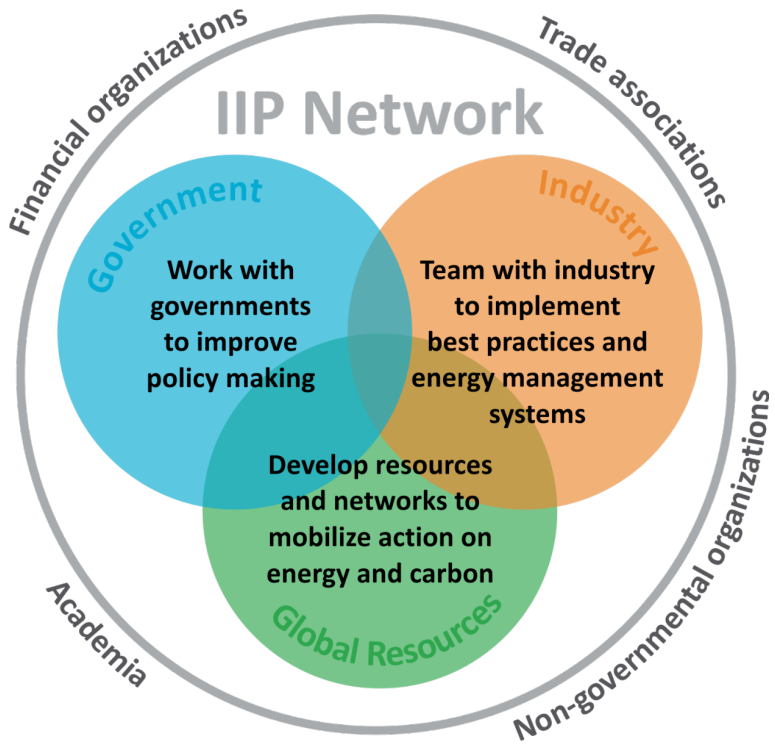
Learning From CHP/WHP Bright Spots

Bruce Hedman
Institute for Industrial Productivity

About the Institute for Industrial Productivity

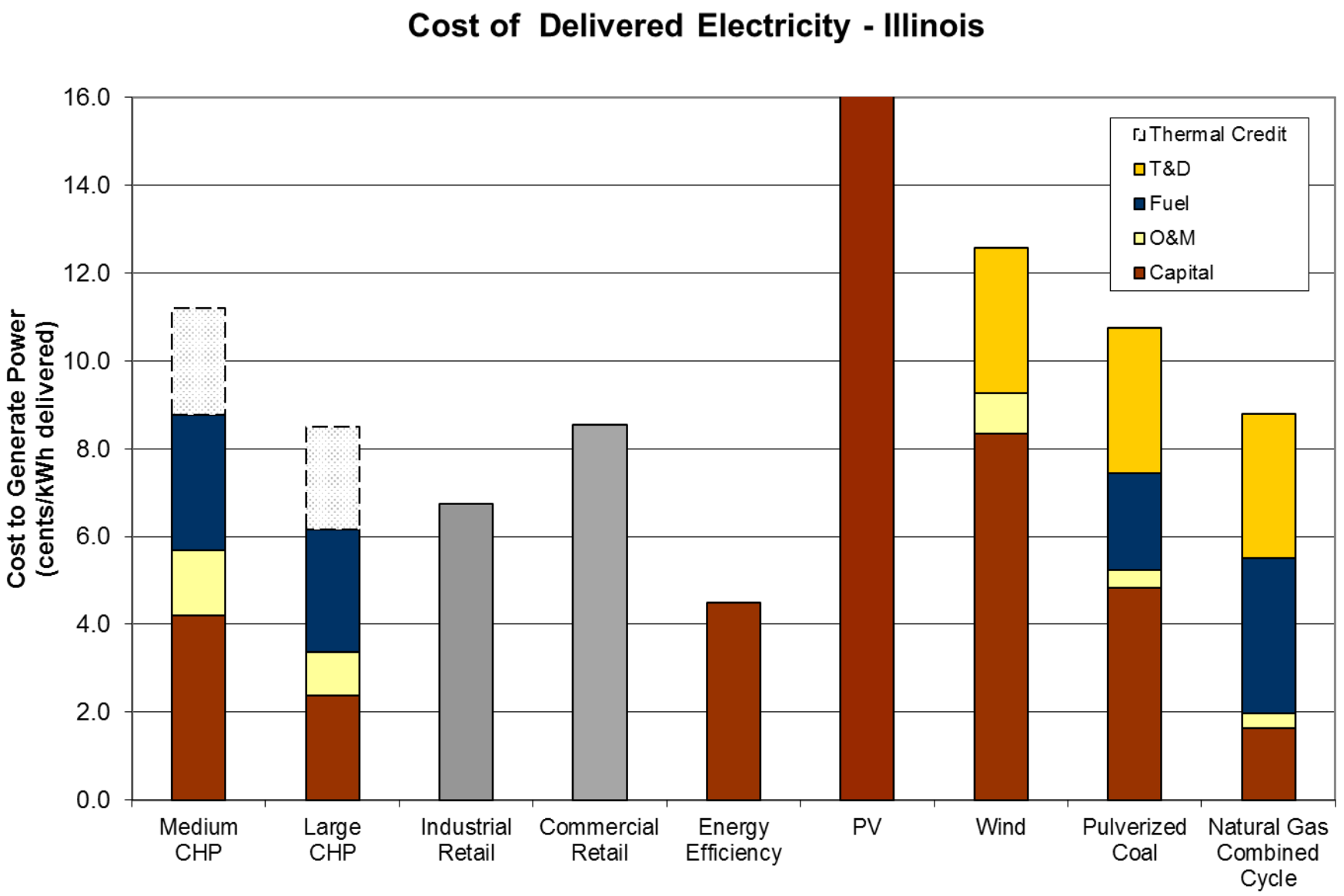
The Institute for Industrial Productivity provides industry and governments with the best energy efficiency practices to reduce energy costs and prepare for a low carbon future.

