

Microgrids Why now Back to the Future

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Definition of DER or DG

Distributed energy resources consists of a range of smaller-scale and modular generation and storage devices designed to provide electricity, and sometimes also thermal energy, in locations close to consumers or end user.

Definition of Microgrid

A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

Types of DER

Solar Photovoltaic Wind Turbines **Engine Generator Sets Turbine Generator Sets Fuel Cells Batteries** Capacitors **Flywheels Thermal Storage Ice Storage Solar Thermal**



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Microgrid Classification - DOE

Level 1 or single customer microgrid.

This is a single DER system such as a PV system, combined heat and power (CHP) or fuel cell system that is serving one customer and that is connected to and can island from the distribution grid.

Level 2 or single customer – campus setting.

This is a single or multiple DER systems with multiple buildings, but controlled by one meter at the point of common coupling that is connected to and can island from the distribution grid.

Level 3 or multiple customers / advanced microgrid.

This is a single or multiple DER system that serves several different buildings/customers that are not on the same meter or on the same site as the DER. An advanced microgrid would be designed with one point of common coupling (PCC). The individual buildings/customers may be independently connected to the larger distribution grid and through the microgrid PCC..

N.J.S.A. 48:3-51 - Definitions

Off-site end use thermal energy services customer

On-site generation facility

N.J.S.A. 48:3-77.1

Utilization of locally franchised public utility electric distribution infrastructure.

New Jersey BPU DER Goals

Develop 1500 MW of Combined Heat and Power (CHP) and Distributed Generation (DG)

Increase the Use of Microgrid Technologies and Applications for Distributed Energy Resources (DER)

Create Long-Term Financing for Local Energy Resiliency Measures including Town Center DER microgrids Through an ERB and other financing mechanisms

The State should continue its work with the USDOE, the utilities, local and state governments and other strategic partners to identify, design and implement Town Center DER microgrids to power critical facilities and services across the State.

Improve and Enhance the EDC Smart Grid and Distribution Automation Plans

Current New Jersey	CHP/FC and DER facilities
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DER	Number	MW
CHP/FC total	219	2,900
CHP/DG DG	98	347
CHP/FC renewable	19	31
PV total	38,983	1,535
PV Behind the Meter	38,855	1,203
PV Grid Supply	128	332
TOTAL DER	39,100	1,913

