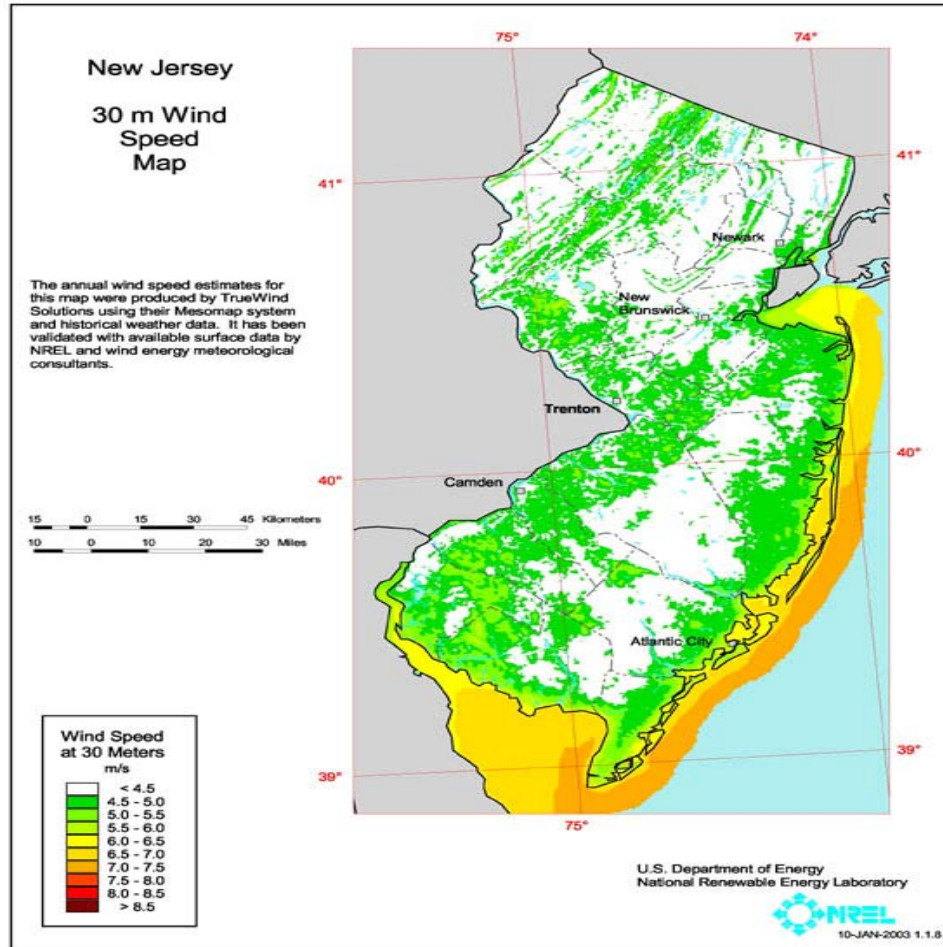


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New Jersey Wind Resources



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Class I Renewable Energy

Electric energy produced from:

- Solar technologies, photovoltaic technologies, **wind energy**, fuel cells powered by renewable fuels, geothermal technologies, wave or tidal action,
- and/or methane gas from landfills or a biomass facility, provided that the biomass is cultivated and harvested in a sustainable manner.
- Types of class I renewable energy that qualify for use in meeting the requirements of this subchapter are set forth at N.J.A.C. 14:8-2.5.



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CORE Program - EPBB

- Wind Program Incentive is calculated based upon Expected Performance Based Buy-down (EPBB).
 - Expected performance based on output
 - Specific turbine
 - Specific site
- How does the EPBB work?
 - Performance calculator calculates output for a given location
 - Input parameters
 - Wind speed at 50m
 - System hub height
 - Turbine power curve
- The EPBB is designed to produce higher rebates for project which maximize power production
- More closely calibrates with goals defined in the Renewable Portfolio Standard (RPS) and the Energy Master Plan (EMP).