- Sharing best practices, including policy experience, and providing access to a network of international experts.
- Developing original research, analysis and databases.
- Bridging the gap between government policy and industry implementation.

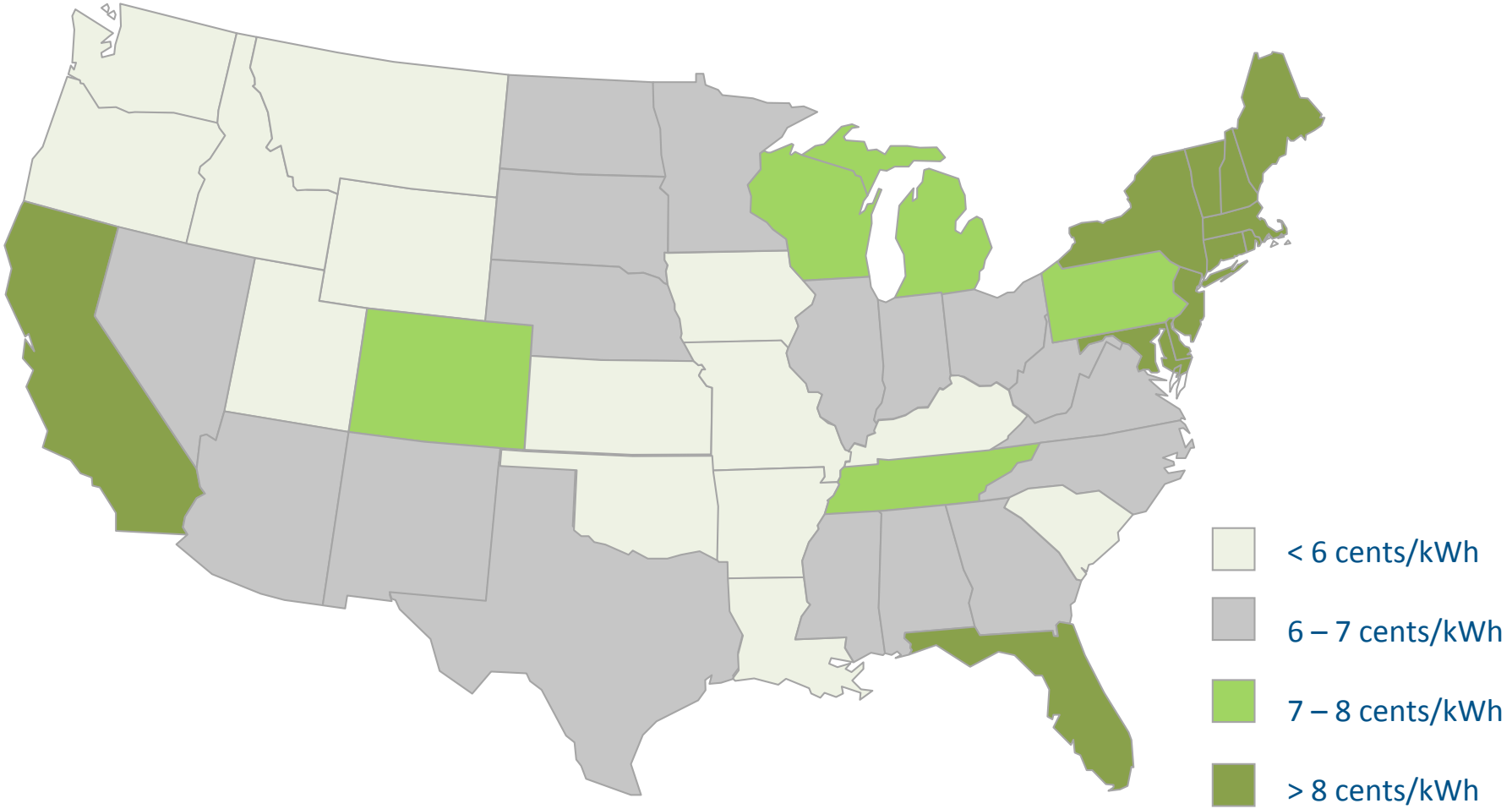


Institute for Industrial Productivity

Cost of Delivered Electricity



Average Industrial Electricity Prices



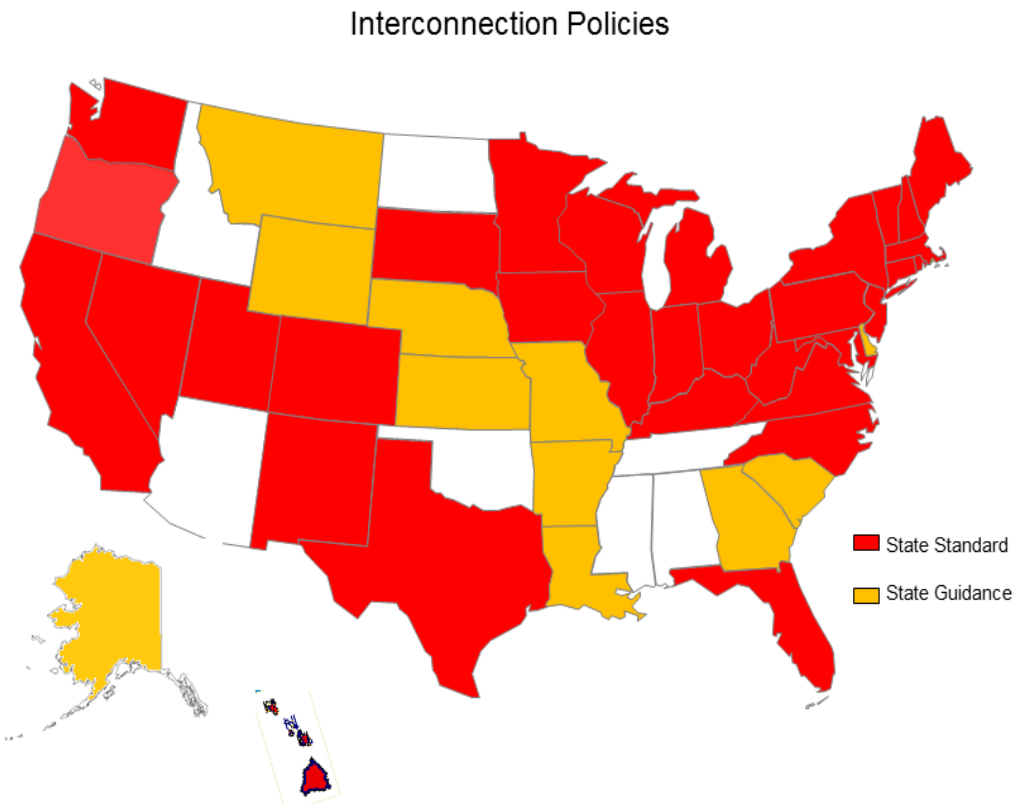
Institute for Industrial Productivity

State Policies and Programs to Support CHP

- Standardized and simplified interconnection and permitting
- Reasonable standby and supplemental power rates
- Regulatory certainty related to emissions regulations
- Inclusion of CHP in Renewable and Energy Efficiency Portfolio Standards
- Specific Incentives to Promote CHP
- CHP for Reliability and Resiliency
- Utility Participation in CHP

Grid Interconnection

- The safety of the utility line personnel must be maintained at all time
- The safety of the equipment must not be compromised
- The reliability of the distribution system must not be compromised



Approaches to Reasonable Interconnection Standards

- Fees commensurate with system complexity
- Streamlined procedures with simple decision-tree screens (faster application processing for smaller systems and those unlikely to produce significant system impacts)
  - Maine's Level 2 and 3 (2 and 10 MW) have timelines of 15 and 17 business days for utility approval
  - Kentucky's Level 1 process requires utilities to notify within 20 business days
  - Ohio provides a checklist to determine "short form" or standard
- Practical and predictable technical requirements
  - New Hampshire does not require an external disconnect for inverter systems that comply with IEEE 1547 and UL1741
  - Delaware provides for expedited review for systems up to 2 MW that used lab certified equipment

Approaches to Reasonable Interconnection Standards

- Standardized, simplified interconnection agreements
  - Maryland's application limited to 8 pages
  - Massachusetts has proposed a uniform on-line application
- Dispute resolution procedures to resolve disagreements
  - Massachusetts proposed requiring an arbitrator
  - Hawaii requires a meeting within 15 days of a written request
- Allow larger CHP systems to qualify under the standards
  - Connecticut has guidelines for systems up to 20 MW
  - California has standards for systems up to 10 MW
- Allow interconnection to both radial and network grid
  - New York has requirements for systems up to 2 MW on radial and secondary network systems
  - Texas standard rules apply to systems up to 10 MW on radial and secondary network systems

Standby Rates

- *Backup power* during an unplanned generator outage
- *Maintenance power* during scheduled generator service for routine maintenance and repair
- *Supplemental power* for customers whose on-site generation under normal operation does not meet all of their energy needs
- *Delivery* associated with these energy services.

