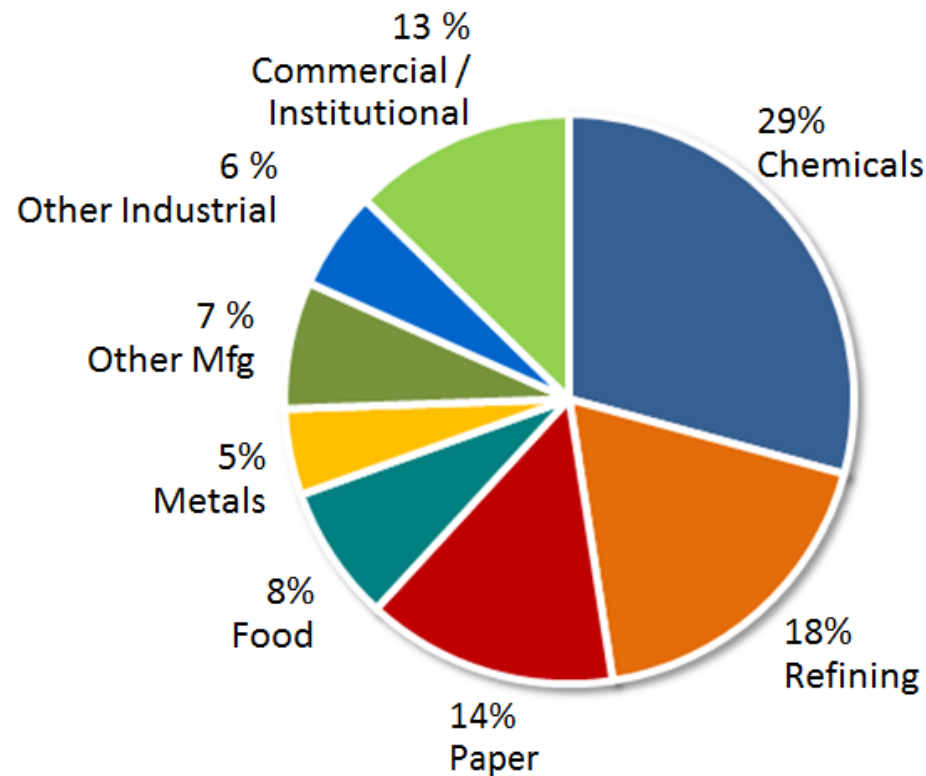


# Combined Heat and Power: *Market Status and Emerging Drivers*

## Midwest Cogen Association Meeting

Bruce Hedman  
April 4, 2013

# CHP: Already an Important U.S. Energy Resource

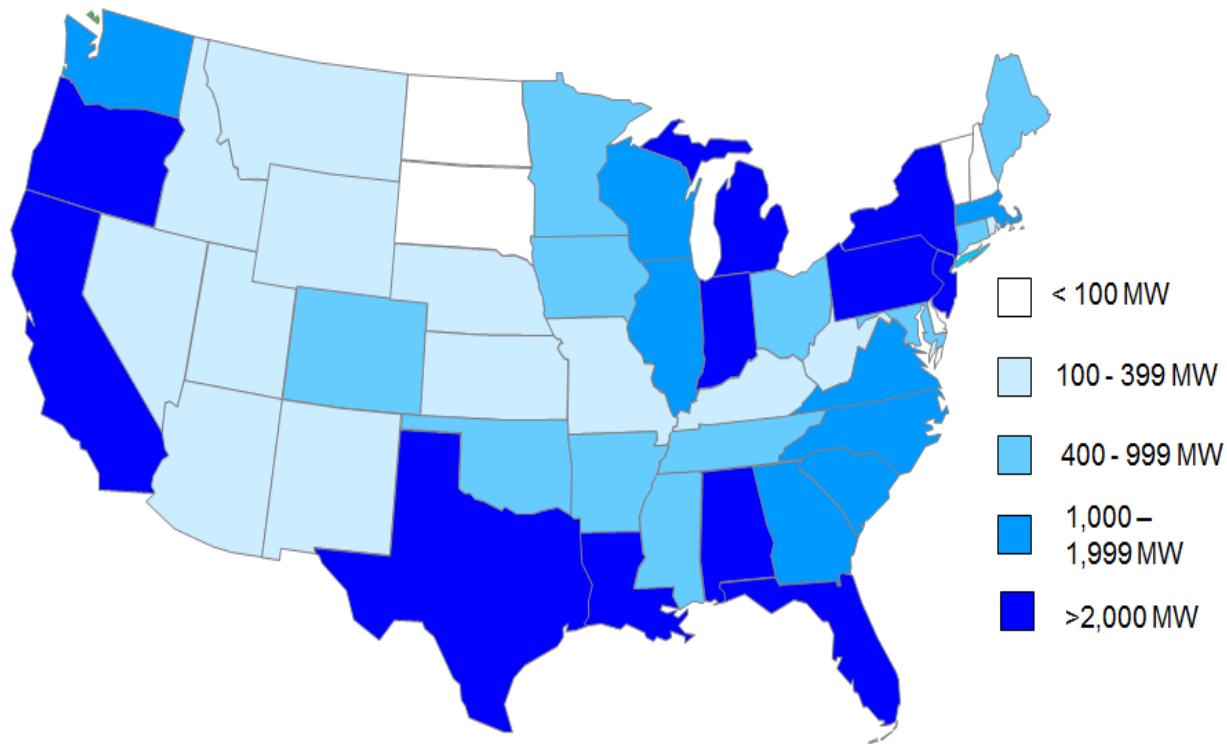


Source: ICF CHP Installation Database



- **82 GW** of installed CHP at 4,100 industrial and commercial facilities (2012)
- 87% of capacity in industrial applications
- 71% of capacity is natural gas fired
- Avoids more than **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **241 million metric tons of CO<sub>2</sub>** compared to separate production

