



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



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.

Current New Jersey CHP/FC and DER facilities		
DER	Number	MW
CHP/FC total	219	2,900
CHP/DG DER	68	309
CHP/FC renewable	15	15
PV total	37,984	1,513
PV Behind the Meter	37,857	1,192
PV Grid Supply	127	321
TOTAL DER	38,067	1,837

TRC -BPU						
Applicant	City	Facility Type	Year Applied	Service Territory	System Size (kW)	Capable of Operating Off the Grid
Ortho-Clinical Diagnostics, Inc.	Raritan	Healthcare/Lab	2005	PSE&G	1,500	No response
Raritan Valley Community College	Somerville	College/Univeristy	2005	JCP&L	1,425	Yes
Rowan University	Glassboro	College/Univeristy	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
St. Peter's College	Jersey City	College/Univeristy	2011	PSE&G	360	Yes
Jersey Gardens Lodging LLP	Elizabeth	Hospitality	2012	PSE&G	300	Yes
Bristol Myers Squibb	Pennington	Pharmaceutical	2012	PSE&G	4,110	Yes
Monmouth Medical Center	Long Branch	Hospital	2012	PSE&G	3,000	
New CMC Inc	Toms River	Hospital	2012	PSE&G	3,000	
UMM - Energy Partners LLC	Little Fall	College/Univeristy	2012	PSE&G	5,670	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
Owens Corning Sales, LLC	Kearny	Manufacturing	2012	PSE&G	525	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	2014	PSE&G	100	Yes
Masonic Charity	Burlington	Multifamily /Assisted	2014	PSE&G	498	No
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	2015	PSE&G	200	Yes
Green Hill, Inc	West Orange	Multifamily/Assisted	2015	PSE&G	75	No
Nicolas Market	North Haldon	Retail/Supermarket	2015	PSE&G	350	Yes
Shop Rite of Toms River	Toms River	Retail/Supermarket	2015	JCP&L	450	Yes
Total					39,580	

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.