Approaches to Reasonable Standby Rates

- Offer daily or monthly as-used demand charges for backup power and shared transmission and distribution facilities.
- Reflect load diversity of CHP customers in charges for shared delivery facilities.
- Schedule maintenance service at nonpeak times
- Allow the customer to address back-up needs with a load reduction plan
- In states with retail competition, allow customer-generators the option to buy all of their backup power at market rates

Output-Based Emissions Regulations

- OBR encourages energy efficiency and clean energy supply by relating emissions to the productive output of the energy-consuming process
- The goal of OBR is to encourage the use of fuel conversion efficiency as an air pollution control measure
- OBR can be designed to explicitly account for the multiple outputs of CHP
- States can use OBR for:
  - Conventional emissions limits (state implementation plans)
  - Emissions limits for small distributed generation (DG) and CHP
  - Allowance allocation in emissions trading programs
  - Allowance allocation set-asides for energy efficiency and renewable energy

Texas Has Three Permitting Routes

- Standard Permit – applies to most EGUs
- Permit by Rule (PBR) – only applies to CHP systems
- Case-by-Case – applies to systems not eligible under the 1st two options
- Provides for a credit for CHP thermal output– based on a rate of 1 MWh for each 3.4 MMBtu of heat recovered
- To receive compliance credit, the heat recovered must be ≥ 20% of the total heat energy output of the CHP unit

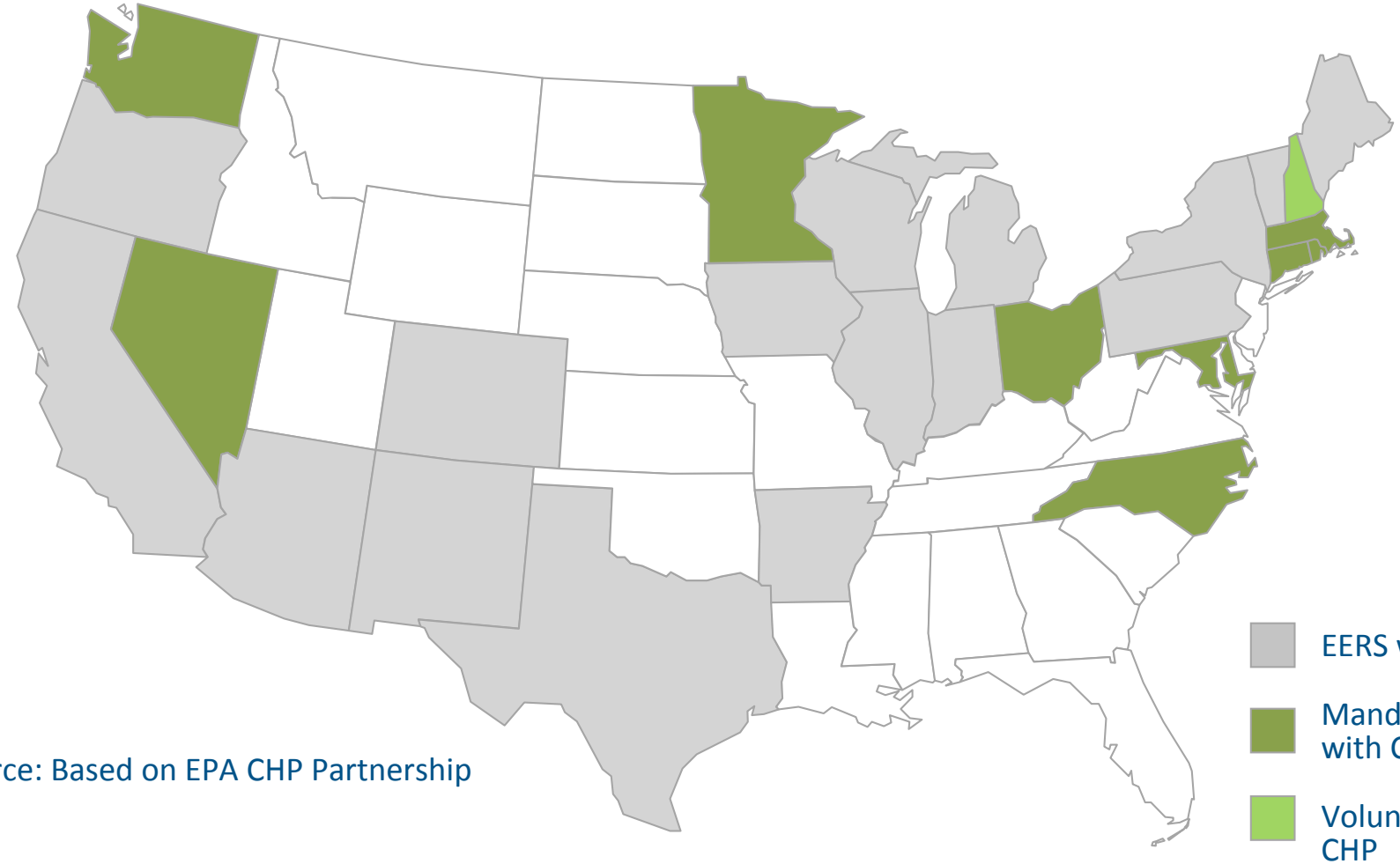
Texas Permit by Rule for CHP

- Expedited permit option for CHP systems powered by "pipeline-quality" natural gas-fired engines, including turbines
- CHP systems < 20 kW are exempt from permitting requirements
- To qualify, any individual CHP system or any group of units may not exceed 15 MW in capacity
- CHP systems from 8 to 15 MW must install an oxidation catalyst
- NOx limits are generally less stringent than those in the standard permit, and CO limits also apply
- CHP thermal credited same as under the standard permit

