

# Microgrids

Exploring the GHG, Energy Cost Reduction, Resilience, and Economic Development Benefits of Next Generation Energy Infrastructure

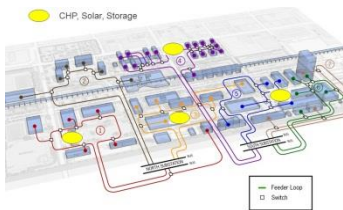
June 2016

# What are Microgrids?

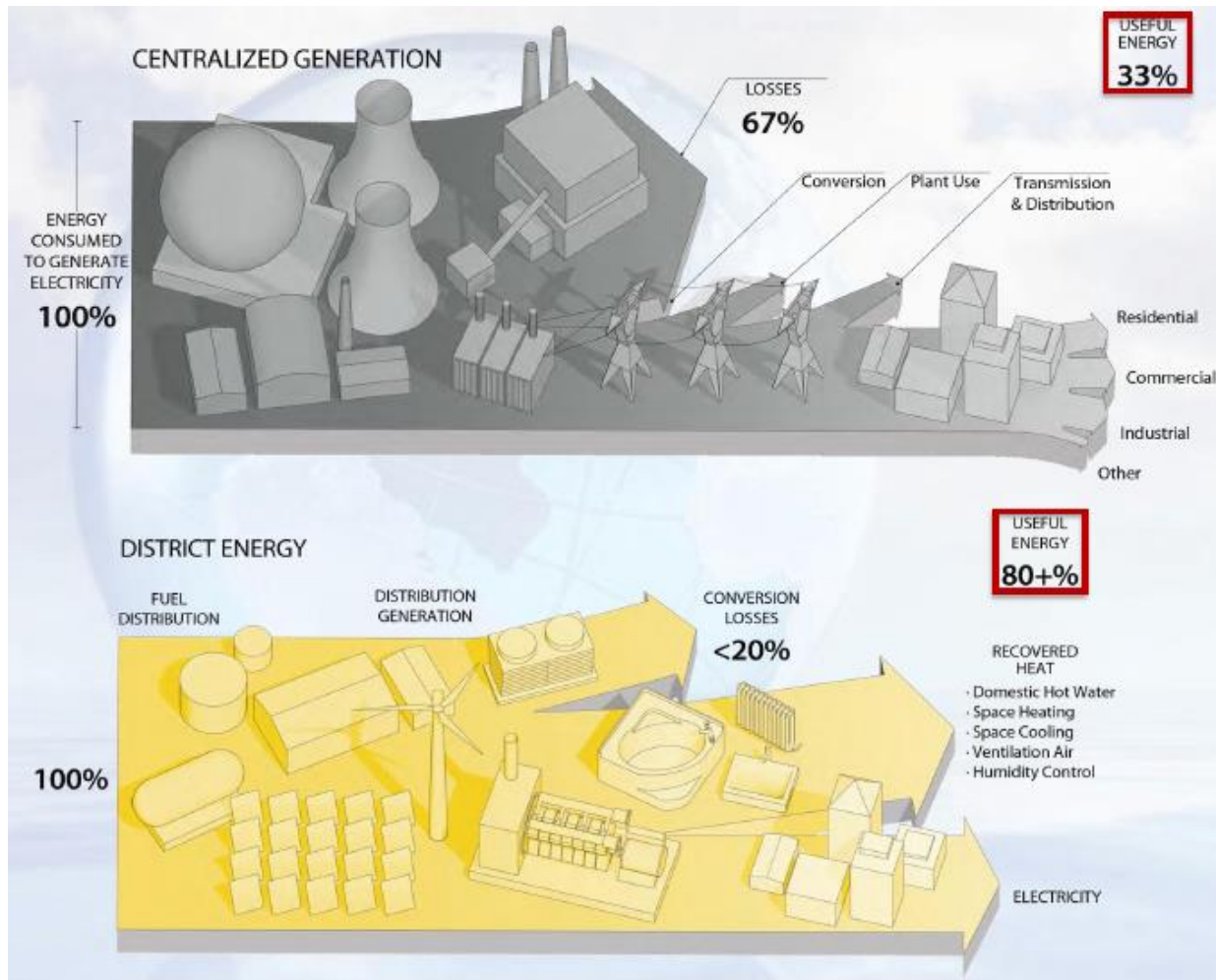
**Microgrids** are small, “islandable” electricity, heat and/or cooling distribution systems that coordinate and distribute energy supplied from multiple generation sources to a network of users in a spatially defined area.

