

COMBINED HEAT AND POWER (CHP) EN BANC HEARING

October 2014

Peoples

❖ Peoples Gas

- Serves 360,000 customers, 16 counties, annual consumption of 67 BCF
- Serves 4,000 producer interconnects, annual deliveries of 30 BCF
- On-system storage, working capacity of 1.1 BCF
- Integrated Distribution, Gathering and Transmission pipeline system

❖ Peoples TWP

- Serves 60,000 customers, 9 counties, annual consumption of 23 BCF
- Serves 2,500 producer interconnects, annual deliveries of 19 BCF
- On-system storage, working capacity of 0.6 BCF
- Integrated Distribution and Transmission pipeline system

❖ Peoples Gas (Equitable Division)

- Serves 260,000 customers, 10 counties, annual consumption of 48 BCF
- Serves 1,500 producer interconnects, annual deliveries of 19 BCF
- Integrated Distribution and Transmission pipeline system

Peoples Advantage

- ❖ Access to 68 BCF of low cost gas supply priced at Dominion SP which is \$1.10-\$1.70 below NYMEX Henry Hub and one of the lowest in the region
- ❖ Access to interstate pipelines including Dominion, Columbia, Texas Eastern, National Fuel, Tennessee and Equitrans
- ❖ Access to on and off system no-notice storage to balance load swings and provide balancing services for energy choice suppliers
- ❖ Open access and market friendly programs offer energy choice from 20 different suppliers

Technology Partners



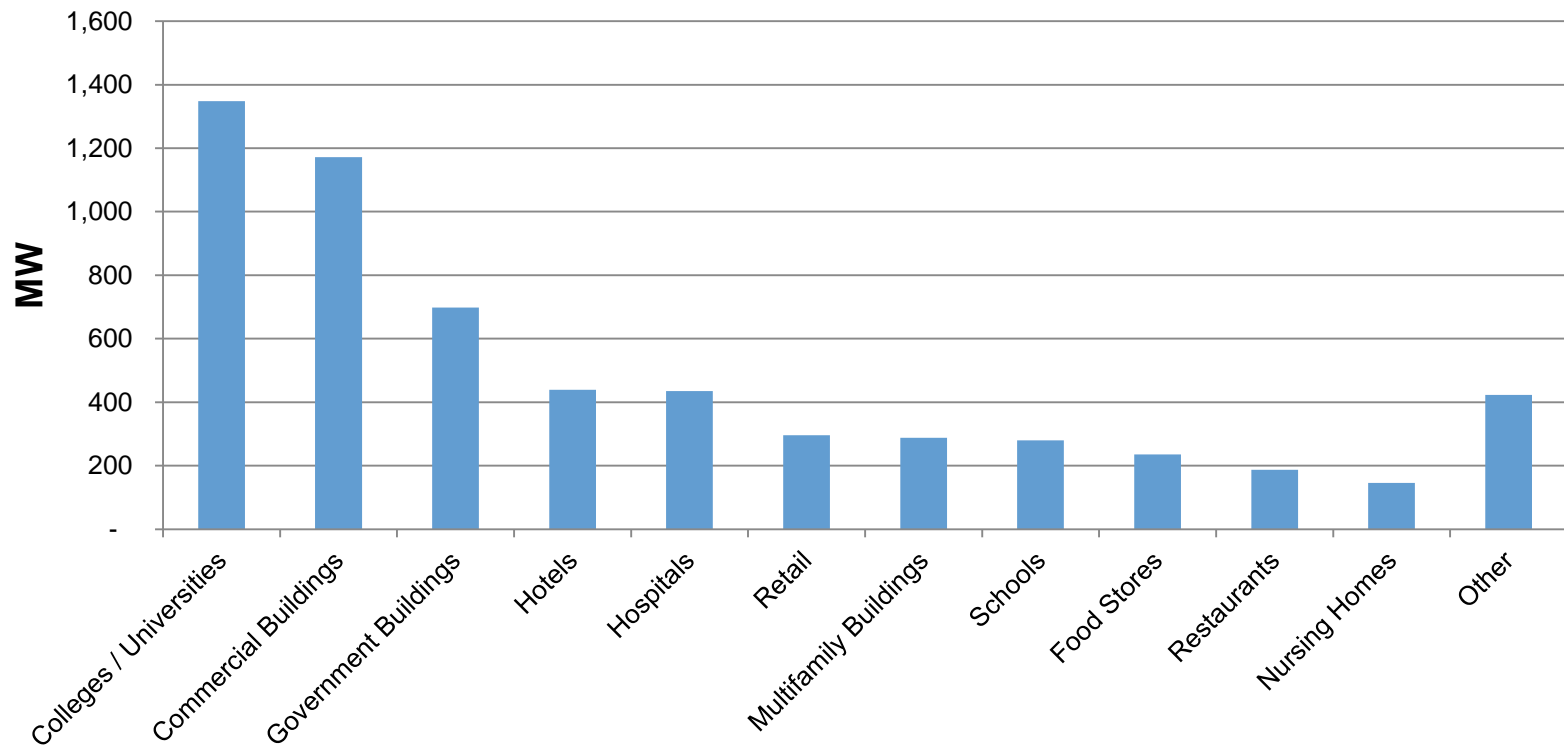
- Accelerate the Introduction and Deployment of New Gas Solutions
- Enable Energy Customers to Achieve Conservation, Efficiency, and Environmental Goals through the Use of Natural Gas
- Builds partnerships between utilities and equipment manufacturers and vendors



