Wind Interconnection and Net-Metering in MA

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NSTAR ELECTRIC

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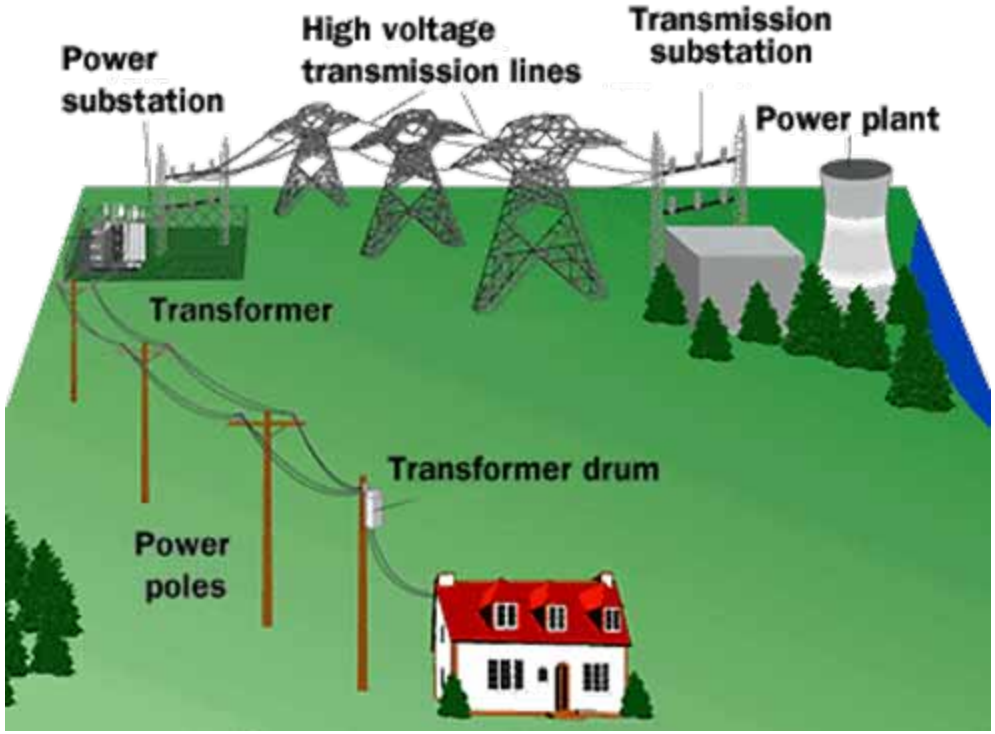
Electric Transmission and Distribution System

- The Electric Power System (EPS) is designed to safely and reliably move high quality power from source to load.
- Distributed Generation (DG) can be interconnected to the transmission and distribution system

- DG must be designed & interconnected so there is no adverse affect on:
  - Safety
  - Reliability
  - Power quality



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Governing Regulations and Bodies

- State jurisdiction vs. FERC jurisdiction
  - Will your system impact the bulk power system (transmission)?
  - Will you sell to the market or will you sell to the host utility as a QF or under net metering?
  - Are you the “first on” the distribution feeder?
- ISO-NE Schedule 22 and Schedule 23: If you will be connecting to the transmission system, or if you will sell to the market on an existing “FERC jurisdictional” feeder.
  - Independent System Operator New England administers
  - Significant application fee and queueing

Governing Regulations and Bodies

- Distribution Level interconnection tariffs: Connection to a distribution feeder under "State Jurisdiction"
  - Local Distribution Company administers
  - MA for investor owned utilities have a standardized process
  - See the following links for assistance
    - http://sites.google.com/site/massdgic/
    - http://masstech.org/cleanenergy/howto/interconnection/tariffs.htm

- Combination projects
  - Interconnect to transmission could be ISO jurisdictional
  - If customer does not have a right-of-way to the transmission system from their site
    - NGrid has used a separate Related Facilities Agreement (RFA) between the customer and NGrid Distribution for the facilities needed to interconnect wind farm to transmission