Small scale CHP under the NJCEP

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Applicant	City	Facility Type	Year	Service	System	Operating Off
	· · · · · · · · · · · · · · · · · · ·	· · · ·	Applied	Territory	Size (kW)	the Grid 🖃
Ortho-Clinical Diagnostics, Inc.	Raritan		2005	PSF&G	1.500	No response
Raritan Valley Community College	Somerville	College/Univeristy	2005	JCP&L	1.425	Yes
Rowan University	Glassboro	College/University	2005	ACE	4.700	Yes
Browertown Associates Inc., TIA	Hackensack	Healthcare/Data	2005	PSE&G	140	No
Regent Care Center, Inc.	Hackensack	Healthcare/Home	2005	PSE&G	140	No
Salem Community College	Carney's Point	College/Univeristy	2006	ACE	130	Yes
Johnson Matthey	West Deptford	Pharmaceutical	2006	PSE&G	200	Yes
E.R. Squibb and Sons/BMS	New Brunswick	Pharmaceutical	2006	PSE&G	2,000	Yes
Christian Health Care Center	Wyckoff	Healthcare/Home	2006	PSE&G	230	Yes
KPMG LLP	Montvale	Office	2006	RECO	796	Yes
Princeton University	Princeton	College/Univeristy	2006	PSE&G	486	Yes
Ortho McNeil Pharmaceuticals	Raritan	Pharmaceutical	2007	PSE&G	3,000	Yes
Jersey Shore University Medical	Neptune	Hospital	2007	JCP&L	1,900	Yes
Infineum USA LP	Linden	Manufacturing	2007	PSE&G	275	Yes
Overlook Hospital	Summit	Hospital	2010	JCP&L	2,000	Yes
Ocean County College	Toms River	College/Univeristy	2010	JCP&L	1,100	Yes
St. Peter's College	Jersey City	College/Univeristy	2011	PSE&G	320	Yes
Newark Housing Authority	Newark	Multifamily	2011	PSE&G	75	No
Newark Housing Authority	Newark	Multifamily	2011	PSE&G	150	No
Newark Housing Authority	Newark	Multifamily	2011	PSE&G	150	No
Viking Yacht	New Gretna	Manufacturing	2012	ACE	390	No
Rider University	Lawrenceville	College/Univeristy	2012	PSE&G	1,100	Yes
Metro YMCAs of the Oranges	Wayne	Multipurpose	2012	PSE&G	150	No
Fellowship Village	Basking Ridge	Multifamily	2012	JCP&L	225	Yes
Douglas Electrical Components	Randolph	Manufacturing	2013	JCP&L	75	Yes
Masonic Charity Foundation of NJ	Burlington	Multifamily/Assisted	2013	PSE&G	800	No
Steve & Cookies By the Bay	Margate City	Restaurant	2013	ACE	20	Yes
Rose Garden Nursing & Rehab Center	Toms River	Multifamily/Assisted	2013	JCP&L	75	No
St. Peter's College - Student Center	Jersey City	College/Univeristy	2013	PSE&G	160	Yes
Riviera Towers Corp.	West New York	Multifamily	2013	PSE&G	400	Yes
Hallmark Investments LLC	Newark	Multifamily	2013	PSE&G	100	Yes
New Brunswick Board of Education - MS	New Brunswick	K-12	2014	PSE&G	75	Yes
New Brunswick Board of Education - CS	New Brunswick	K-12	2014	PSE&G	75	Yes
New Brunswick Board of Education - HS	New Brunswick	K-12	2014	PSE&G	100	Yes
Camden Tech School	City of Camden	K-12	2014	PSE&G	200	Yes
Green Hill, Inc	West Orange	Multifamily/Assisted	2014	PSE&G	75	No
Nicolas Market	North Haldon	Retail/Supermarket	2014	PSE&G	350	Yes
Shop Rite of Toms River	Toms River	Retail/Supermarket	2015	JCP&L	450	Yes
Shop Rite of Oakland	Oakland	Retail/Supermarket	2015	PSE&G	450	Yes
Shop Rite of Burlington	Burlington	Retail/Supermarket	2015	PSE&G	450	Yes
Total					26,437	

Renewable Energy CHP under NJCEP

Applicant	City	Facility Type	Year Applied	Service Territory	System Size (kW)	Capable of Operating Off the Grid
REX LUMBER	Manalapan	Millworks	2001	JCP&L	150	No
NJ ECO COMPLEX/RUTGERS	Florence	Research & Development	2002	PSE&G	120	No
SOUTH MONMOUTH REGIONAL SA	Belmar	Sewage Treatment Plant	2002	JCP&L	30	
ALUMINUM SHAPES	Pennsauken	Manufacturing	2003	PSE&G	1,850	
JOINT MEETING OF ESSEX & UNION COUNTIES	Elizabeth	Sewage Treatment Plant	2005	PSE&G	3,240	
ATLANTIC COUNTY UTILITIES AUTHORITY	Pleasantville	Landfill	2005	ACE	1,500	
WARREN COUNTY	Oxford	Landfill	2005	JCP&L	3,800	
OCEAN COUNTY	Woodbine	Landfill	2006	ACE	150	
CAPE MAY COUNTY MUA	Tinton Falls	Landfill	2006	JCP&L	1,000	
COUNTY OF MONMOUTH	Vineland	Sewage Treatment Plant	2006	Vineland	185	
LANDIS SEWERAGE AUTHORITY	Florence	Landfill	2008	PSE&G	7,150	
BURLINGTON COUNTY	Piscataway	Greenhouse	2008	PSE&G	250	
RUTGERS UNIVERSITY	Belmar	Sewage Treatment Plant	2009	JCP&L	280	
S. MONMOUTH REG. SA	Piscataway	College/Univeristy	2012	PSE&G	10	
RUTGERS UNIVERSITY DINING SERVICES	Ridgewood	Sewage Treatment Plant	2012	PSE&G	240	
VILLAGE OF RIDGEWOOD DPW	Livingston	Sewage Treatment Plant	2012	PSE&G	150	
LIVINGSTON TWP WATER POLLUTION CF	Manchester	landfill	2013	JCP&L	9,600	
BERGEN COUNTY UTILITIES AUTHORITY	Little Ferry	Sewage Treatment Plant	2014	PSE&G	1,400	
HANOVER SEWERAGE AUTHORITY	Hanover	Sewage Treatment Plant	2015	JCP&L	100	
Total					31,205	