CHP in Clean Energy Portfolio Standards

- Renewable Portfolio Standards (RPS)
- Energy Efficiency Portfolio Standards (EERS)
- Alternative Energy Portfolio Standards (APS)
- Approaches to incorporating CHP
  - Include CHP as a generally eligible resource
  - Establish separate tier for CHP
  - Establish separate standard with specific subtargets for CHP
  - Definitions for eligible technologies, fuels and minimum efficiency requirements

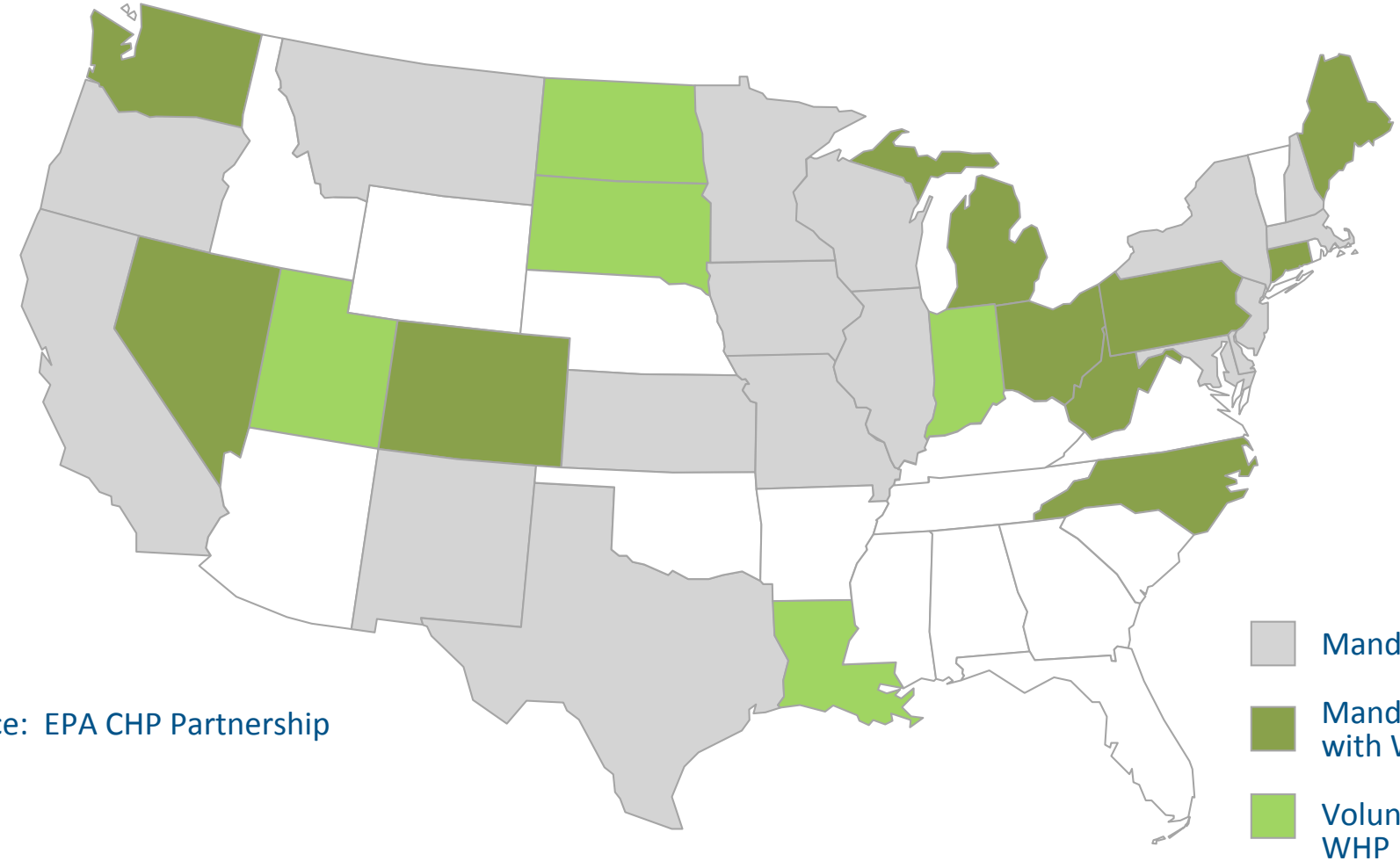
EERS that Include CHP



Source: Based on EPA CHP Partnership

MN EERS only includes WHP

RPS/APS that Include WHP



Source: EPA CHP Partnership

EERS that includes WHP: MN, OH

Institute for Industrial Productivity

Approaches to Prioritizing CHP in Portfolio Standards

- Define CHP eligibility explicitly
  - Separate, distinct targets or tiers
- Binding targets are most effective
- Allow all technologies and all fuels
  - Minimum efficiencies or performance metrics
- Account for CHP's benefits appropriately
  - Recognize both thermal and power outputs
  - Calculate CHP savings based on objectives