- Contribute to socially responsible workforce development
- Foster energy and sustainable technology advancement
- Assist in job creation through a commitment to diversity, innovation and comprehensive education

CHP Potential in the Commercial Market

CHP Potential at Existing Commercial Facilities - 2011



Marketing

- ❖ Our role is to provide education, provide savings analysis and provide vendor solutions
 - Teaming with Energy Innovation Center to showcase new CHP technology, track maintenance history and track energy savings
 - Teaming with ESC for education on new technology, building a vendor network to support customers and provide solutions

- ❖ Market activity and accomplishments
 - Peoples serve two universities with central natural gas CHP plants
 - Peoples serves a food processing plant with central CHP
 - Peoples serves a training facility utilizing reversible gas absorption heat pumps
 - Peoples is working with three additional universities on converting central coal plants to natural gas
 - Peoples is also working with office buildings, hotels and schools to find energy efficient solutions using natural gas

CHP Economics

❖ Energy costs in Western Pennsylvania

- Electricity between \$0.06 to \$0.08 per KWH
- Natural Gas between \$5 to \$6 per MCF

❖ CHP Cost

- Equipment between \$500 to \$6,000 per KW
- Equipment maintenance between \$0.005 to \$0.038 per KWH

❖ Investment Risks

- New technology
 - Reliability concerns
 - Noise concerns
- Electric to Natural Gas price differential stability
- Capital investment
 - Energy savings versus new revenue
 - Long payback period

General rule of thumb for CHP

Payback Analysis, Varying the Price of Natural Gas & Electricity Engines Sizes for Electrical Load