ARRA Program CHP

Applicant	City	Facility Type	Year Applied	Service Territory	System Size (kW)	Capable of Operating Off the Grid
ACB Energy Partners LLC	Atlantic City	Hotel/Casino/Retail	2010	ACE	7,965	Yes
ACI Energy Partners LLC	Atlnatic City	Hotel/Casino/Retail	2010	ACE	7,965	Yes
DSM - Nutritional Products, Inc	White	Healthcare/Nutrition	2010	JCPL	9,500	No
RED-Burlington National Gypsum	Burlington	Manufacturing	2010	PSE&G	3,370	No
NRG Thermal LLC	Plainsboro	Energy	2010	PSE&G	4,600	Yes
Bristol Myers Squibb	Pennington	Pharmaceutical	2012	PSE&G	4,110	Yes
Monmouth Medical Center	Long Branch	Hospital	2012	PSE&G	3,000	no final design
New CMC Inc	Toms River	Hospital	2012	PSE&G	3,000	no final design
UMM - Energy Partners LLC	Little Fall	College/Univeristy	2012	PSE&G	5,670	Yes
Total					49,180	

Fuel Cells

Applicant	City	Facility Type	Year Applied	Service Territory	System Size (kW)	Capable of Operating Off the Grid
MERCK	Rahway	Pharmaceutical	2002	PSE&G	200	No
RICHARD STOCKTON COLLEGE	Pamona	College/Univeristy	2003	ACE	200	No
STARWOOD HOTELS AND RESORTS	Parsippany	Hotel	2003	JCP&L	250	No
OCEAN COUNTY COMMUNITY COLLEGE	Toms River	College/Univeristy	2004	JCP&L	250	No
THE COLLEGE OF NEW JERSEY	Ewing	College/Univeristy	2006	PSE&G	200	No
THE COLLEGE OF NEW JERSEY	Ewing	College/Univeristy	2006	PSE&G	200	No
THE COLLEGE OF NEW JERSEY	Ewing	College/Univeristy	2006	PSE&G	200	No
RENEWABLE ENERGY HOLDINGS, LLC	West Amwell	Residential	2008	JCP&L	5	No
Verizon	Basking Ridge	Office/Datacenter	2013	PSE&G	2,000	No
AT&T - Freehold	Freehold	Office/Datacenter	2014	JCP&L	600	No
AT&T - Middletown	Middletown	Office/Datacenter	2014	JCP&L	1,000	No
AT&T - Middletown Phase II	Middletown	Office/Datacenter	2014	JCP&L	1,000	No
Total					6,105	



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New Jersey Microgrids - Total 29

Level 1 or single customer microgrid --- 23

Level 2 or single customer – campus setting - 6

Level 3 or multiple customers / advanced microgrid. Proposed Hoboken New Jersey Transit Grid Potential

NJIT Town Center Mapping for 9 Sandy Designated counties - 24 Town Center MG in 17 municipalities





Poles down across the state – Grid down







- **1. East Coast Derecho July 2011**
- 2. Hurricane Irene August 2011
- 3. October snow storm October 30, 2011
- 4. Super Storm Sandy October 29, 2012
- 5. Northeaster November 7, 2012
- 6. East Coast Derecho June 2013
- 7. New Jersey wind storms June and July 2015

Total Storm Outage Report

Outage Event	# of Total Events	# of Cumulative Affected Customers	% of reported events	Mean size of customer outages
Wind/Rain	96	4,430,900	67.1	46,155
Winter Weather/Nor'easters	22	2,018,200	15.4	91,736
Ice Storm	5	95,500	3.5	19,100
Tornado	2	121,000	1.4	60,500
Lightning	9	175,800	6.3	19,533
Hurricane/Tropical Storm	9	5,768,500	6.3	640,944
Totals	143	12,609,900		