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CORE Program - EPBB

- EPBB Incentive levels

Annual Estimated Production	Incentive Level
1-16,000 kWh	\$3.20 / Annual kWh
16,000-750,000 kWh	\$0.50 / Annual kWh

- This is different than the previous wind incentive level which was calculated on the capacity of the system.
- Factors included in calculating annual input
 - Location specific wind speed
 - Hub Height
 - Obstructions within 500 feet



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CORE Program - EPBB

- Obtaining locals average annual wind speed
 - Wind maps for no charge are available at:
 - <http://firstlook.3tiergroup.com/>
 - <http://www.awstruewind.com/maps/united-states.cfm/region/46688>
 - <http://eosweb.larc.nasa.gov>
- Additionally a wind resource site assessment may be performed even though the average wind speed can be determined from the wind maps
- Site assessments are performed by;
 1. Certified site assessor evaluates topography and site characteristics to give a more accurate evaluation
 2. Engineering firm performs detailed site assessments including wind speed analysis based on anemometer readings



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CORE Program - EPBB

- Wind turbine equipment currently accepted by the program:
 - ARE
 - PGE
 - Vestas
 - Bergey
 - Proven
 - Whisper
 - Endurance
 - Scirocco
 - Entegritty
 - SWWP
 - Jake
 - Ventera
- If a wind turbine is not presently accepted by the program the following information must be provided
 - Power curve based on one year of actual energy production data
 - Engineering certification form the manufacturer based on the power curve from an independent third party
- To apply to the program applicant must complete a pre-application for guidance purposes

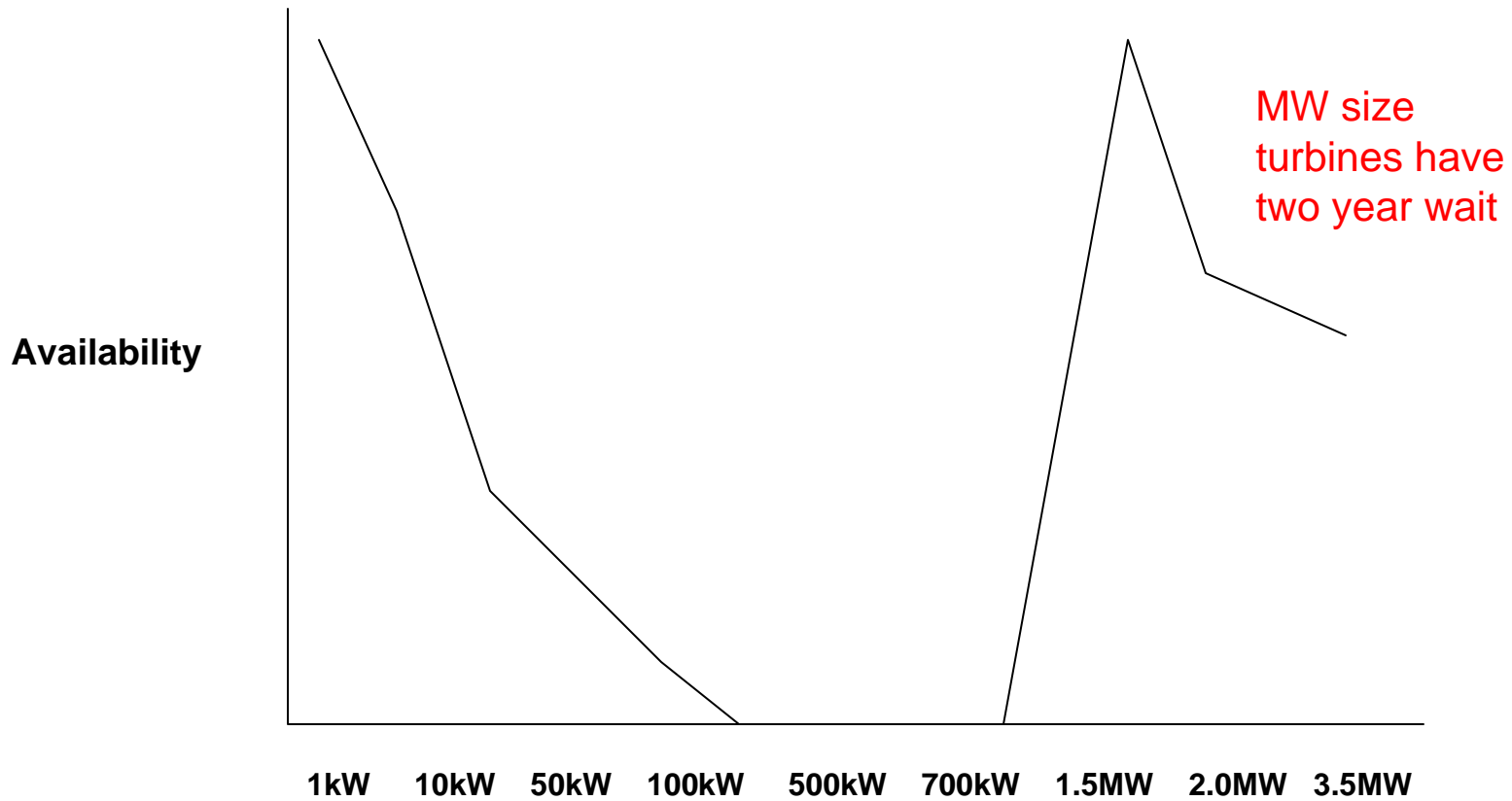


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Turbine availability vs. turbine size

