

# 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.

# 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.**

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

# **New Jersey Microgrids - Total 29**

**Level 1 or single customer microgrid --- 21**

**Level 2 or single customer – campus setting - 8**

**Level 3 or multiple customers / advanced microgrid.**

**Proposed**

**Hoboken**

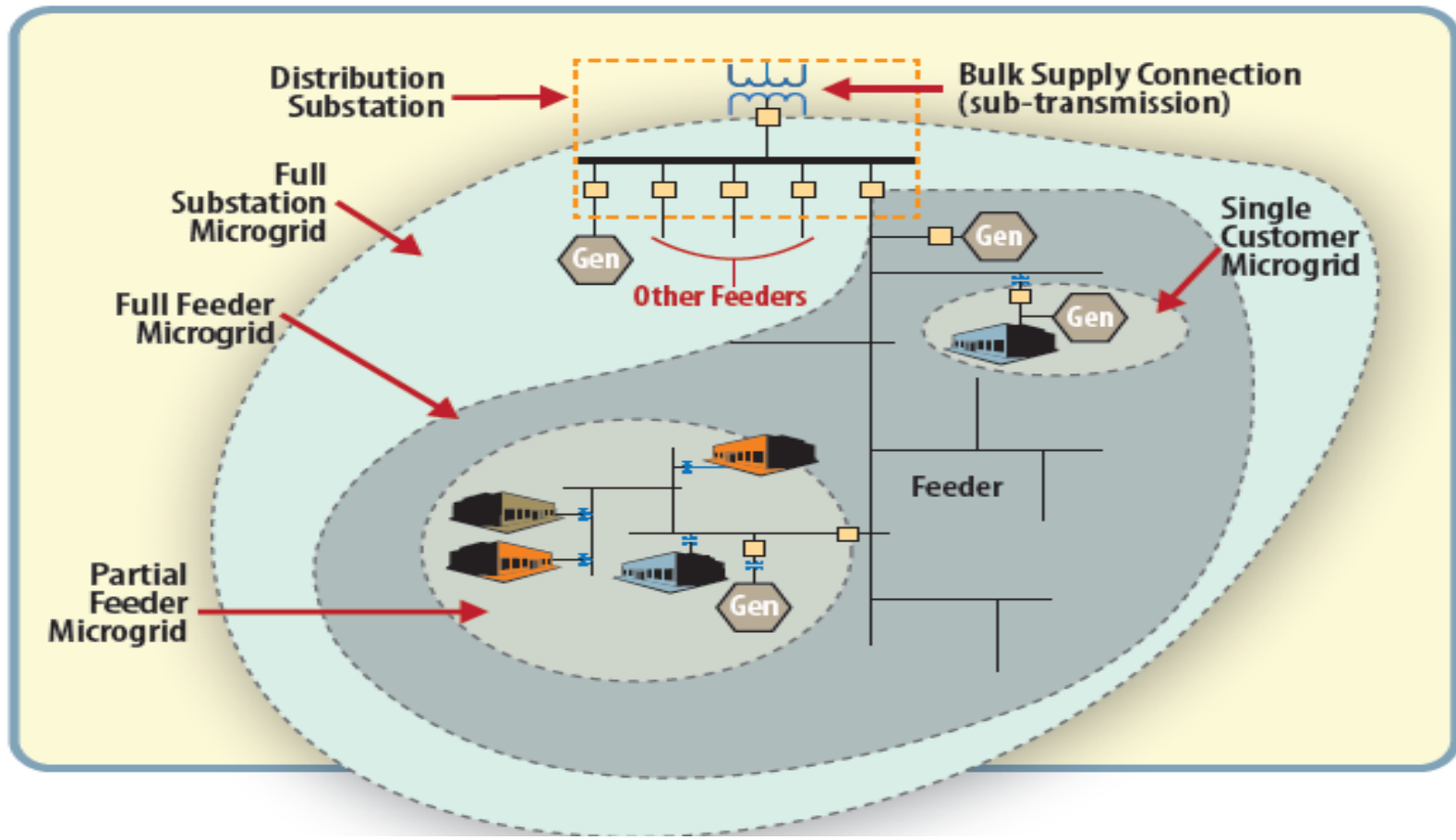
**New Jersey Transit Grid**

**Potential**

**NJIT Town Center Mapping for 9 Sandy Designated counties - 24**

**Town Center MG in 17 municipalities**

**2 Inter-District Thermal Plants – AC and Trenton**



# New Jersey BPU DER Goals

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

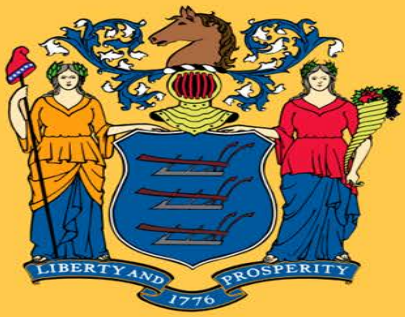
*Increase the Use of Microgrid Technologies and Applications for Distributed Energy Resources (DER)*