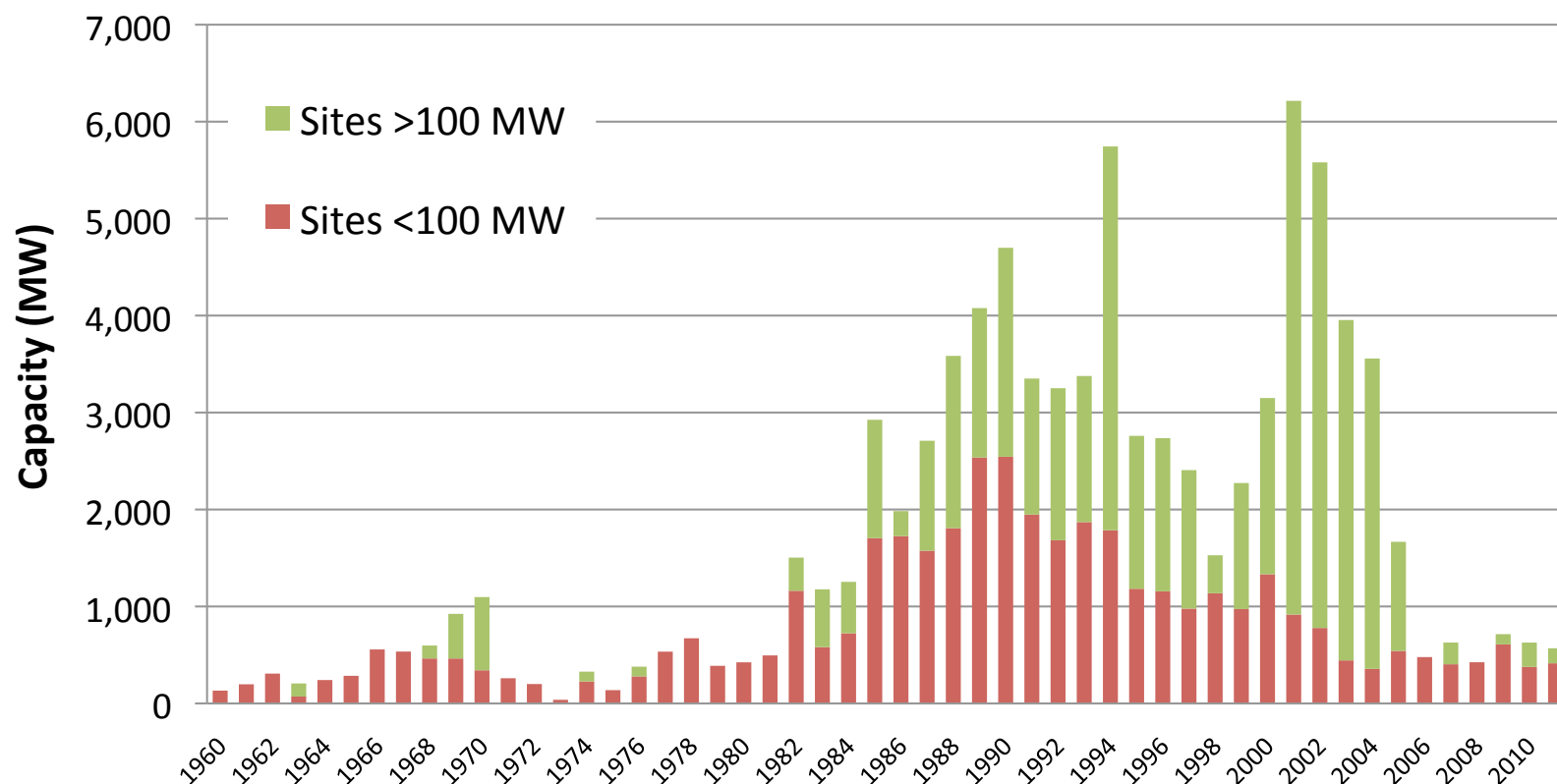
# Existing CHP



- Natural gas based CHP concentrated in Northeast, Gulf Coast, Midwest and California
- Northwest and Southeast have high concentration of sites in forest products and paper industries