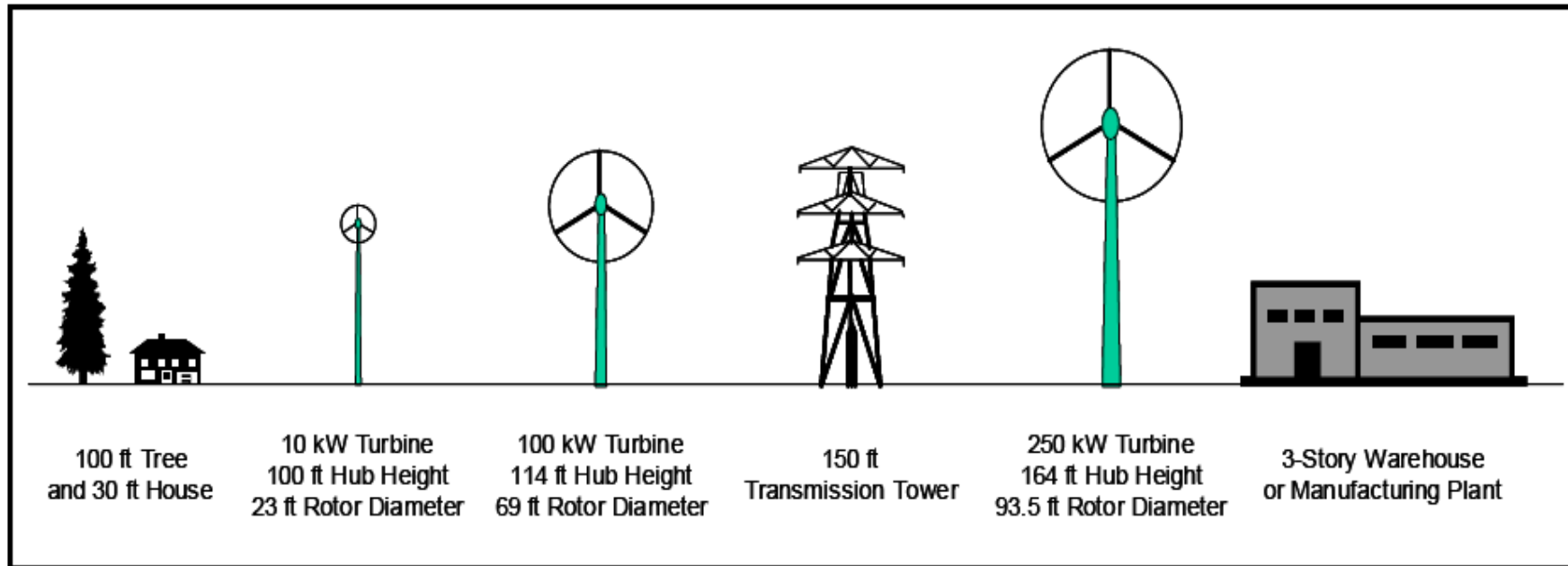


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Small Wind Turbine Height Comparison



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Model Ordinance

- **The Model ordinance passed by Ocean Gate was designed to allow the development of wind projects in their community.**
- **It acknowledges the NJ BPU Renewable Portfolio Standard**
- **Their current zoning regulations to not inhibit the installation of wind projects there were unintentional barriers to developing wind projects**
- **The Model Ordinance standardizes and streamlines the requirements for permitting wind turbine projects**
- **The ordinance is designed to preserve and protect public health and safety without significantly increasing the cost or decreasing the efficiency of a wind project.**
- **The ordinance addresses the following issues:**
 - **Standards**
 - **Setbacks**
 - **Access**
 - **Permit requirements**
 - **Abandonment**
 - **Administration and enforcement**



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Small Scale Wind Myth Busters