*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*

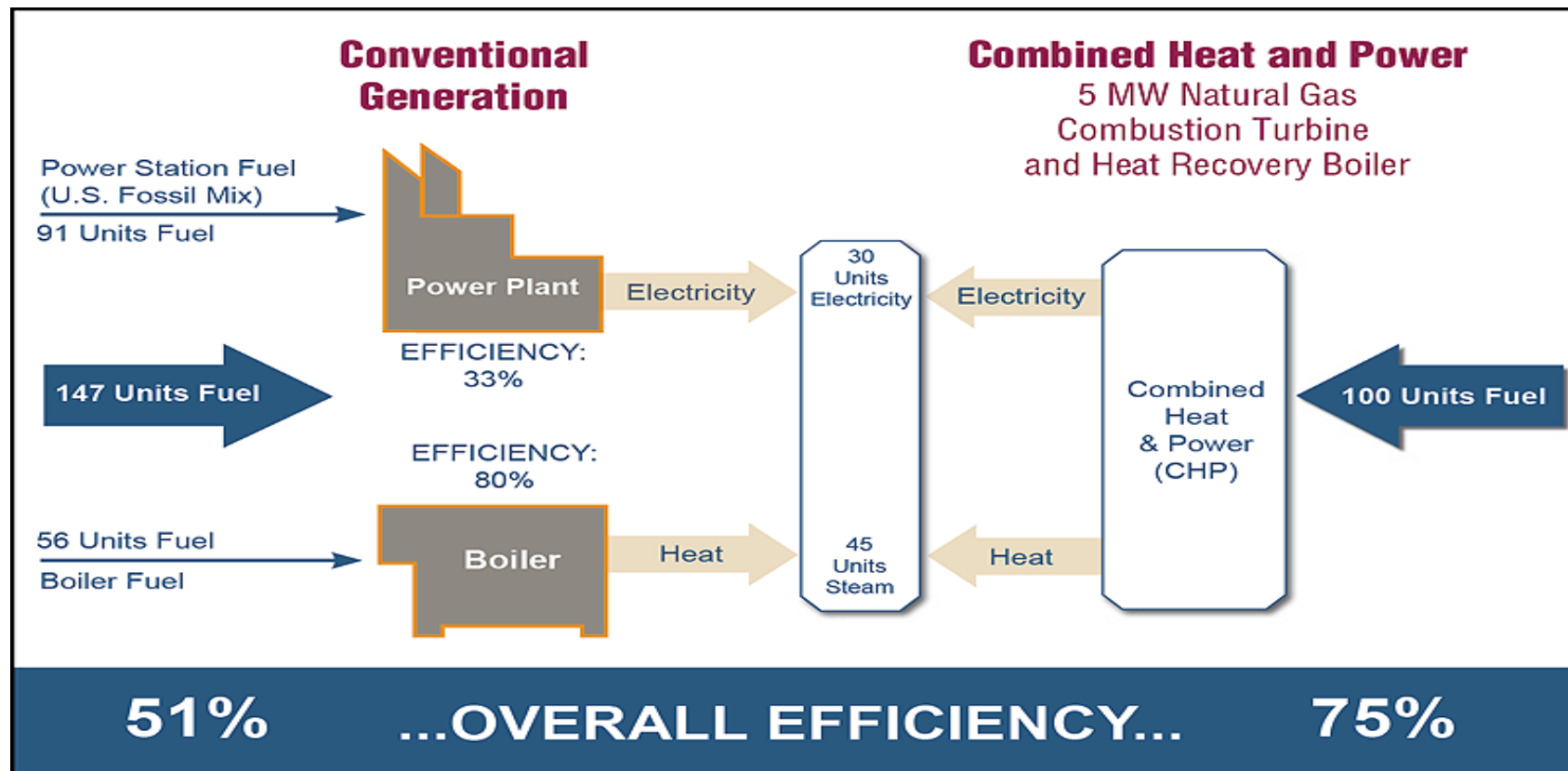




## Poles down across the state – Grid down



## 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.