# Community Microgrid Stakeholder Benefits

- Energy cost reduction
- GHG reductions
- Energy resilience for critical facilities
- Renewable energy integration enabler
- Utility infrastructure investment deferral
- Power quality, reliability
- Spur economic development
- Platform for innovation adoption



# District Scale/Distributed Energy Infrastructure Efficiency Advantage



# GHG Reduction Goals (80% by 2050)

## Buildings (9.8%)

- All cost-effective energy efficiency/RGGI (7.1%)
- Advanced building energy codes (1.6%)
- Building energy rating and labeling
- “Deep” energy efficiency improvements for buildings (0.2%)
- Expanding energy efficiency programs to C/I heating oil (0.1%)
- Developing a mature market for solar thermal water/space heating (0.1%)
- Tree retention and planting to reduce heating and cooling loads (0.1%)
- Federal appliance and product standards (0.6%)
- ***Microgrids/District Energy (?%)***





Back Bay, Boston, substation fire, 2012

Gas Station lines,  
post Hurricane Sandy



Co-op City microgrid,  
post Hurricane Sandy

Central MA 2011 EF3 tornado



# Cost of Interruptions

Table ES-1: Estimated Interruption Cost per Event, Average kW and Unserved kWh (U.S.2013\$) by Duration and Customer Class

Interruption Cost	Interruption Duration					
	Momentary	30 Minutes	1 Hour	4 Hours	8 Hours	16 Hours
<b>Medium and Large C&amp;I (Over 50,000 Annual kWh)</b>						
Cost per Event	\$12,952	\$15,241	\$17,804	\$39,458	\$84,083	\$165,482
Cost per Average kW	\$15.9	\$18.7	\$21.8	\$48.4	\$103.2	\$203.0
Cost per Unserved kWh	\$190.7	\$37.4	\$21.8	\$12.1	\$12.9	\$12.7
<b>Small C&amp;I (Under 50,000 Annual kWh)</b>						
Cost per Event	\$412	\$520	\$647	\$1,880	\$4,690	\$9,055
Cost per Average kW	\$187.9	\$237.0	\$295.0	\$857.1	\$2,138.1	\$4,128.3
Cost per Unserved kWh	\$2,254.6	\$474.1	\$295.0	\$214.3	\$267.3	\$258.0
<b>Residential</b>						
Cost per Event	\$3.9	\$4.5	\$5.1	\$9.5	\$17.2	\$32.4
Cost per Average kW	\$2.6	\$2.9	\$3.3	\$6.2	\$11.3	\$21.2
Cost per Unserved kWh	\$30.9	\$5.9	\$3.3	\$1.6	\$1.4	\$1.3

# Microgrid Barriers

- New microgrid on the block
- Can I sign a microgrid PPA?
- Commercial building owners: “what are microgrids and why should I care?”
- Is there an optimal size for microgrids? How many should be built in Massachusetts? Will my microgrid reliably island and reconnect to the grid?
- From snowflakes to i-phones



Market  
Awareness

Microgrid Report, Stakeholder  
Workshops, Microgrid Expo

Map  
Opportunities

Boston Community  
Energy Study

Improve  
Regulatory  
Environment

Stakeholder Workshops,  
DPU Dialogues

Innovation,  
Deployment,  
Demonstration

Microgrid Market Actor  
RFI, Microgrid Feasibility  
Study RFP