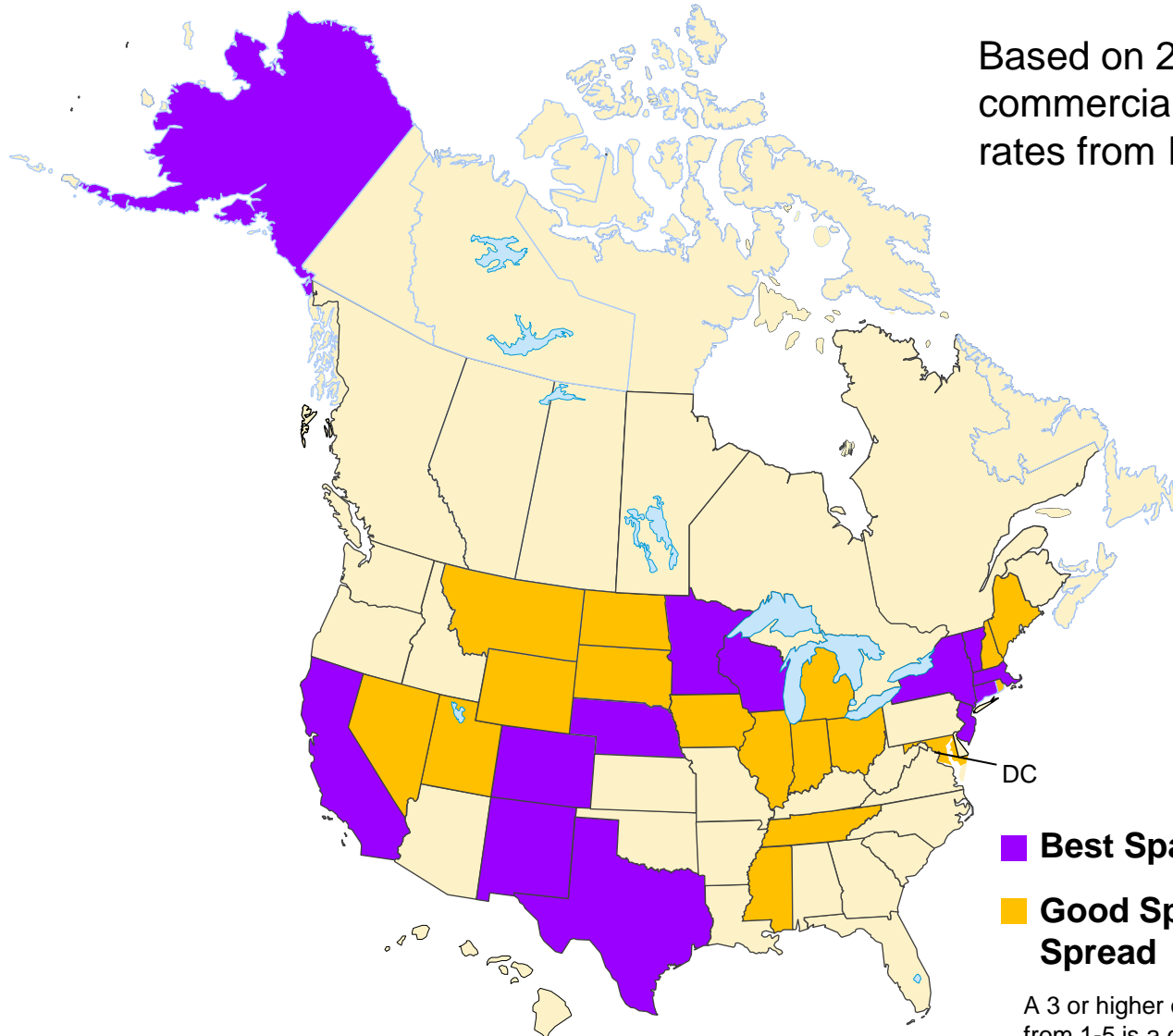
		Natural Gas Price, \$/MMBtu									
		\$5	\$6	\$7	\$8	\$9	\$10	\$11	\$12	\$13	\$14
Electricity Price, \$/kWh	\$0.06	9.1	16.2	72.5	-29.2	-12.2	-7.7	-5.6	-4.4	-3.6	-3.1
	\$0.07	5.2	6.9	10.3	20.4	945.4	-21.3	-10.5	-7.0	-5.2	-4.2
	\$0.08	3.6	4.4	5.5	7.6	11.8	27.5	-85.7	-16.8	-9.3	-6.4
	\$0.09	2.8	3.2	3.8	4.6	6.0	8.4	14.0	42.3	-41.0	-13.8
	\$0.10	2.3	2.5	2.9	3.3	4.0	4.9	6.5	9.3	17.0	91.7
	\$0.11	1.9	2.1	2.3	2.6	3.0	3.5	4.2	5.3	7.0	10.6
	\$0.12	1.6	1.8	1.9	2.1	2.4	2.7	3.1	3.7	4.4	5.6
	\$0.13	1.4	1.6	1.7	1.8	2.0	2.2	2.5	2.8	3.2	3.8
	\$0.14	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.3	2.5	2.9
	\$0.15	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.1	2.3