# 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)**

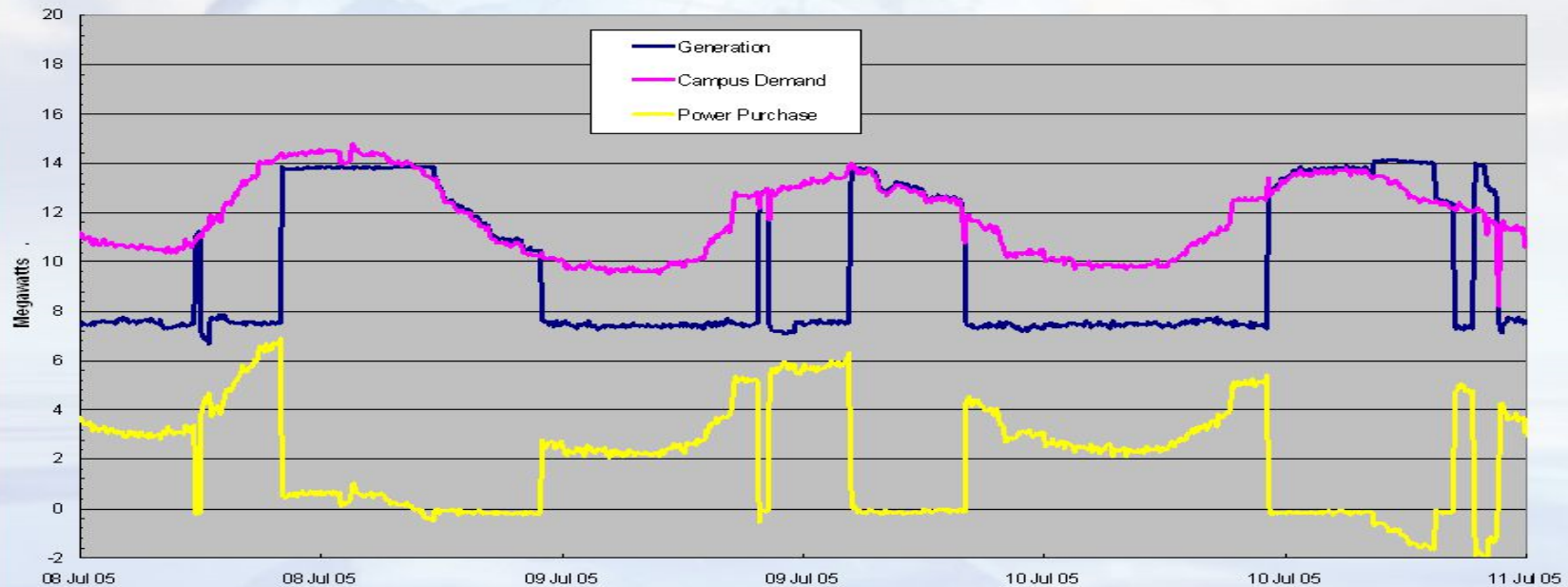
**Plus increased efficiency to 25% (12%) (15-20%)**