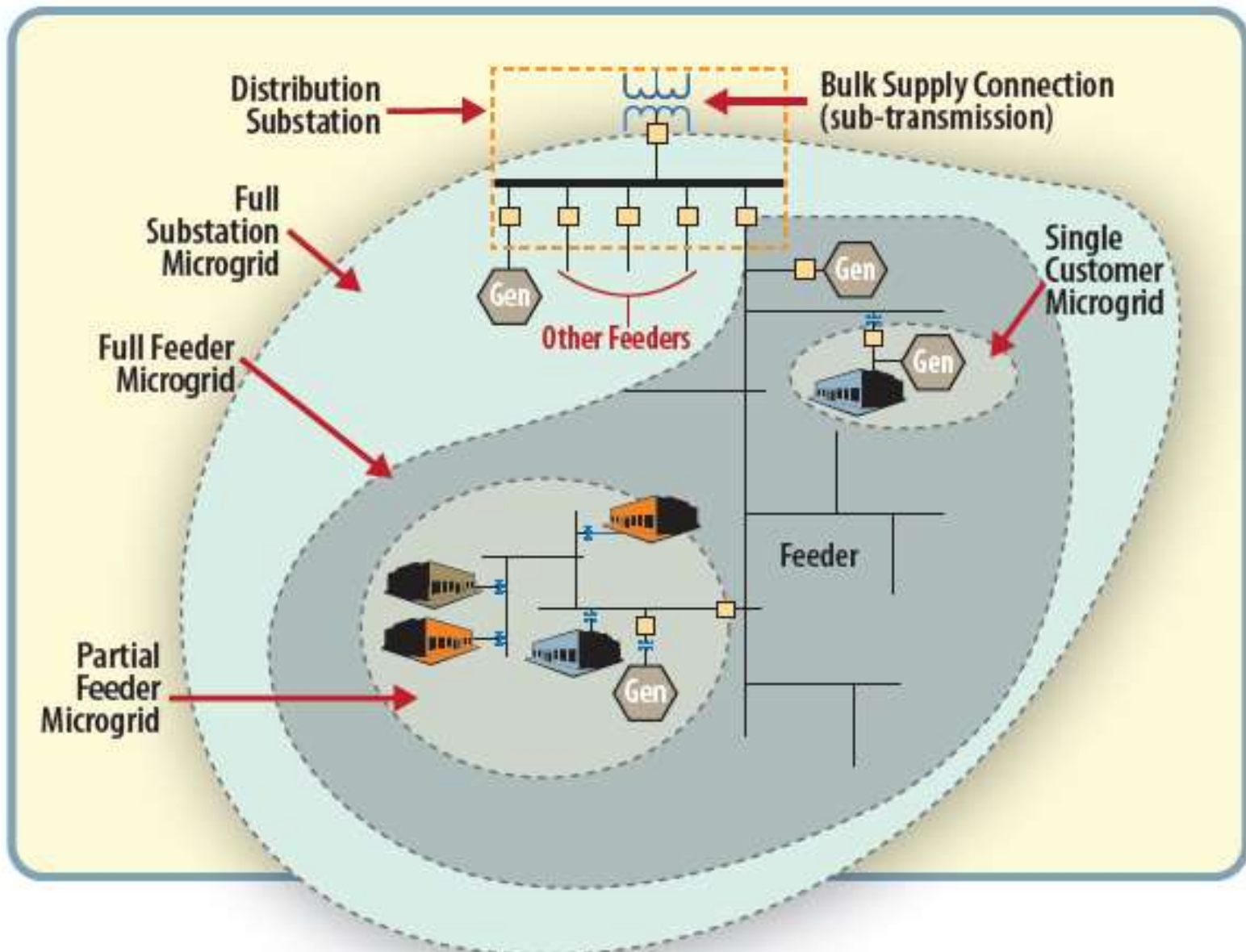
Proposed

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		

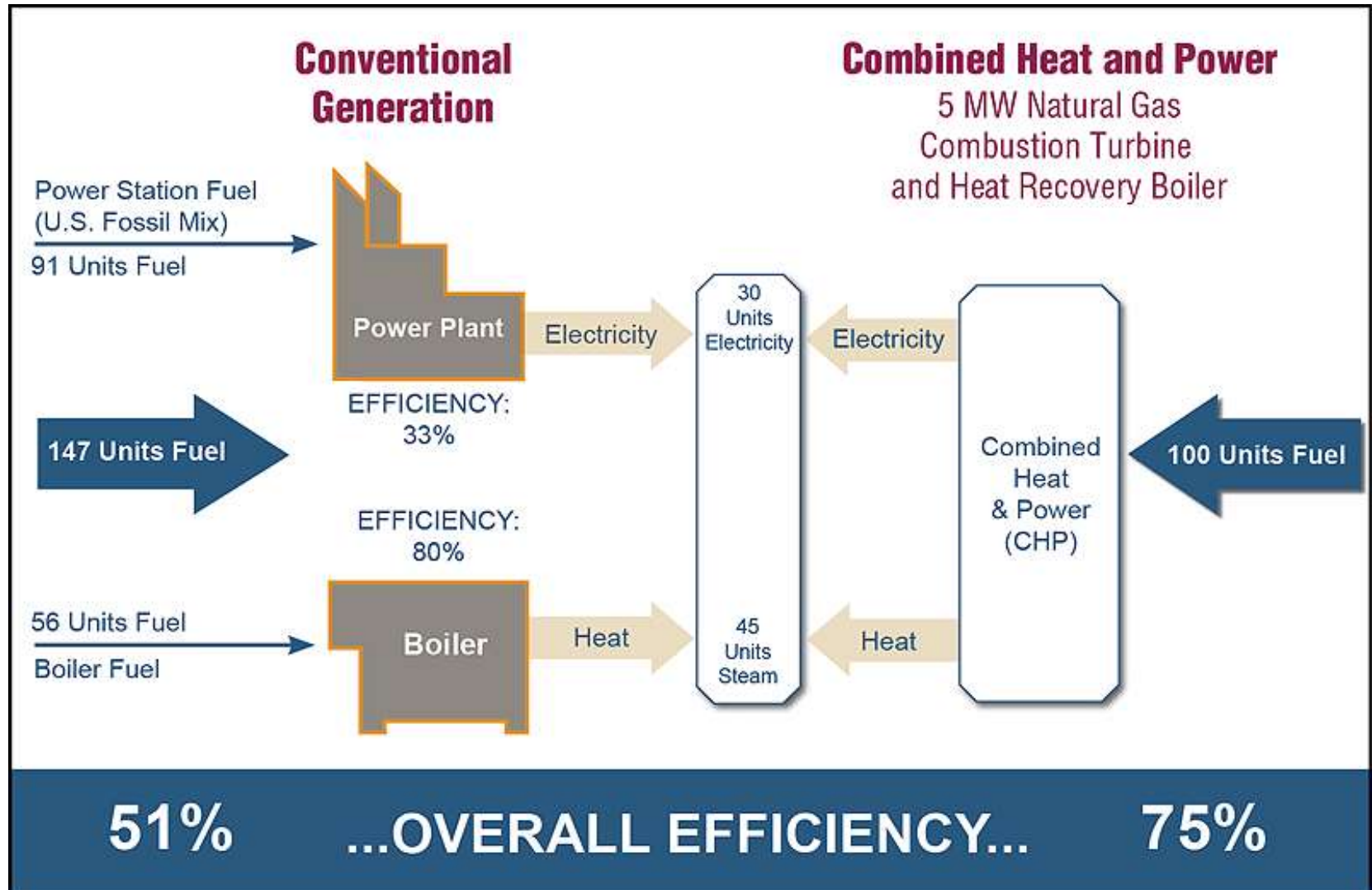
Database storm event totals and proportion of storm types/mean outages; from CEEEP Storm Events Database)