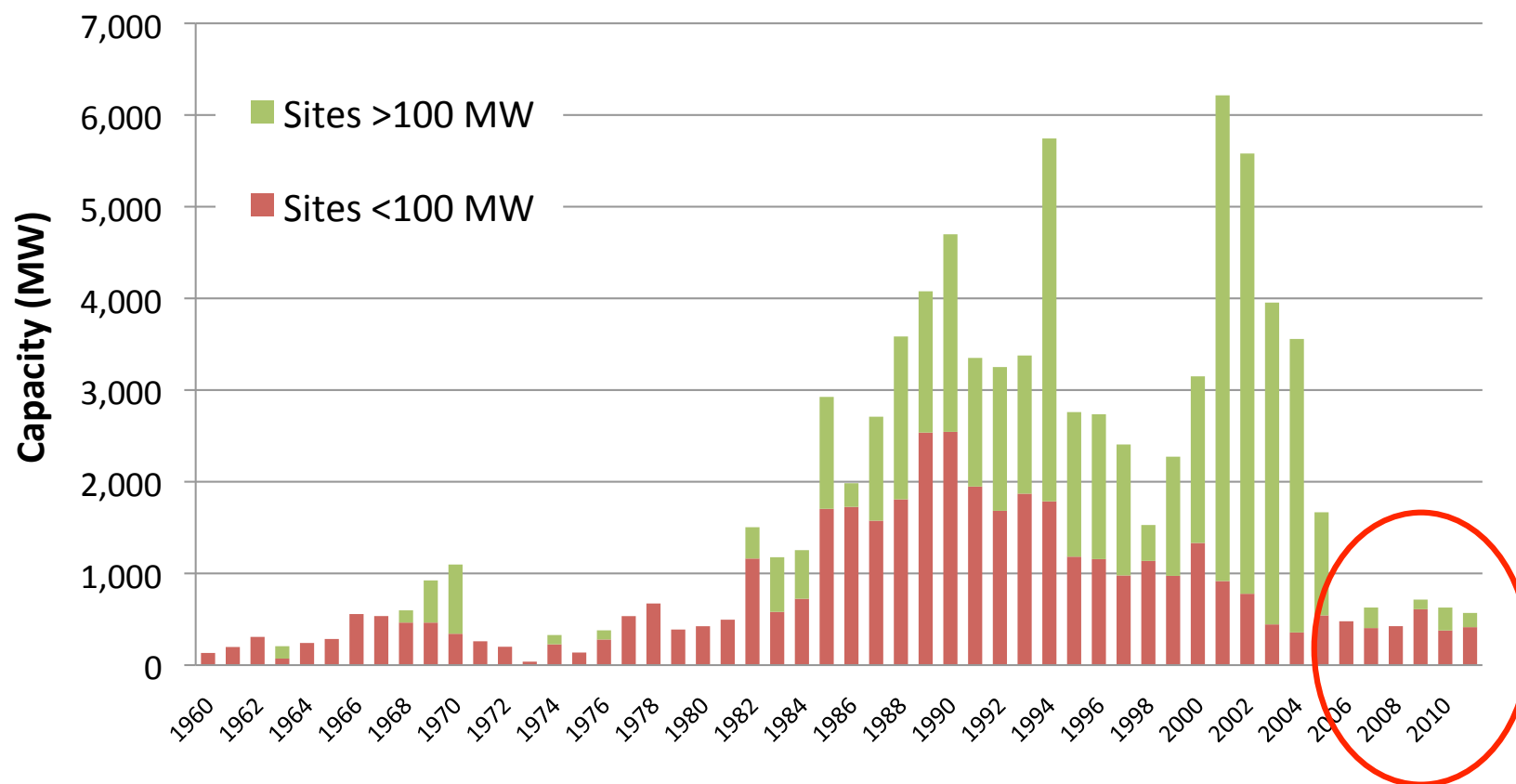
# CHP Annual Additions

## Annual Capacity Additions by