**Micro-CHP moving to \$1 per watt (\$50-\$15-\$5/w)**

**Battery Storage increase capacity 5X  
and lower cost 5X (\$1W-\$3W -- \$200-700/kwh)**

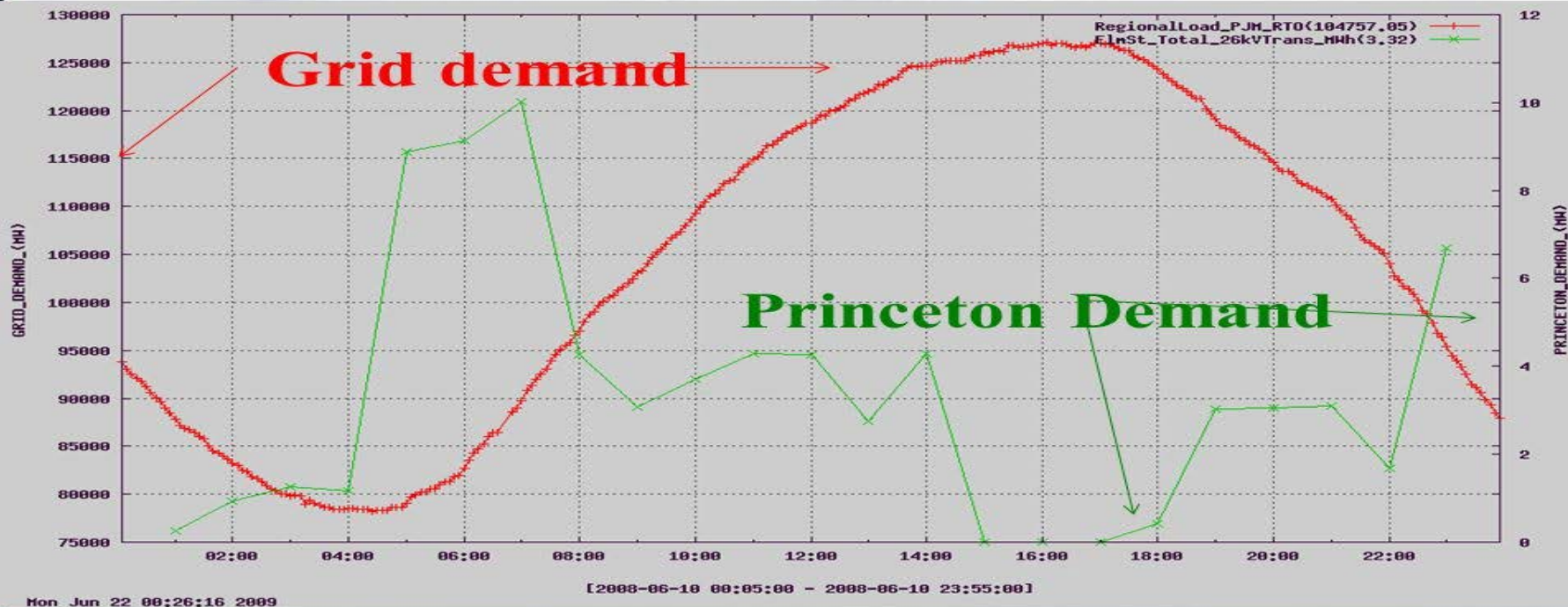
**There are limits based on the current distribution grid capacity**