Where & How to connect to the EPS

- Generators may connect at various voltage levels based on:
  - Aggregate rating of generation system
  - Type of distribution system located nearby and characteristics of the system
- Interconnecting customer is responsible for costs of all studies and upgrades to Electric Power System
- Interconnection voltage levels:
  - Transmission – usually =>69 kV (bulk power)
  - Distribution – 13 kV, 23kV, 34 kV
  - Secondary voltages – 120/240 single phase, 120/208 three phase, 277/480 three phase

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Things to keep in mind

- Budget time and money for various interconnection studies
  - Applying through ISO-NE Schedule 22 / 23 – you will be placed in a queue
  - Applying to local utility
- Budget time and money for potential modifications needed for the utility's Electric Power System
- Require your equipment suppliers to provide accurate information about the generators to be installed
- You may need a specialized engineer for relay and protection
- Larger systems have more impact on the EPS
- Utilities want to help you interconnect (but)
- Utilities need all the proper information and time to evaluate and ensure no adverse impact on Safety, Reliability, or Power quality

Interconnection Process

- Simplified (UL1741.1 certified inverter) – up to 25 kWs three phase, 10 kWs single phase
- Expedited (UL1741.1 certified) – all systems that may have gotten certification
- Standard (not certified) - all others
- Application fee of $3/kW ($300 min to $2,500 max)
- Timelines begin only after we have a complete application
- Impact studies needed to review impact on distribution system
- Wind turbine fall zone review

Interconnection can be easy and inexpensive

- Scenario – installation of a 1.5 MW wind turbine
- Location: Closed landfill at the edge of a town.
- Local distribution system: Three-phase 23 KV distribution which runs down street near landfill.
- Modifications needed: New junction pole, primary metering pole and anchors, some protection modifications required – approximately $30,000.

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Interconnection can be difficult and expensive

- Scenario – installation of a 1.5 MW wind turbine
- Location: Closed landfill at the edge of a town.
- Local distribution system: Single phase 2.4 kV distribution line which runs down street near landfill. Nearest three-phase is half mile away and nearest system over 4 KV is at substation 2 miles away.
- Modifications needed: Install new substation transformer and controls, either double circuit 15 kV class dedicated feeder or re-conductor and convert area from 4 kV to 15 kV class – $500k to $1m or more.

600 KW Wind Turbine System connecting to radial 22.8 KV circuit

- Applied for interconnection July 2005
- Studies cost approximately $7.25K
- All studies completed November 13, 2005 (delays waiting for customer info)
- Agreement sent to customer February 9, 2006 (delays waiting for customer info)
- EPS modifications total ~$55K
- Went live on June 14, 2006

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1.5 MW Wind Turbine System connecting to radial 23 KV circuit

- Applied for interconnection Spring 2006
- Studies cost approximately $15K
- All studies completed Dec 2006 (delays waiting for customer info)
- Agreement sent to customer May 2007 EPS modifications total $100K
- Went live on late summer 2007

Large MW Scale Wind or Photovoltaic Systems Connecting to 13 KV distribution circuits

- **In other parts of the country, intermittent resources over 2 to 5 MWs typically have been required to interconnection at sub-transmission (23 kV and higher) or transmission voltages due to voltage regulation issues.**
- **National Grid has received applications totaling over 90 MWs of solar and wind at many locations. These range from 2 to 10 MWs – serious concern about connecting these resources to 13 kV distribution circuits. Cloud cover will cause voltage swings as solar output changes quickly. Quick changes in wind speed will cause same effect on voltage**
- **MA utilities are studying this effect – NGrid's 1.2 MW solar array at our central MA distribution center will have power quality monitoring in place to provide sub-second analysis.**
- **Projects beyond 2 MWs on a 13 kV feeder may require additional power quality review to ensure that power quality (voltage) will not be affected. Such concerns may result in requiring either additional energy storage equipment on site or dedicated circuits, which may have significant impact on the economic viability of a project.**

Google maps

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New MA net-metering regulations effective 12/1/09

Metered sales (kWh delivered to utility) and purchases (kWh delivered to customer) are "netted" over the billing month

- **Utility charges* apply for net monthly purchases (i.e., if metered purchases > metered sales)**
- **A net metering credit is provided for net monthly excess kWh (i.e., if metered sales > metered purchases)**