Size



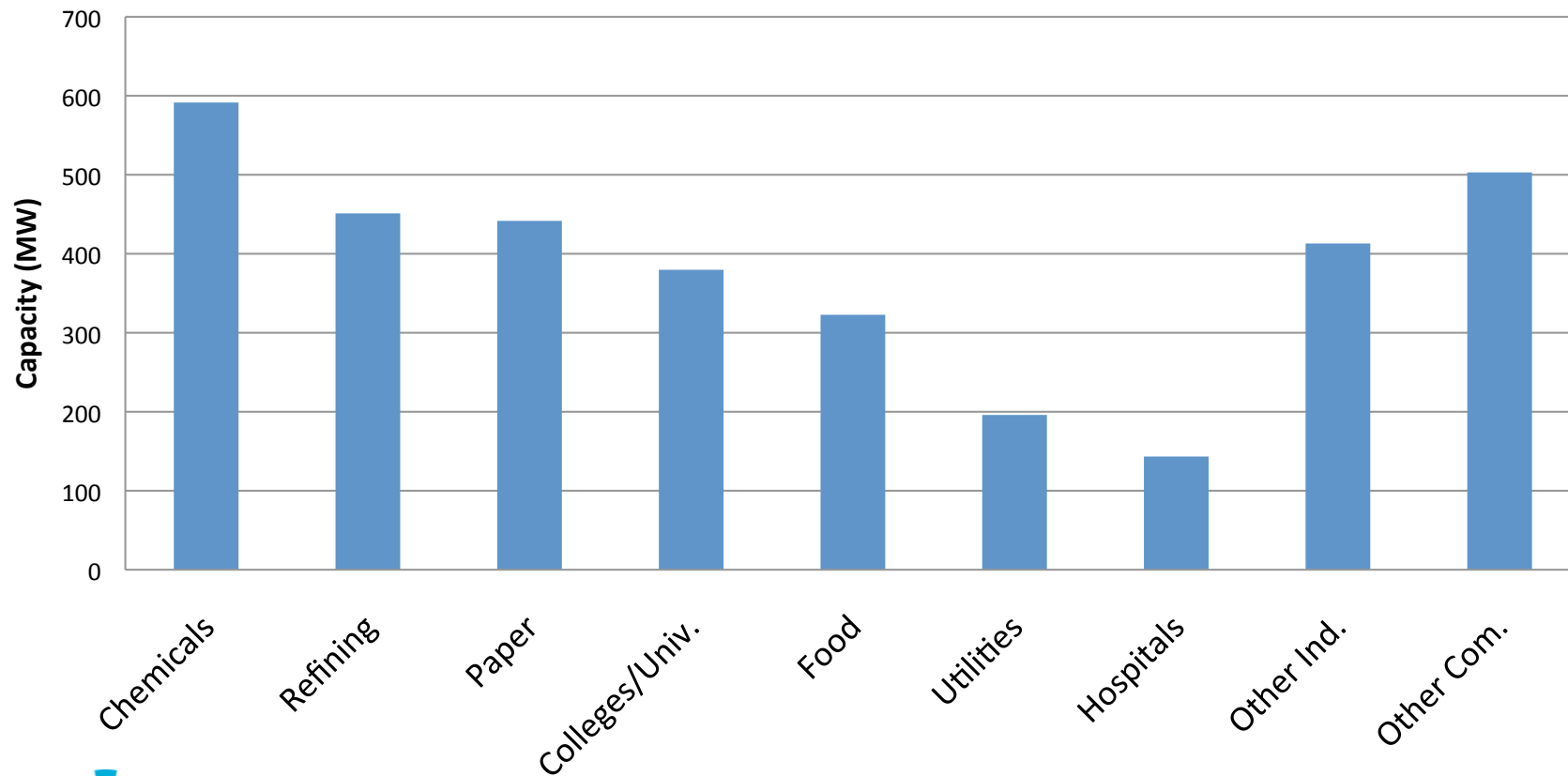
# CHP Annual Additions

## Annual Capacity