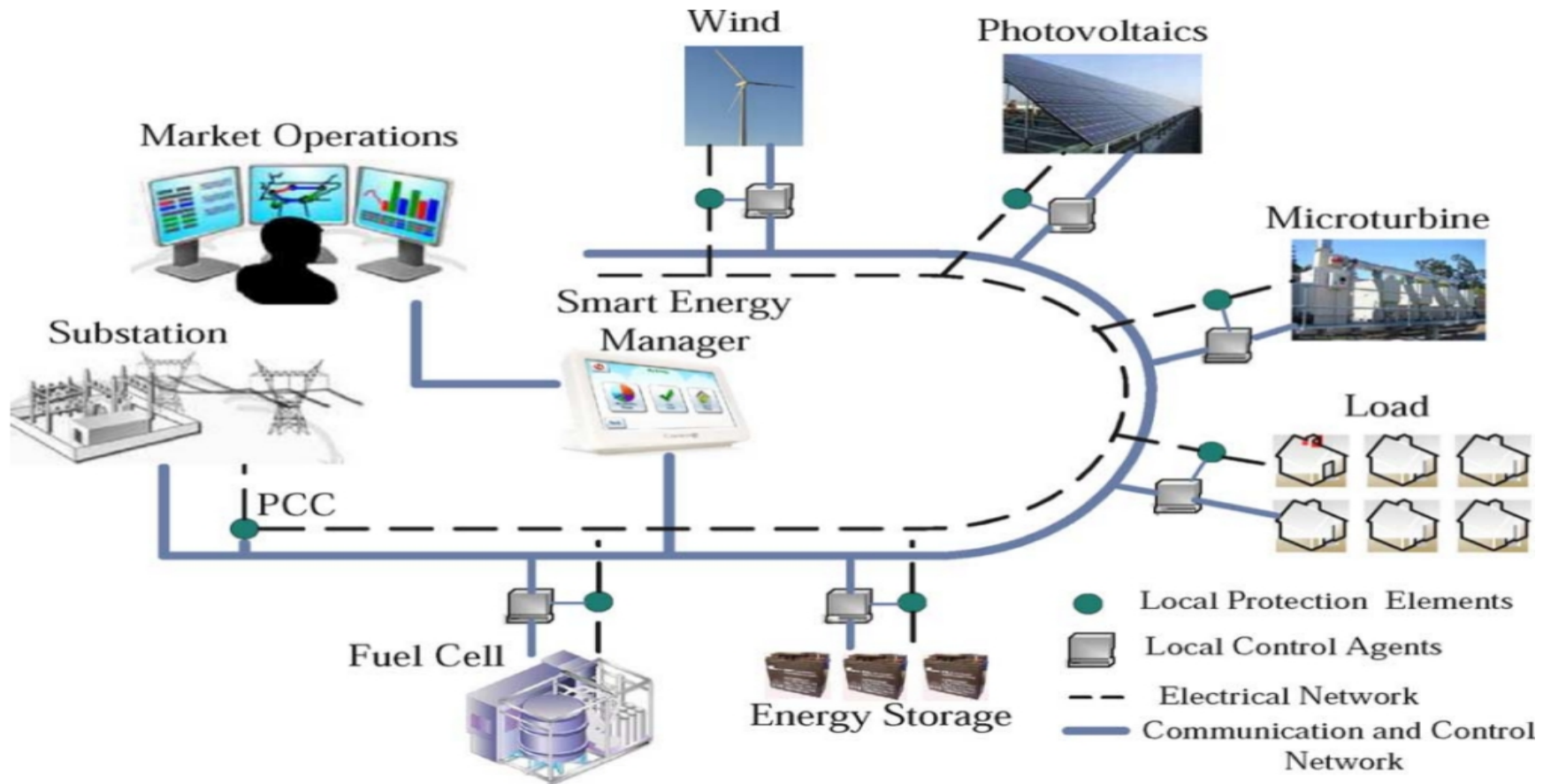
## Princeton Micro-Grid Power Generation Dispatch To Optimize Savings – PJM Grid