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



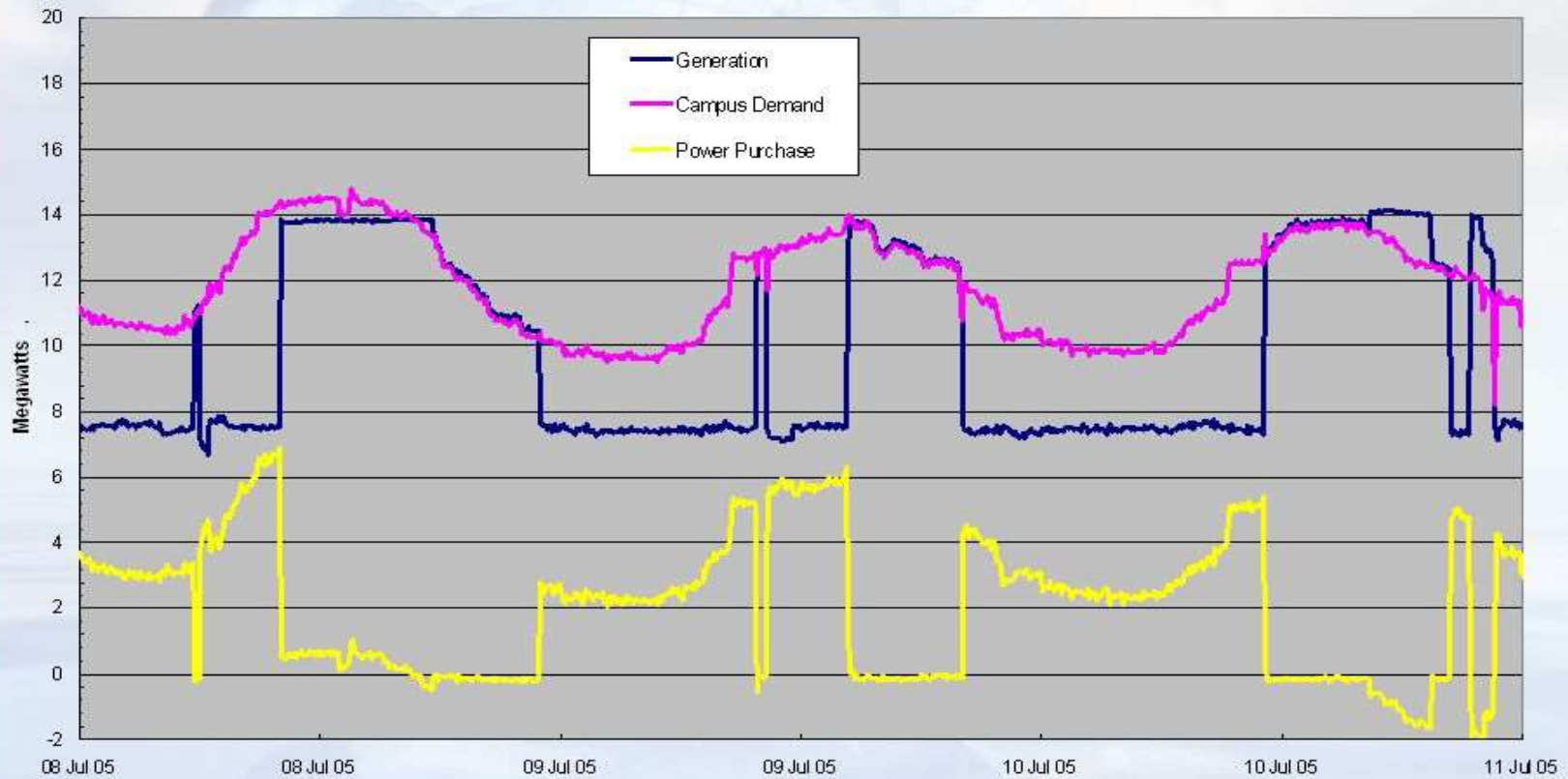
The advance microgrid can provide benefits to the grid