Additions by Size



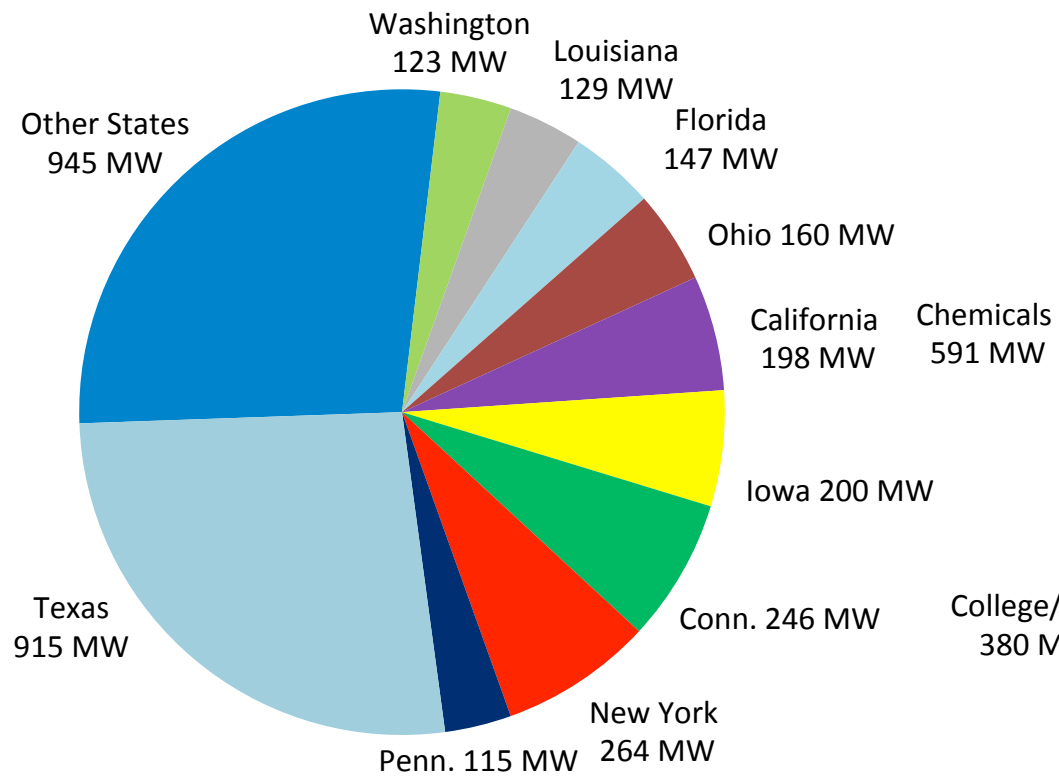
# CHP Additions 2006-2011 (3,442 MW)