■ Greater than 5-year payback

□ Less than 5-year payback

Spark Spread - Electric versus Natural Gas Price CHP Differential

Best Spark Spread	
Connecticut	5.40
Alaska	5.15
New York	5.10
California	5.07
New Jersey	4.27
Wisconsin	3.92
Mississippi	3.81
Texas	3.74
New Mexico	3.71
Massachusetts	3.68
Nebraska	3.67
Colorado	3.66
Vermont	3.54
Minnesota	3.51
Good Spark Spread	
Tennessee	3.44
Michigan	3.41
Ohio	3.39
Nevada	3.38
South Dakota	3.36
New Hampshire	3.34
Maryland	3.32
Indiana	3.31
Maine	3.30
North Dakota	3.30
Wyoming	3.24
Illinois	3.21
Iowa	3.15
Utah	3.14
D.C.	3.09
Montana	3.09



Based on 2011 retail commercial energy rates from EIA.

Best Spark Spread
Good Spark Spread

A 3 or higher on a scale from 1-5 is a good spark spread.

Comparisons for Reference: Installed Costs, O & M Costs & More

Technology	Steam Turbine ¹	Recip. Engine	Gas Turbine	Microturbine	Fuel Cell
Power efficiency (HHV)	15-38%	22-40%	22-36%	18-27%	30-63%
Overall efficiency (HHV)	80%	70-80%	70-75%	65-75%	55-80%
Effective electrical efficiency	75%	70-80%	50-70%	50-70%	55-80%
Typical capacity (MW _e)	0.5-250	0..01-5	0.5-250	0.03-0.25	0.005-2
Typical power to heat ratio	0.1-0.3	0.5-1	0.5-2	0.4-0.7	1-2
Part-load	ok	ok	poor	ok	good
CHP Installed costs (\$/kW _e)	430-1,100	1,100-2,200	970-1,300 (5-40 MW)	2,400-3,000	5,000-6,500
O&M costs (\$/kWh _e)	<0.005	0.009-0.022	0.004-0.011	0.012-0.025	0.032-0.038
Availability	near 100%	92-97%	90-98%	90-98%	>95%
Hours to overhauls	>50,000	25,000-50,000	25,000-50,000	20,000-40,000	32,000-64,000
Start-up time	1 hr - 1 day	10 sec	10 min - 1 hr	60 sec	3 hrs - 2 days
Fuel pressure (psig)	n/a	1-45	100-500 (compressor)	50-80 (compressor)	0.5-45
Fuels	all	natural gas, biogas, propane, landfill gas	natural gas, biogas, propane, oil	natural gas, biogas, propane, oil	hydrogen, natural gas, propane, methanol
Noise	high	high	moderate	moderate	low
Uses for thermal output	LP-HP steam	hot water, LP steam	heat, hot water, LP-HP steam	heat, hot water, LP steam	hot water, LP-HP steam
Power Density (kW/m ²)	>100	35-50	20-500	5-70	5-20
NO _x (lb/MMBtu) (not including SCR)	Gas 0.1-2 Wood 0.2-.5 Coal 0.3-1.2	0.013 rich burn 3- way cat. 0.17 lean burn	0.036-0.05	0.015-0.036	0.0025-.0040
lb/MWh _{TotalOutput} (not including SCR)	Gas 0.4-0.8 Wood 0.9-1.4 Coal 1.2-5.0.	0.06 rich burn 3- way cat. 0.8 lean burn	0.17-0.25	0.08-0.20	0.011-0.016

* Data are illustrative values for typically available systems; All costs are in 2007\$