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.

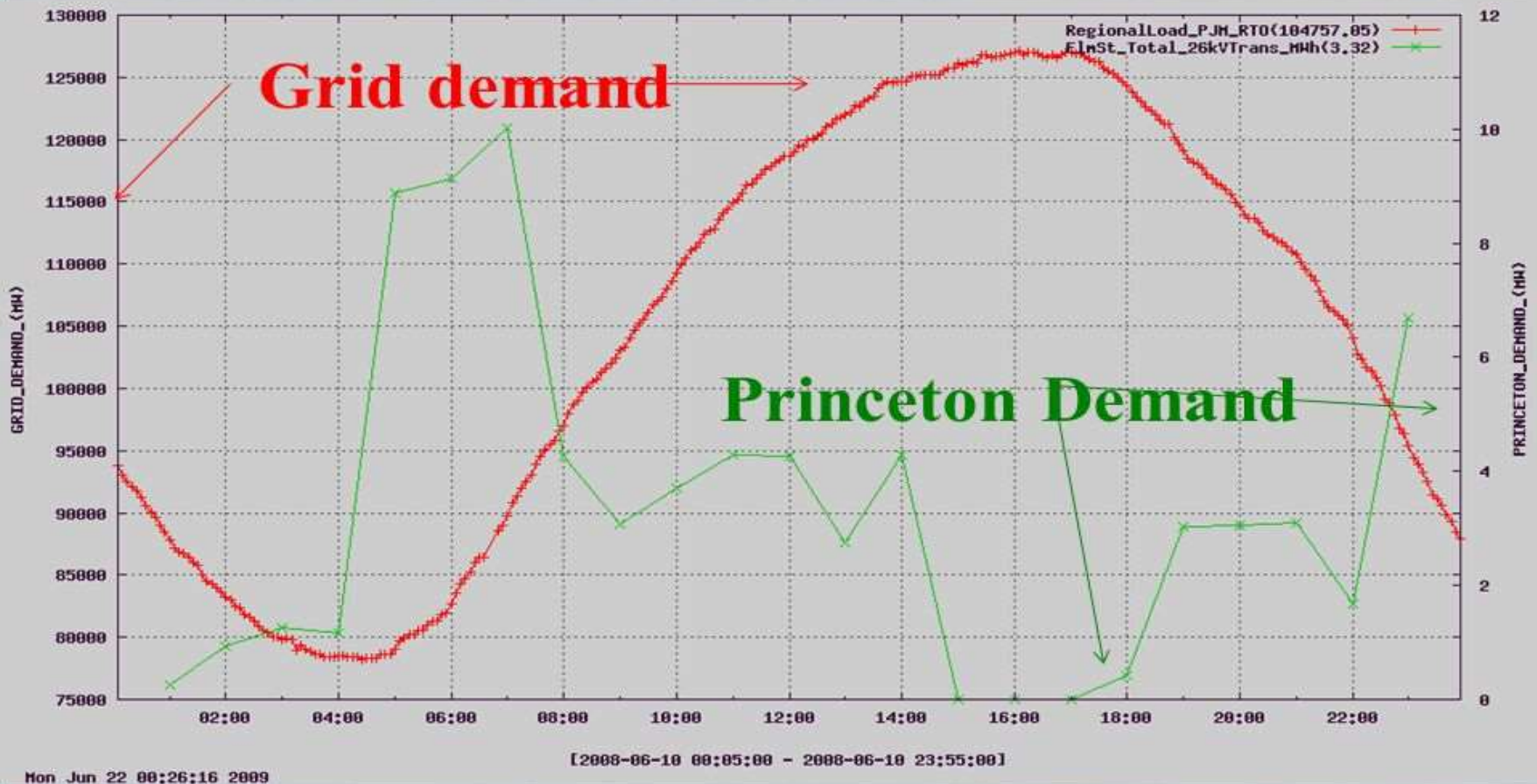
The advanced microgrid receives benefits from the distribution grid.