Specific Incentives to Promote CHP

- Technical assistance
- Capital incentives
- Feed-in tariffs
- Discounted natural gas rates
- Tax incentives
- Financing

Connecticut

- "An Act Concerning Energy Independence", June 2005
- Customer CHP and DG Incentives
  - $450/kW, additional $50/kW in congestion area
  - Utilities receive $200/kW
  - Low interest financing
  - Natural gas distribution cost rebate
  - No back-up power for new systems
- More than 80 applications representing 300 MW between 2006 and 2008

California: Self-Generation Incentive Program (SGIP)

- Fossil fueled CHP reinstated in 2011
- GHG reduction is sole eligibility criteria. No size limits
- CHP, Waste Heat to Power, Pressure Reduction Turbines (in-conduit hydro) and advanced energy storage added and join wind and fuel cells.
- Incentives:
  - $1.25/W for wind, WHP and PRT. The “Renewable” Category
  - $0.50/W for CHP, microturbine and gas turbine on non-renewable fuel. “Conventional” Category

California - Feed In Tariffs (FIT)

- California enacted a CHP FIT for systems less than 20 MW and with excess power (AB 1613)
  - Must be sized to thermal load and > 62% efficiency
  - Price tied to natural gas and time of day and season (Market Price Referrent (MPR))
- Federal Energy Regulatory Commission (FERC) Rulings
  - CPUC's FIT not preempted by FERC as long as generators are QF's and the rate does not exceed the avoided cost
  - Approved multi-tiered rates (higher rates for higher efficiency)
  - Approved adders for transmission constraints and environmental externalities

Massachusetts

- MA Alternative Energy Portfolio Standard – CHP is eligible technology
  - Target of 250 MW by 2020
  - $20/MWh equivalent
  - CHP credit includes electricity and thermal
  - Metered power output and useful thermal reported quarterly with independent verification
- Green Communities Act (2009) directs utilities to purchase all cost-effective efficiency and makes CHP eligible
  - ***CHP KWh's are credited to utility's EE goals***
  - $750/kW rebate based on cost effective test (roughly need < $3000/kW, > 5,000 annual hours, full thermal utilization)

New York

- CHP technology demonstration and fleet program – Energy Efficient Power Systems
- Existing Facilities Program – pay for performance
- Multi-family Facilities Program – pay for performance
- CHP Accelerator Program
  - CHP Catalog of pre-approved systems
  - Up to 1.3 MW
  - Pre-approved applications (hospitals, hotels, multi-family) if within specific parameters

CHP Acceleration "Catalog" Program

Program Mechanism:

- Created a catalog of "pre-qualified" systems (systems in the catalog have been evaluated for reasonable component sizing and are comprised of reputable components; this protects use of public funds)

Use of Best Professional Judgment, in absence of availability of Industry Standard Certification Process

- Assigned a specific "rebate" to each system
- Inviting customers to shop from catalog
  - Streamlined approach to system sizing*
  - Customized approach to system sizing

* Via Rules-of-Thumb (for example):

- a hotel with 300 guest rooms should buy 60 kW system
- an apartment building with 300 housing units should buy 100 kW system
- a hospital with 300 beds should buy 600 kW system

Size kW	Downstate Incentive	Rate $/kW
100	$180,000	$1,800
300	$510,000	$1,700
600	$930,000	$1,550
900	$1,260,000	$1,400
1,200	$1,500,000	$1,250

Chillers are credited at their equivalent kW displacement

Institute for Industrial Productivity

CHP Acceleration "Catalog" Program

Catalog Items:

- Clean and Efficient CHP
- Integrated Controls Package
- Built-in Data Monitoring Features
- Bumper-to-Bumper Warrantee
- 5-year Service Plan
- Capable of "stand-alone" Operability

CHP Acceleration "Catalog" Program

Eligible CHP Vendors and Systems

Vendor	Model	kW	50 to 100	101 to 300	301 to 500	501 to 700	701 to 900	901 to 1300
Aegis Energy Services	Agen Power Sync 75	75	■					
	Agen Power Verter 75	75	■					
	Agen Power Sync 150	150		■				
	Agen Power Verter 150	150		■				
GEM Energy	IPS-65-CHP	65	■					
	IPS-130-CHP	130		■				
	IPS-195-CHP	195		■				
	IPS-260-CHP	260		■				
	IPS-390-CHP	390			■			
	IPS-1000-CHP	1,000						■
	MCPS-260-CHP	260		■				
	MCPS-390-CHP	390			■			
IntelliGen Power Systems	IntelliGen 150	150		■				
	IntelliGen 150 Inverter	150		■				
	IntelliGen 250	250		■				
	IntelliGen 250 Inverter	250		■				
Kraft Power Corporation	KMGR-55-4SH	55	■					
	KMGR-80-4SH	80	■					
	KMGR-150-4SH	150		■				
	KMGR-250-4SH	250		■				
RSP Systems	C65-DM-iCHP	65	■					
	C200-DM	200		■				
	C400-DM	400			■			
	C600-DM	600				■		
	C800-DM	800					■	
	C1000-DM	1,000						■
Tecogen, Inc	InVerde INV-100	100	■					
	InVerde Ultra INV-100	100	■					
Unison Energy	UE-600-H	600				■		
Veolia Energy	CGC-080MA-080-NG-60-3WY	80	■					
	CGC-0160MA-080-NG-60-3WY	160		■				
	CGC-0260MA-080-NG-60-3WY	260		■				
	CGC-0310GU-080-NG-60-OXY	310			■			
	CGC-0400GU-080-NG-60-OXY	400			■			
	CGC-0620GU-080-NG-60-OXY	620				■		
	CGC-1300CU-078-NG-60-OXY	1,300						■