¹For steam turbine, not entire boiler package

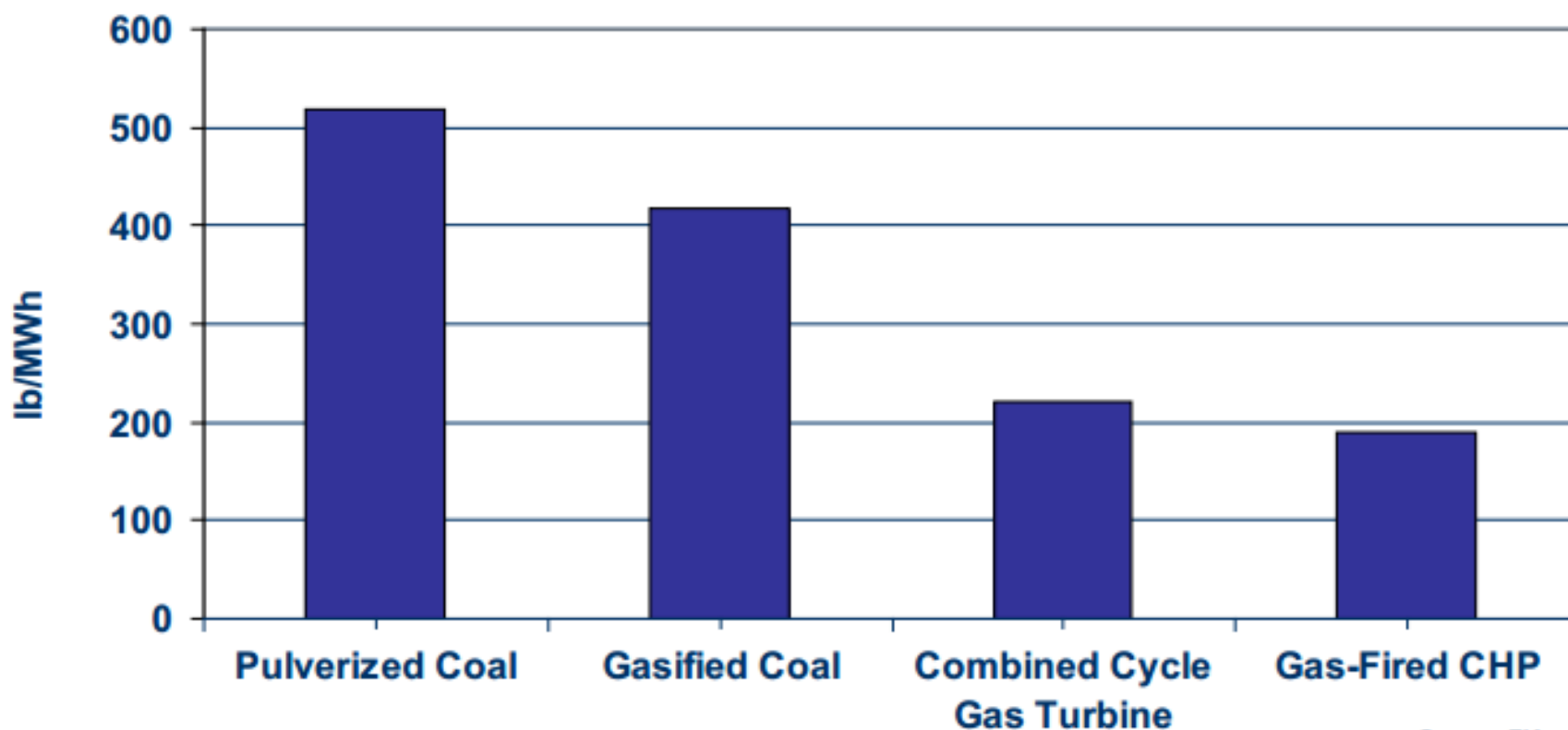
Courtesy ICF/EEA

Promote CHP Benefits

- ❖ CHP has the low Carbon Emissions
 - Improves company's ability to meet EPA standards
- ❖ CHP improves company Leeds certification
 - Improves company sales to environmental and energy conservation groups
- ❖ CHP is more efficient use of energy
 - Promotes energy conservation
- ❖ CHP is more reliable
 - Lowers susceptibility to power outages
 - Lowers electric grid dependency
 - Less outages means more revenues