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.

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



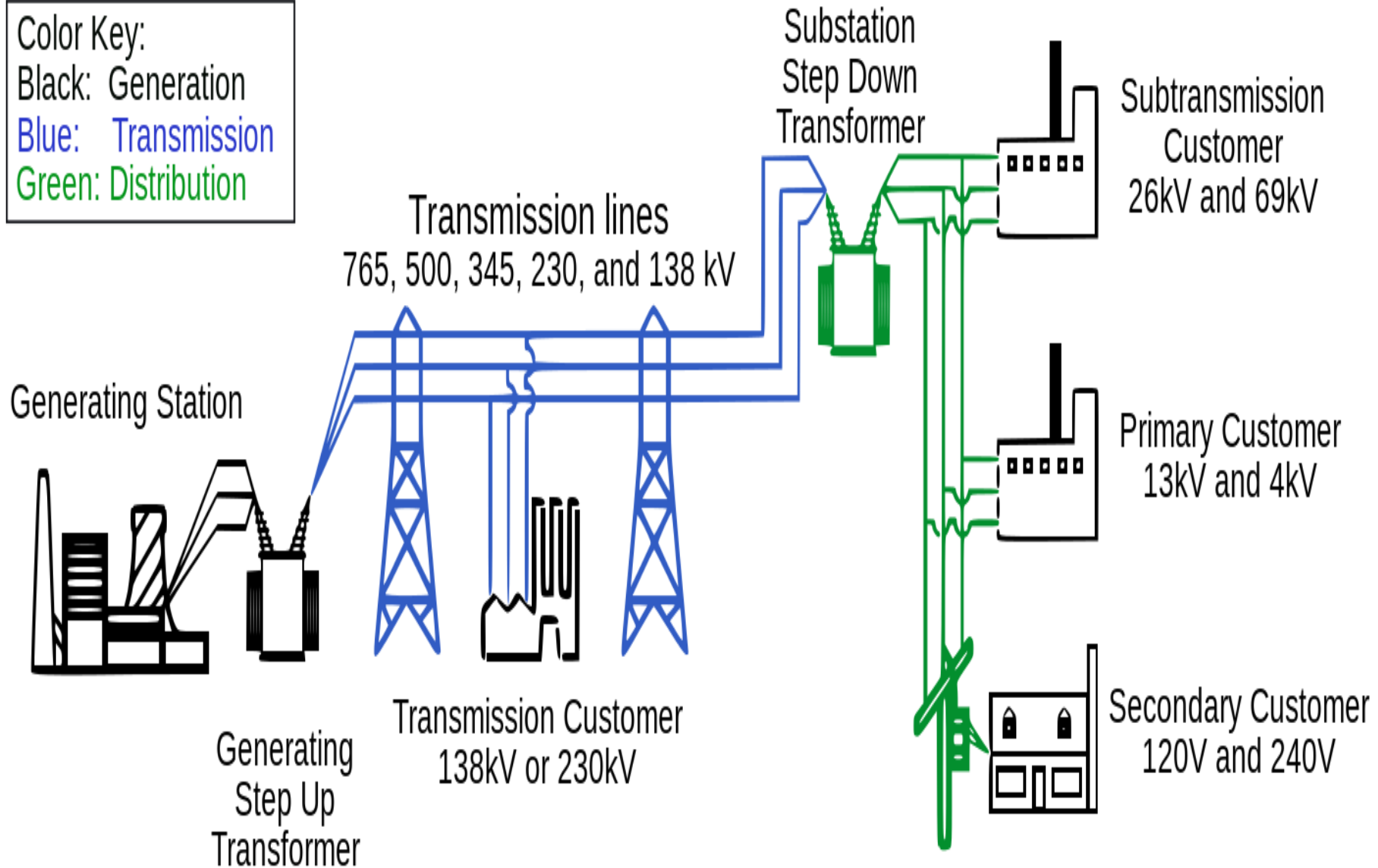
Princeton CHP/District Cooling Reduces Peak Demand on Local Grid