Net Metering Credit = Excess kWh x applicable tariff rates							
				Component of Service			
Class	Min	Max	Type	Default Service	Distribution	Transmission	Transition
1	0	60 kW	Agriculture, Wind, Solar	X	X	X	X
1	0	60 KW	All others	Average, loss-adjusted ISO-NE monthly clearing price			
2	> 60 KW	1,000 kW	Agriculture, Wind, Solar	X	X	X	X
3	>1,000 kW	2,000 kW	Agriculture, Wind, Solar	X	Municipal & Government only	X	X

*** Customer service charges and demand charges not impacted by monthly netting. Per kWh charges apply to metered purchases (i.e., without netting) for components of service not listed in table above.**

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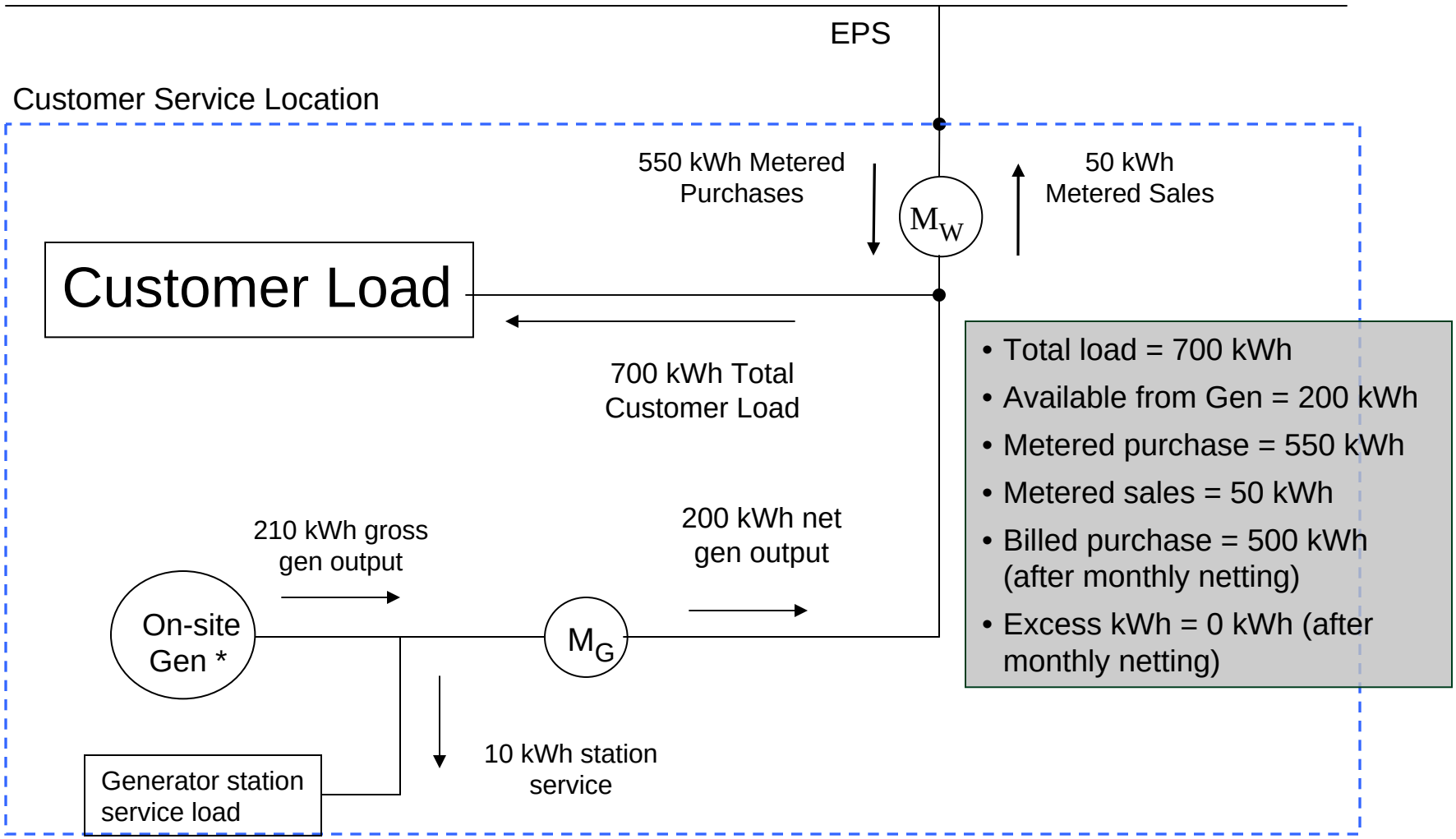
Net Metering Example 1: Monthly Purchases > Sales