Capacity Additions by Application

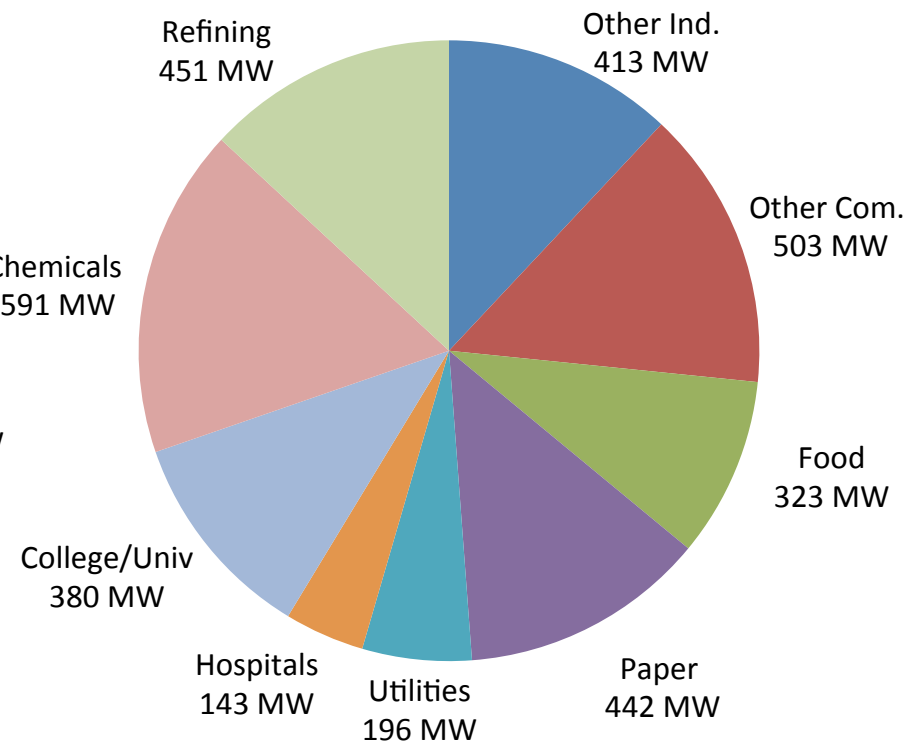


# CHP Additions 2006-2011 (3,442 MW)

## CHP Additions by State



## CHP Additions by Application



# Recent Market Conditions

Most activity in states with favorable regulatory treatment and/or specific incentives

Natural gas CHP in areas with supportable spark spread (Northeast, Texas, California)

Biomass and opportunity fuels in Southeast, Midwest and Mountain

“Hot” applications: universities, hospitals, waste water treatment, other institutional applications

Growing interest in waste heat to power applications

Project inquiries increasing







# CHP Value Proposition

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh <sub>t</sub>	None	None	None
Footprint Required	6,000 ft <sup>2</sup>	1,740,000 ft <sup>2</sup>	76,000 ft <sup>2</sup>	N/A
Capital Cost	\$24 million	\$60.5 million	\$24.4 million	\$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO <sub>2</sub> Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx

Electricity displaces National All Fossil Average Generation (eGRID 2010 ) -

9,720 Btu/kWh, 1,745 lbs CO<sub>2</sub>/MWh, 2.3078 lbs NOx/MWh, 6% T&D losses

Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

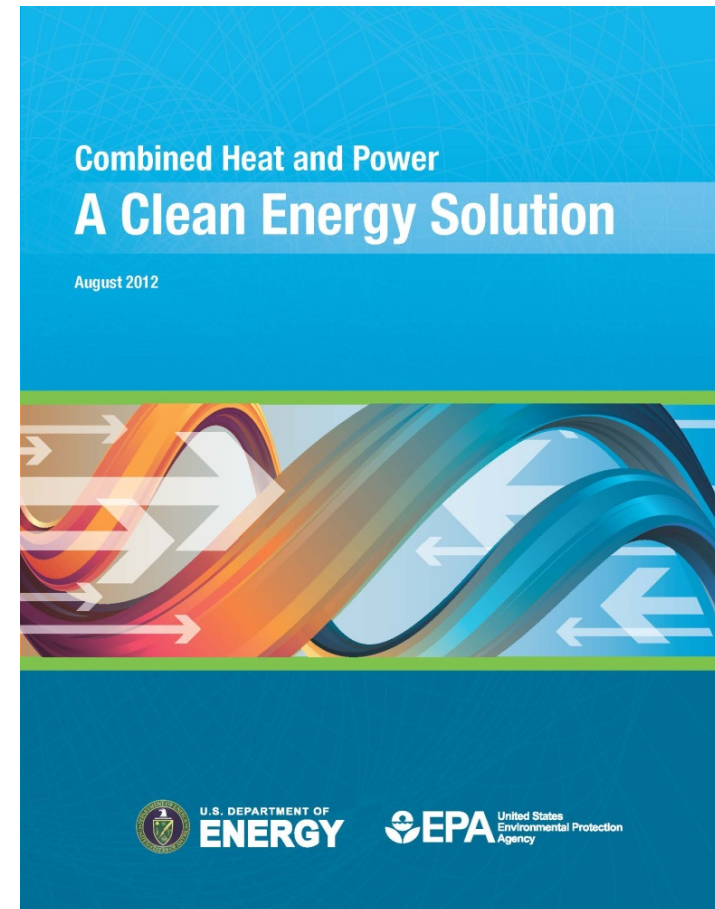
org

# Executive Order – August 30, 2012

“coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost effective industrial CHP in the United States by the end of 2020”