- All of these systems are capable of running during a grid outage.
- To receive an incentive, the system must be installed and commissioned showing it runs during a grid outage, and systems must be sited "high and dry" at buildings located in flood prone areas.
- Annual conferences for vendors and consultants, periodic expos for potential customers.

CHP Acceleration "Catalog" Program

Aegis Energy Services, Inc. **Aegen PowerSync 150** **150 kW**

Description

Type of prime mover	Number of prime mover units	Synchronous or Inverter	Chiller	Eligible for N+1 installation	Qualification Status
RICE	2	Synchronous	No	Yes	Conditionally qualified

NYSERDA Incentives

ISO Zones I and J	ISO Zones A through H
$266,250	$221,250

Performance at Full Load

Ambient	Fuel in MBTU/hr	Net kW	Hot Water to Building @ 120°F		Hot Water to Building @ 180°F		NOx lbs/MWhr	Chilled Water to Building		
			MBTU/hr	Return °F	MBTU/hr	Return °F		MBTU/hr	Supply °F	Return °F
0°F	1897.2	150	1046	170°F	1046	170°F	0.177			
50°F	1897.2	150	1046	170°F	1046	170°F	0.177			
95°F	1897.2	150	1046	170°F	1046	170°F	0.177	N/A	N/A	N/A

Footprint

	Width ft	Length ft	Height ft	Weight lbs
Core system based on minimum area*	16FT	13FT	4FT	6,100
Core system based on minimum width*	8FT	26FT	4FT	
Heat Rejection subsystem*	4.5FT	9FT	5FT	1,400
Largest part for delivery	2.67FT	2.67FT	2.5FT	850
Heaviest part for delivery	2.67FT	2.67FT	2.5FT	850

*Includes maintenance clearances.

Vendor Statement

The Leader in Combined Heat & Power since 1985

Made in the USA

Reducing Energy Costs with Onsite Combined Heat and Power

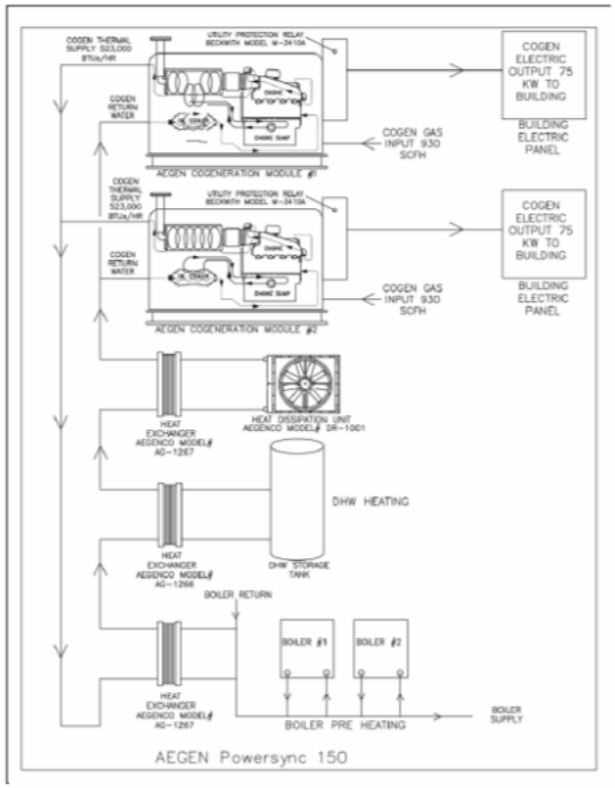
Vendor Information

Aegis Energy Services, Inc.
55 Jackson St.
Holyoke, MA 01040
(413) 536-1156
LeeV@aegisenergyservices.com
www.aegisenergyservices.com

NYSERDA CHP Acceleration Program PON 2568
Version 1.0 Revised 12/20/2012
For the most recent version go to
http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2568-CHP-Acceleration-Program.aspx

8

Aegis Energy Services, Inc. **Aegen PowerSync 150** **150 kW**



NYSERDA CHP Acceleration Program PON 2568
Version 1.0 Revised 12/20/2012
For the most recent version go to
http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2568-CHP-Acceleration-Program.aspx