* 2 kW Solar (PV) Generator

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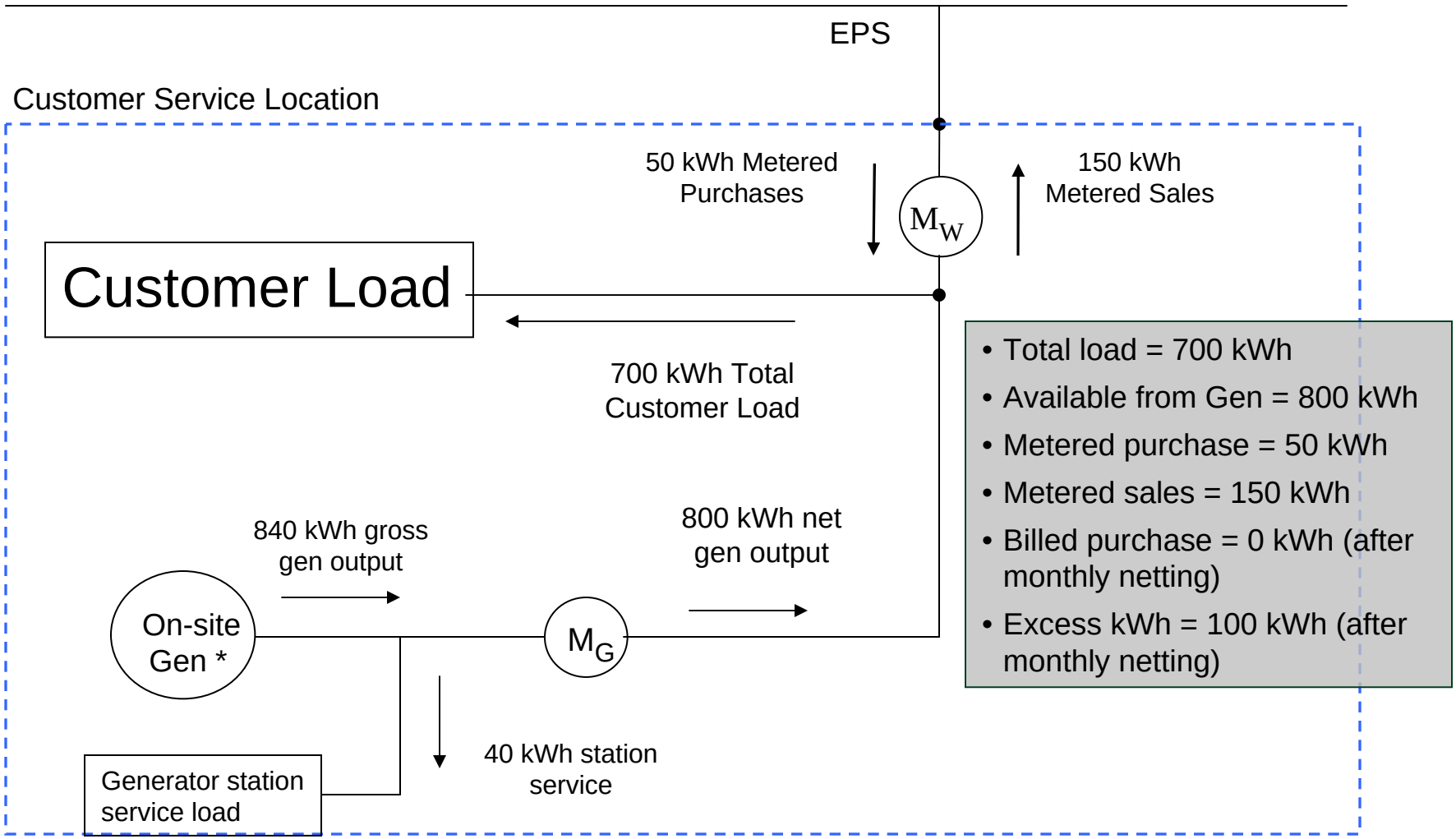
Net Metering Example 2: Monthly Sales > Purchases



* 8 kW Solar (PV) Generator

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Rate application for net-metered customers in MA

- For a behind the meter application, the customer's current imported usage will determine the proper rate to be used for retail billing and calculation of any net metering credit.