- Wind turbines kill birds, bats and butterflies
- Wind turbines are noisy
- The towers are prone to falling over
- Turbines interfere with TV and Radio reception
- Wind turbines hurt property values
- Turbines may throw blades or ice from the blades
- Wind power is expensive and inefficient
- Wind turbines only operate a small percentage of the time



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BioPower Project Development

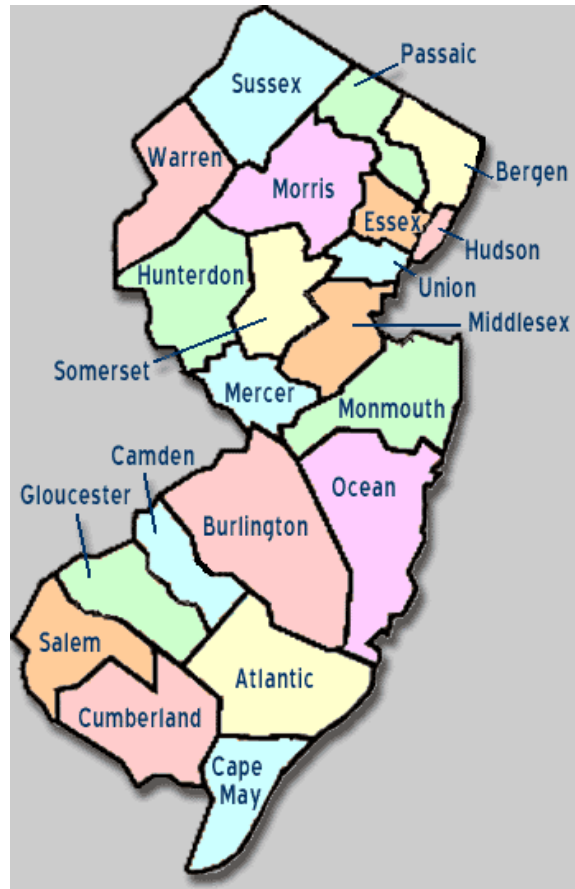


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Municipal Resource Assessment



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Class I and II Renewable Energy

Class I Renewable Energy produced from:

- Solar technologies, photovoltaic technologies, wind energy, fuel cells powered by renewable fuels, geothermal technologies, wave or tidal action,
- **and/or methane gas from landfills or a biomass facility, provided that the biomass is cultivated and harvested in a sustainable manner.**

Class II Renewable Energy produced from:

- a resource recovery facility or hydropower facility,
- provided that such facility is located where retail competition is permitted and provided further that the Commissioner of Environmental Protection has determined that such facility meets the highest environmental standards and minimizes any impacts to the environment and local communities



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Components of a Biomass Generation System



- Determination of Sustainability

- Anaerobic Digestion
- Direct Combustion
- Fermentation
- Thermochemical Conversion
- Pyrolysis

- Generation to Electricity

- Off set onsite consumption
- Generate Renewable Energy Credits (REC)

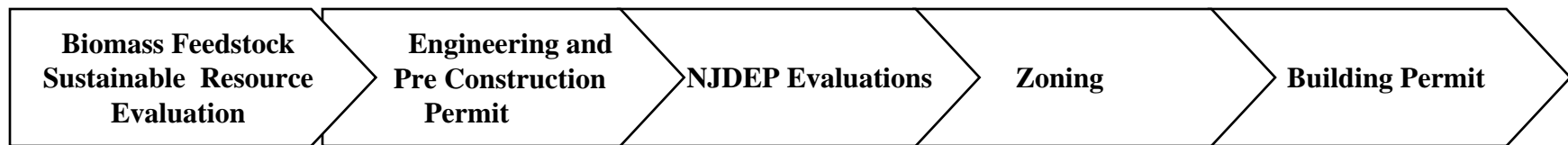


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Biomass Generating Facility: Pre Construction and Permitting process



- Determine Biomass Resource
- Biomass Sustainability Determination (project owner)
- Potential of feedstock aggregation

- Engineering- design and seals required
- Equipment Selection
 - Conversion
 - Generation
 - Control
- Pre-Construction Permit (owner)
 - Site Evaluation
 - Facility
 - Equipment

- Facility Pre-Construction Permit process (NJDEP review)
- Technology Evaluation
 - Biomass Generating Technology Determination
 - Biomass Sustainability Determination
 - Control Equipment Certification
 - Ash Management NPDES

- Engineering drawings
- Site Map
- Ownership
- NJDEP certifications
- Local Land Use Permit
 - Seals & Stamps