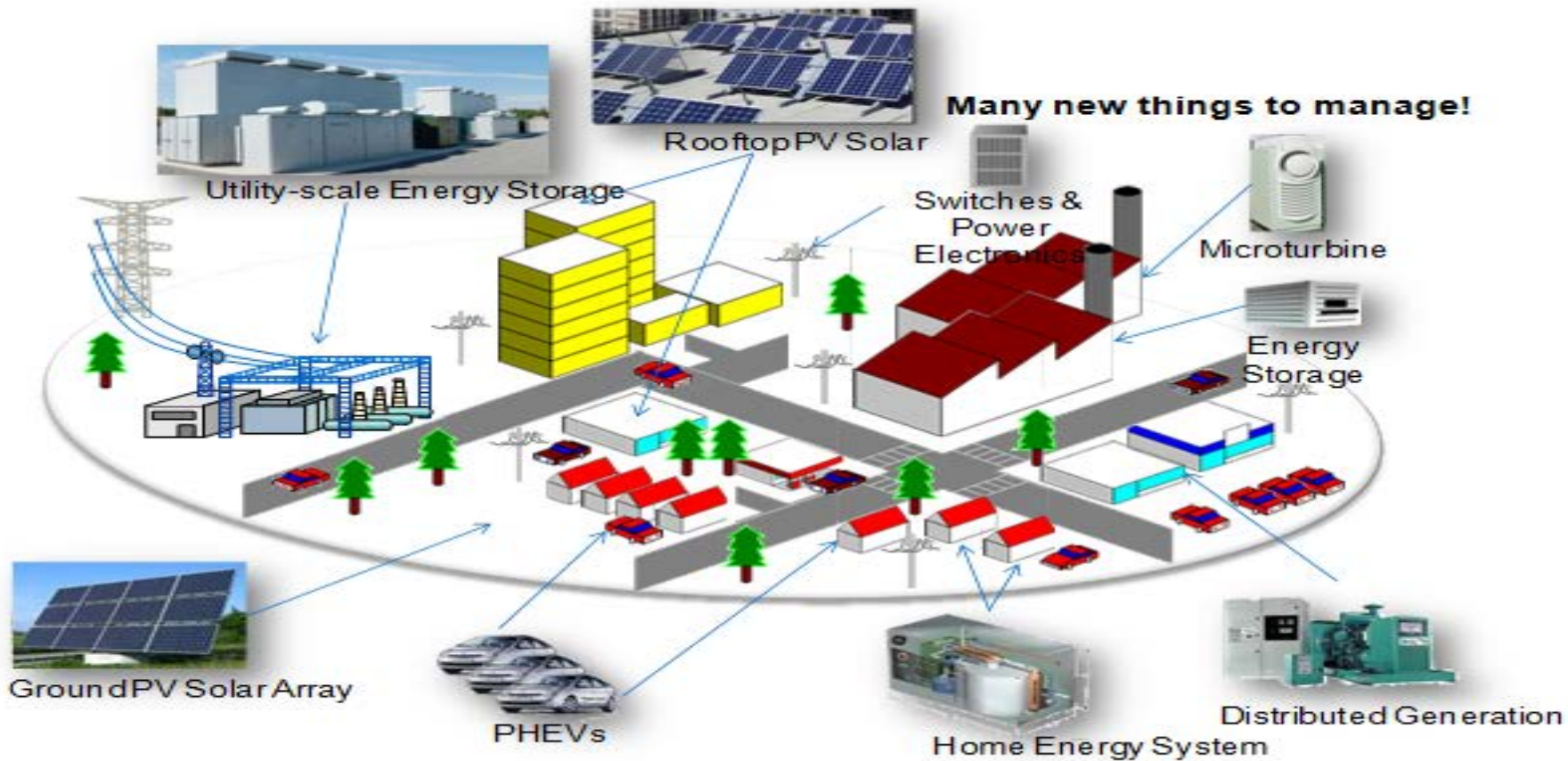
# Princeton CHP/District Cooling Reduces Peak Demand on Local Grid







# Types of MG Distributed Generation or Distributed Energy Resources



**Why Now –**

**The Price Getting Right**

**Distribution Automation/Smart  
Grid**

**It's a Wireless World**