- For a stand-alone system with no customer loads except parasitic loads, the customer's usage on the import channel will determine the proper rate to be used for retail billing and calculation of any net metering credit.

  - E.g. a 1.5 MW wind turbine has monthly use of approximately 1,500 to 2,000 kWhs and 3-12 kWs of peak demand per month, so they would be put on the NG-MA's G-1 rate for both imported usage as well as to calculate credits

NG-MA net-metering credits per exported kWh

Credits per kWh effective 1/1/10 for National Grid-MA				
	Basic Svc	Credits for Class I	Credits for Class II	Credits for Class III
R1 rate (<600 kWhs)	$0.08827	$0.13340	N/A	N/A
RI rate (>600 kWhs)	$0.08827	$0.14015	N/A	N/A
G1 rate (<2,000 kWhs)	$0.08720	$0.13374	$0.13374	$0.11921
G1 rate (>2,000 kWhs)	$0.08720	$0.15197	$0.15197	$0.13744
G2 rate				
basic service - SEMA	$0.07690	$0.09367	$0.09367	$0.07959
basic service - WCEMA	$0.07809	$0.09486	$0.09486	$0.08078
basic service - NEMA	$0.07733	$0.09410	$0.09410	$0.08002
G3 rate				
basic service - SEMA	$0.07690	$0.09782	$0.09782	$0.08590
Offpeak 9pm to 8 am		$0.09008	$0.09008	$0.07816
basic service - WCEMA	$0.07809	$0.09901	$0.09901	$0.08709
Offpeak 9pm to 8 am	off peak	$0.09127	$0.09127	$0.07935
basic service - NEMA	$0.07733	$0.09825	$0.09825	$0.08633
Offpeak 9pm to 8 am	off peak	$0.09051	$0.09051	$0.07859
Note: For municipal or State accounts, Class III facilities are paid the same credits as Class II facilities				

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Net-metering in MA

- Allocation of net-metering credits
  - New regulations allow for customers to either carry forward cash value of net-metering credits on the retail account to offset future charges,
  - Or, can allocate/split the funds to as many other customers as they want within the same load zone by filling out schedule Z
    - Needless to say, utility billing issues are huge, will need to manually transfer credits for some time
  - All customers requesting net-metering service must fill out Schedule Z
    - Try to include it with interconnection application

1% limit of peak load for net-metering in MA

- National Grid: https://www.nationalgridus.com/masselectric/business/energyeff/4_net-mtr.asp
  - National Grid had a historical peak load of 5,067 MWs (8/6/06), making the 1% limit 50.67 MWs. As of March 2010, there are 10.2 MWs with net-metering service. There are 19.3 MWs with net metering applications in the process of being interconnected.

- NStar: http://nstar.com/business/interconnections/other.asp
  - Highest Historical Peak Load: 4,958 megawatts (8/6/06), Net Metering Cap: 49.58 megawatts. Net Metering Totals (Through the end of March 2010); Projects Online: 11 megawatts; Projects with Applications Submitted: 26 megawatts

- WMECo: http://www.wmeco.com/residential/understandbill/ratesrules/NetMetering.aspx
  - The highest historical peak load at WMECO is 845 MW (8/6/06). Cap is 8.45 MW. As of April 1, 2010, the aggregate capacity of all installed Class 1, 2 and 3 facilities is 2.4 MW. Additionally, the aggregate capacity of Class 1, 2 and 3 facilities pending interconnection is 0.1 MW.

- Unitil: http://services.unitil.com/mass/net_metering.asp
  - Historical Peak Load: 102 MW (7/27/05)
    Net Metering Cap: 1.02 MW
    Net Metering Online as of 3/10: 0.24 MW;
    Applications Pending: 0.05 MW

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Questions

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