- Building Permit
- Electrical



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Waste Resource Summary

Feedstock	Source
Forestry Residues	Thinning, logging Fire mitigation practices ~4250Btu/lb (Dry weight)
Primary / Secondary Wood Products	Sawmills, Pulp & Paper mills, chips, sawdust, shavings and bark ~5000 Btu/lb (Dry weight) Pallets, furniture, truss, etc ~5000 Btu/lb (Dry weight)
Waste Water Treatment	Conversion of Biosolids by Anaerobic Digestion or Gasification and methane harvesting for CHP applications 600Btu/lb (Dry weight)
Agriculture Residue	By Product of crop growth In-field residues: corn stover, wheat straw Mill residues: bagasse, rice hulls, oat hulls
Food Waste	Kitchens, Restaurants, Residential, Commercial, Processing Plants 8000Btu/lb (Dry weight)
Energy Crops	Switchgrass, Banagrass, E grass, poplar, willow, hybrids



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BioPower Technologies

- BioPower Technology depends on feedstock
- Feedstock types have different characteristics that may only be compatible for specific technologies
- Not all technologies are cost effective for the feedstock
- Local Zoning and Permitting may be a challenge for certain applications
- Most technologies are cost effective for their application
- Using with Combined Heat and Power (CHP) makes it even more cost effective



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BioPower Technologies

Feedstock	Technologies	Primary Challenges	Fuel costs
			Delivery costs
Forestry Residues	Direct combustion	Aggregation, permitting	\$20 - \$40 / DT
	Gasification	Aggregation, permitting	\$28 - \$46 / DT
Primary / Secondary Wood Products	Direct combustion	Permitting, equip costs	\$2 - \$25 / DT
	Gasification	Permitting, equip costs	\$8 - \$50 / DT
Waste Water Treatment	Anaerobic digestion	Permitting, equip costs	\$0 / DT
	Gasification	Permitting, equip costs	\$0 / DT, but there are still hauling costs
Agriculture Residue	Direct combustion	Aggregation, permitting	\$30 – \$40 / DT
	Gasification	Aggregation, permitting	\$36 - \$45 / DT
Food Waste	Anaerobic digestion	Aggregation, permitting	Cost varies widely
	Gasification	Aggregation, permitting	No consistent data
Energy Crops	Direct combustion	Permitting, equip costs	\$50 - \$75 / DT
	Gasification	Permitting, equip costs	\$56 - \$80 / DT





BioPower Facility Costs

Technology	Capital Cost \$/kW		Fixed O & M \$/kW	Variable O & M \$/MWh
	Low	High		
Direct Fired Biomass	2,250	3,260	70	10
Biomass IGCC	2,500	4,000	70	15
Anaerobic digestion	2,300	3,800	N/A	15
Landfill gas	1,300	2,700	140	40
Refuse Derived Fuel	5,000	7,000	180	30



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Technology Issues

- Resource Sustainability is the foundation upon which biopower industry project development are structured.
- The 1.3 Billion tons/year of biomass is not driven by economics as much as it is driven by what is doable.
- **Fuel Characteristics Drive Technology Selection**
 - Moisture Content
 - Ash Characteristics
 - Ash Content
 - Sulfur & Nitrogen Content
 - Contaminants (chlorides, VOC's Heavy Metals)
 - Particle sizing and processing requirements
 - Availability and transportation requirements



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Feedstock Aggregation

- Not all projects have sufficient on-site feedstock or may be limited in project development due to zoning issues
- Similar feedstock may be aggregated to provide sufficient input to a specific technology to make the economics work
- Determine what is current cost of disposal vs. aggregation
- Distance increases costs.
- Mile radius limits size of facility.
- Transportation limits and supply are limiting factors.
- Present challenges to economics.



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Customer On-site Renewable Energy (CORE) Program

The CORE program supports a variety of technologies such as photovoltaic (solar electricity), small wind, and sustainable biomass equipment.

- On-site behind the meter. Net metered to 2 MW.
- Rebates will be capped on system size possibly with different caps for different technologies
- Renewable Energy Certificates are available for Class I RE technologies.
- Incentives are currently paid on sliding tier based on size of the system being installed and can be used to defray installation, equipment and interconnection costs.
- There are also private alternative tax advantage financing programs available

CORE program information is available on the web at: www.njcleanenergy.com .



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If you have any questions about renewable energy or New Jersey's Clean Energy Programs, please feel free to contact:

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