Database storm event totals and proportion of storm types/mean outages; from CEEEP Storm Events Database)

Major Storm Outage Reports

	# of Major Storms	# of Cumulative Affected Customers	% of Major events	Mean size of customer outages
Wind/Rain	13	2,623,000	48.2	201,76
Winter Weather/Nor'easters	8	1,636,000	29.6	204,50
Hurricane/Tropical Storm	6	5,718,500	22.2	953,08
Totals	27	9,977,500		

"Major" storms and their outages (by totals, proportion, and mean outages); from CEEEP Storm Events Database)

Energy Benefits of DER Combined Heat and Power



Energy Resilience Bank Policy

Comment 116 Submitted by Concord Engineering

To enable multi user applications the BPU should adopt rules that define the provision of emergency power as being exempt from utility franchise restrictions and allowing a direct wire connection from an onsite generator to nearby critical facilities. This would need to include appropriate safeguards similar to emergency generator transfer trip devices to prevent back feeding power onto utility lines which would be a safety hazard.

Response

The issues raised by this comment are beyond the scope of the ERB Guide and Product; further, the rules recommended by the commenter may be outside the authority granted to the Board. Staff will recommend that the Board direct staff to initiate a stakeholder process on issues related to the provision of emergency power, including power to critical facilities, and report back to the Board on whether statutory and/or regulatory changes are necessary and, if so, with recommended statutory and/or regulatory provisions.

Comment 71

EDCs believe more DER behind-the-meter based would lead to further EDC revenue erosion which will eventually need to be recovered from the EDC's remaining ratepayers.

Response

Under the proposal, these facilities will continue to pay capacity and standby charges and will therefore contribute to upkeep of the distribution system while reducing the need for additional investment in infrastructure that might otherwise be required to service this load. ERB Staff will monitor this issue on an ongoing basis.



The advance microgrid can provide benefits to the grid

- 1. Produces electric and thermal energy for its customers.
- 2. Provides ancillary services and reduce the peak demand of the grid.
- 3. Can defer related investment in distribution system upgrades.
- 4. Produces and delivers energy more efficiently.
- 5. Reduce outages which can enhance resiliency and reliability.

The advanced microgrid receives benefits from the distribution grid.

- 1. If not operating additional energy will need to be supplied by the grid.
- 2. Upgrades can be deferred but not fully avoided.
- 3. If not operating environment impacts may increase at peak times.
- 4. If not properly managed could reduce resiliency and reliability.

WHY NOW –states are moving on advanced microgrids Advances in Smart Grid

Distribution Automation or Smart Grid as defined by the National Institute of Standards and Testing (NIST) includes interconnecting DER and automated interface with the end user that allows for two-way communication between the Electric Distribution Company (EDC) and the customer that adds value to both.

As on July 2014 50,000,000 Smart Meters Installed 31 States greater than 15% fully deployed 17 State Greater than 50% fully deployed 27 Utilities fully deployed

Examples of the Generator – Transmission – Distribution systems



Princeton Micro-Grid Power Generation Dispatch To Optimize Savings – PJM Grid



Princeton CHP/District Cooling Reduces Peak Demand on Local Grid



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Why Advanced Microgrids Need Smart Grid

DER limiting factor - interconnected to the distribution system is the provision related to the 15% peak load screen

This means a 12 kV line has a current limit of 3 MW.

This is below the 20%

WHY NOW –states are moving on advanced microgrids

Because the Price is getting right

- Solar moving to \$1 per watt (\$10-\$12/w) Plus increased efficiency to 25% (12%) (15-20%)
- Micro-CHP moving to \$1 per watt (\$50-\$15-\$5)
- Battery Storage increase capacity 5X and lower cost 5X (\$1kW-\$3kW -- \$200-700/kwh)
- There are limits based on the current distribution grid capacity

Why Now –

The Price Getting Right

Distribution Automation/Smart Grid

It's a Wireless World

Types of MG Distributed Generation or Distributed Energy Resources