Mon Jun 22 00:26:16 2009

Examples of the Generator – Transmission – Distribution systems

Color Key:
 Black: Generation
 Blue: Transmission
 Green: Distribution

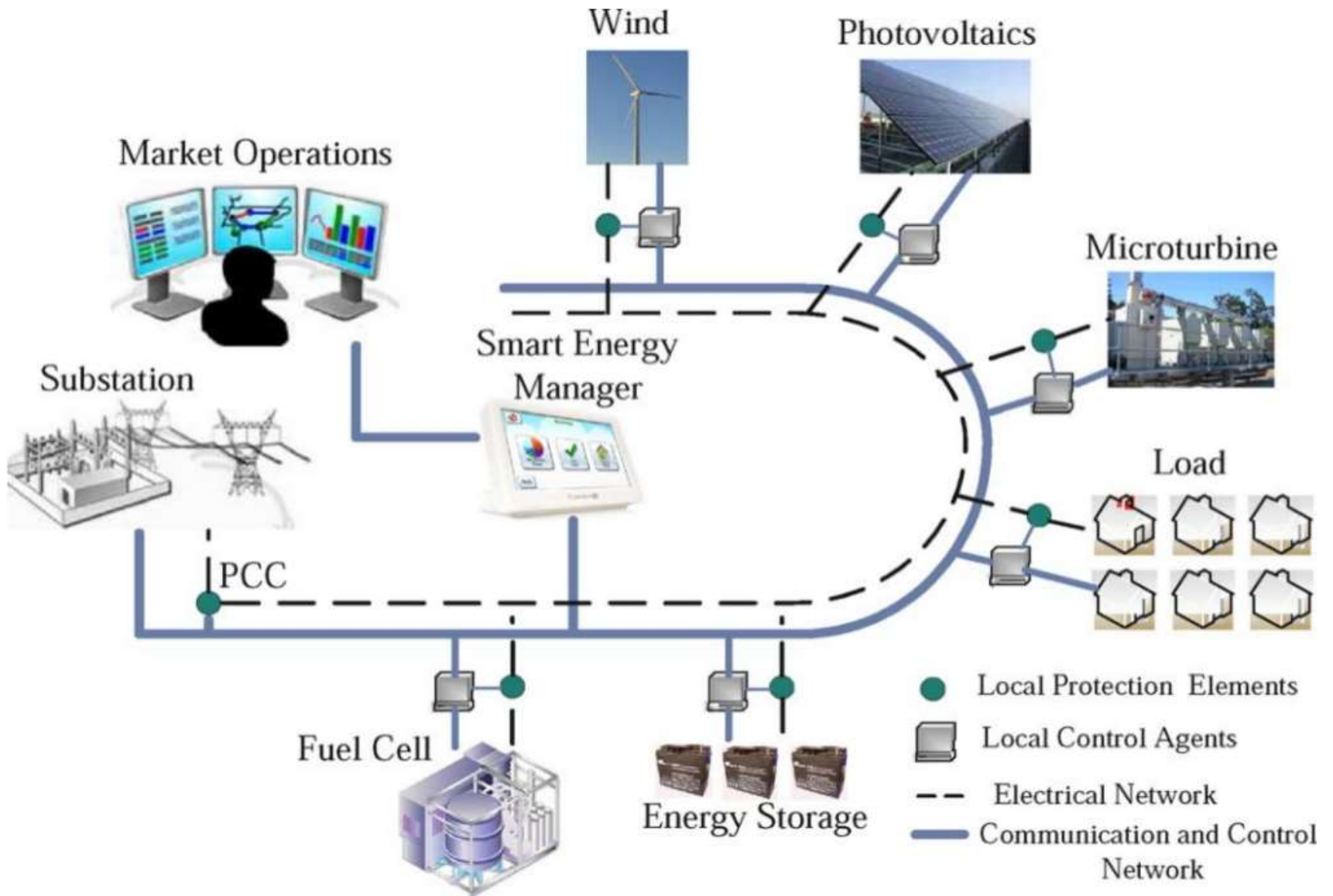


WHY NOW –states are moving on advanced microgrids

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



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 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 –

The Price Getting Right

Distribution

Automation/Smart Grid

It's a Wireless World

Types of MG Distributed Generation or Distributed Energy Resources