“Natural Gas CHP is the Best Choice for Lowering Carbon Based Emissions”

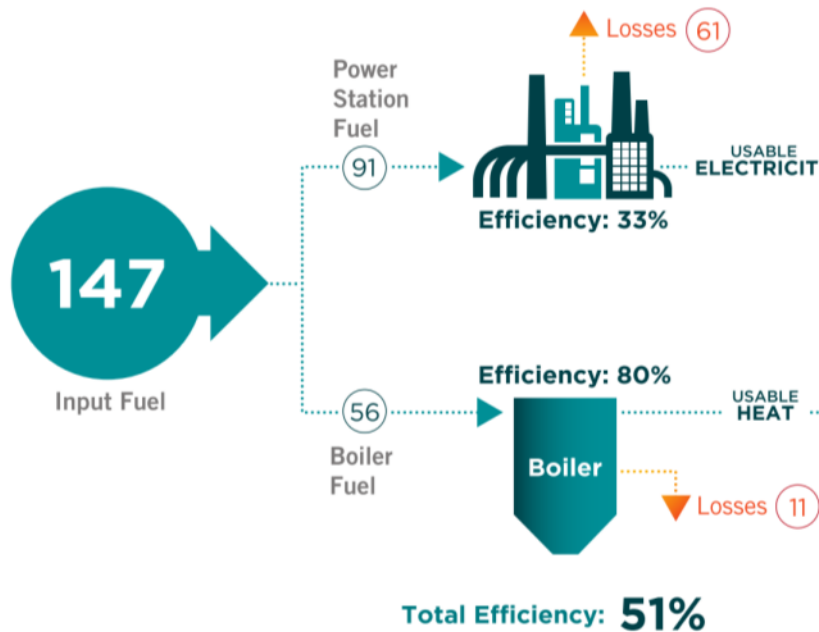
Carbon Emissions



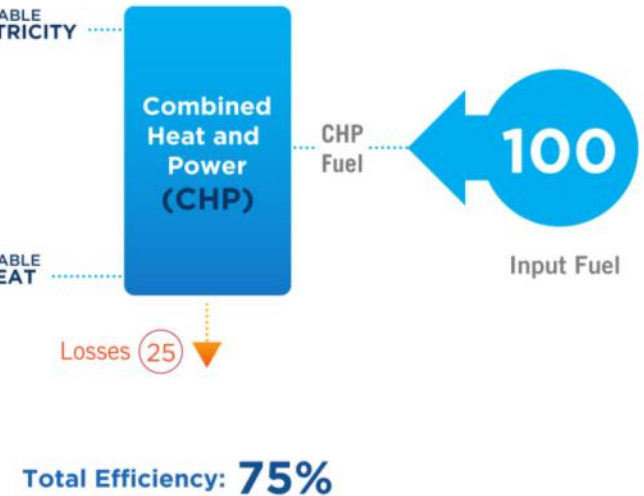
Source: EIA

CHP is Efficient

Conventional Separate Heat and Power Generation



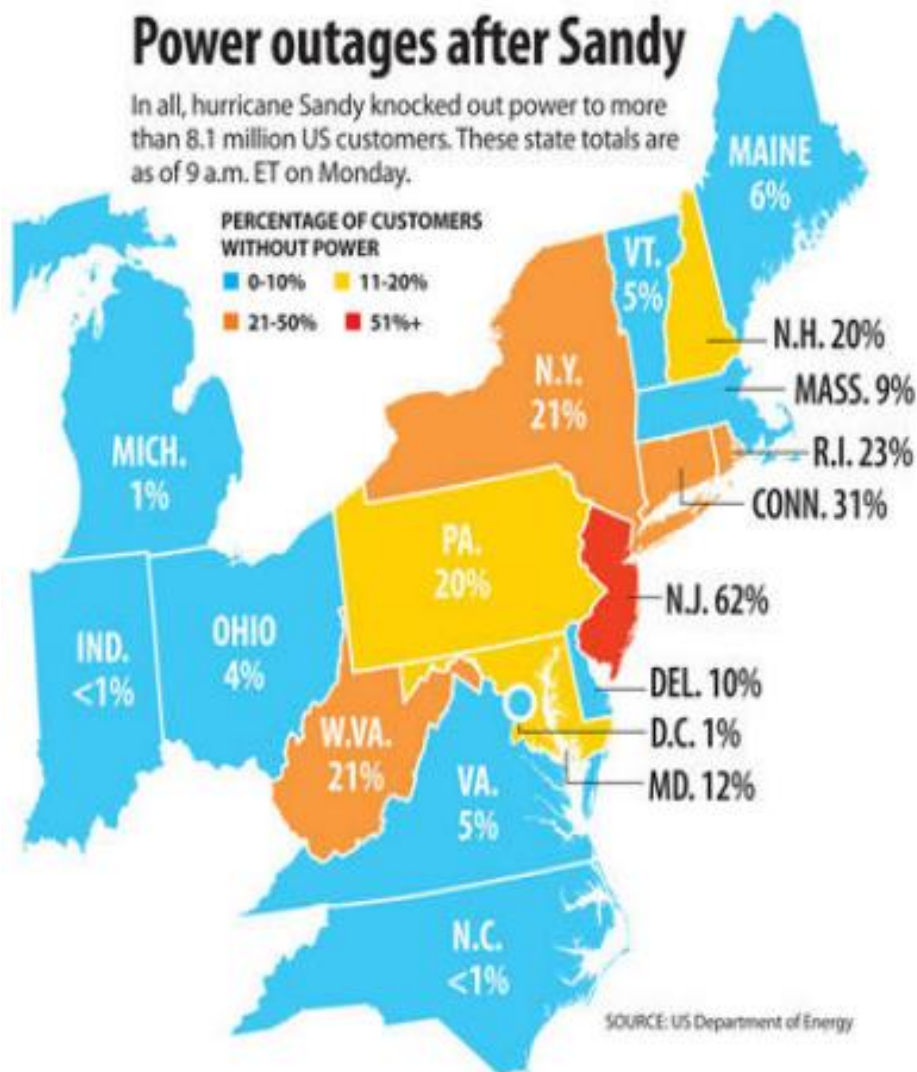
Combined Heat and Power 5 MW Natural Gas Combustion Turbine



CHP can provide reliability

Power outages after Sandy

In all, hurricane Sandy knocked out power to more than 8.1 million US customers. These state totals are as of 9 a.m. ET on Monday.



STATE	CURRENT CUSTOMER OUTAGES
1. New Jersey	2,498,447
2. New York	1,967,874
3. Pennsylvania	1,267,512
4. Connecticut	626,440
5. Maryland	311,020
6. Massachusetts	298,072
7. Ohio	254,207
8. West Virginia	212,183
9. Virginia	182,811
10. New Hampshire	141,992
11. Rhode Island	116,308
12. Maine	90,727
13. Michigan	68,619
14. Delaware	45,137
15. Vermont	17,959
16. Indiana	7,537
17. North Carolina	4,005
18. District of Columbia	3,583

Recommendation

- ❖ Allow utilities to offer financing
 - Removes capital hurdle

- ❖ Provide grants or incentives
 - For emission reduction and energy conservation
 - Improves return on investment

- ❖ Allow utilities to offer rate incentives
 - For electric usage or summer usage
 - Improves energy savings

- ❖ Promote economic development
 - CHP development encourages increased natural gas utilization, energy efficiency and environmental benefits
 - Keeps more of Pennsylvania abundant natural gas resources in state benefitting local economy