9

Emergence of Resiliency as a Policy Priority

- Critical Infrastructure Resiliency is an Emerging Concern
  - In July 2012, CT establishes Microgrid Pilot Program in Response to the Two Storms Report (Hurricane Irene, Oct. 29, 2011 Snowstorm) (P.A. 12-148 Section 7)
  - NY Commission 2100 Report January 2013 calls for accelerated deployment of DG/Microgrids as component of future resiliency planning
- Business Continuity
  - Business downtime, economic losses (beyond traditional CI definition)
  - Cascading problems affecting transport (unavailability of gasoline in NJ post Sandy)
- Emergency Preparedness & Planning
  - Developers reporting inquiries from campuses looking to keep students sheltered
  - Nursing homes, public housing, large multi-family buildings keeping people "safe-in-place"

CHP Kept Critical Facilities Running During Sandy

South Oaks Hospital - NY, 1.25 MW recip. engine

Greenwich Hospital - CT, 2.5 MW recip. engine

Christian Health Care Center - NJ, 260 kW microturbine

Princeton University - NJ, 15 MW gas turbine

The College of New Jersey - NJ, 5.2 MW gas turbine

Salem Comm. College - NJ, 300 kW microturbine

Public Interest Data Center - NY, 65 kW microturbine

Co-op City - NY, 40 MW combined cycle

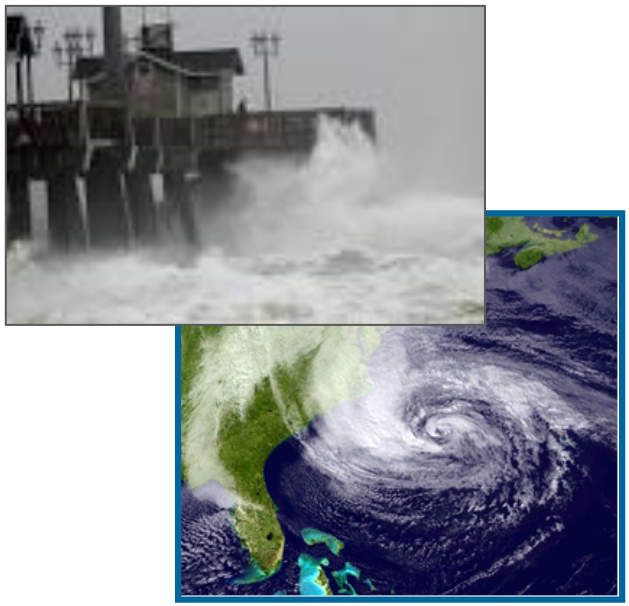
Nassau Energy Corp – NY, 57 MW combined cycle

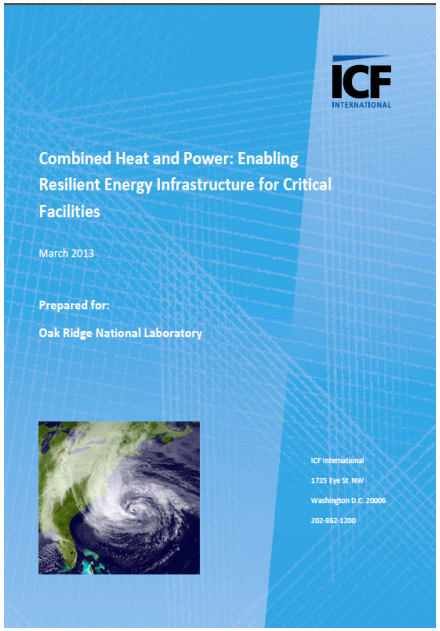
Bergen Wastewater Plant – NJ, 2.8 MW recip. engine

New York University – NY, 14.4 MW gas turbine

Sikorsky Aircraft Corporation – CT, 10.7 MW gas turbine

http://www.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_critical_facilities.pdf





Electric Utility Participation in CHP

- Alabama Power – 500+ MW of CHP at large industrial sites owned by Alabama Power
- Missouri Joint Municipal Electric Utility Commission – joint ownership of CHP assets at ethanol plants
- Austin Energy – sole owner and operator of CHP plants at Domain industrial park (4.5 MW) and Dell Children's Medical Center (4.4 MW)
- Gainesville Regional Utilities – owns and operates the South Energy Center, a 4.3 MW CHP system that serves Shands Cancer Hospital at the University of Florida.
- United Illuminating pilot program paired third party developers with interested customer; encouraging 5 to 10 year power purchase agreements between parties

Gas Utility Participation in CHP

- Discounted natural gas rates
  - California
  - Connecticut
  - Hawaii
  - New Jersey
  - New York
- Philadelphia Gas Works – PGW pays for initial feasibility study, and finances equipment and installation costs. Total costs and cost of capital are recovered in monthly gas bill over a five year period. Customer pays equivalent of current gads and electric bills until repayment is complete.

Utility Participation Issues

- Rules to ensure non-discriminatory access by third parties wishing to enter the CHP market in the utility service territory
- Financial controls to prevent cost shifting to non-CHP customers
- Policy determinations on how to treat CHP-related earnings for rate making purposes
- Models for joint utility-customer ownership of CHP assets