“convene stakeholders, through a series of public workshops, to develop and encourage the use of best practice State policies and investment models that address the multiple barriers to investment in industrial energy efficiency and CHP”

“utilize their respective relevant authorities and resources to encourage investment in industrial energy efficiency and CHP”



# Federal Support for CHP

- Executive Order: “Coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost effective industrial CHP in the United States by the end of 2020”
- DOE focuses technology deployment support for CHP - Regional Clean Energy Application Centers and SEE Action – Regional meetings planned in support of Executive Order
  - [SEEACTION Guide of CHP Policy Best Practices](#)
- EPA recognizes CHP as an efficiency measure under developing greenhouse gas emission standards and promoting output-based options that recognize CHP benefits (ICI Boiler MACT and Utility MACT (MATS))
- FERC Notice of Interest for recognizing ancillary services from small generators



# Proposed Legislative Modifications to ITC

- HR 2750 – Sponsor Jay Inslee (D-WA); 9 Cosponsors
  - Increases eligible equipment cap to 25 MW
  - Eliminates system wide cap of 50 MW
  - Includes waste heat to power
- HR 2783 – Sponsor Paul Tonko (D-NY); 3 Cosponsors
  - Increases the investment tax credit to 30% for highly efficient CHP (70% efficient or greater)
  - Increases eligible equipment cap to 25 MW
  - Eliminates system wide cap of 50 MW
- HR 2812 – Sponsor Paul Tonko (D-NY); 3 Cosponsors
  - Allows *thermal only* waste heat systems to qualify for a 30% investment tax credit
- S 3352 - Bingaman-Snowe
  - Increases CHP ITC to 25 MW, eliminates system size cap
  - Adds Waste Heat to Power as eligible technology

# Legislative Support for CHP

## Clean Energy Standard Act of 2012 (S.2146) -

- Recognizes the additional energy efficiency and greenhouse gas benefits of CHP
- CES for utilities of 24% in 2015 up to 40% in 2035
- CHP awarded additional partial credits to reflect utilization of heat
- WER credited for electricity produced
- CHP qualifies at 50% efficiency (20% electric and 20% thermal)

## Shaheen-Portman (S.1000)

- Updates to building codes
- DOE assessment of DG and RE for buildings
- \$400M lump sum for building EE retrofits
- \$400M annually for 2012-2021 (state revolving loan program)

## Coons-Moran Master Limited Partnership Parity Act (S.3275)

- Clean energy investments qualify for access to lower cost capital with greater liquidity

## Bass-Matheson (HR 4017)

- \$400M lump sum for EE building retrofits for Federal facilities
- Requires coordination of EE R&D
- Requires DOE plan to produce 170 GW from CHP by 2020

# Growing State Support for CHP

- 24 states recognize CHP/WHP in some manner in state Renewable or Energy Efficiency Portfolio Standards
- Massachusetts – CHP a critical part of Advanced Energy Portfolio Standard and Utility Energy Efficiency Programs
- California – Feed in tariff for excess generation from systems under 20 MW
- Ohio – include CHP/WHP in Portfolio Standards; Boiler MACT pilot program
- Maryland – CHP pilot program as part of EmPOWER Maryland energy efficiency program
- Texas – Permit by Rule for CHP systems  $\leq$  15MW
- Louisiana – Guidelines for evaluating CHP in critical government facilities

# Impact of Pending EPA Utility Regulations

- Utility Regulations
  - Mercury and Air Toxics Standards (MATS)
  - Cross-State Air Pollution Rule (CSAPR), formerly “Transport Rule” – (Vacated by the Court)
- Will require compliance investments and/or drive closings of some coal capacity
  - Estimates of shutdown coal capacity range from 20 to 50 GW
- Price impacts will be regional
- Closings could result in localized reliability concerns providing opportunities for CHP



# ICI Boiler MACT

- ICI Boiler NESHAPS (National Emissions Standards for Hazardous Air Pollutants), aka “Boiler MACT”
  - Final rule December 2012
  - Compliance by January 31, 2016 – additional year if upgrades/repowering underway
- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units, replacements for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

# ICI Boiler MACT - Potential CHP Capacity

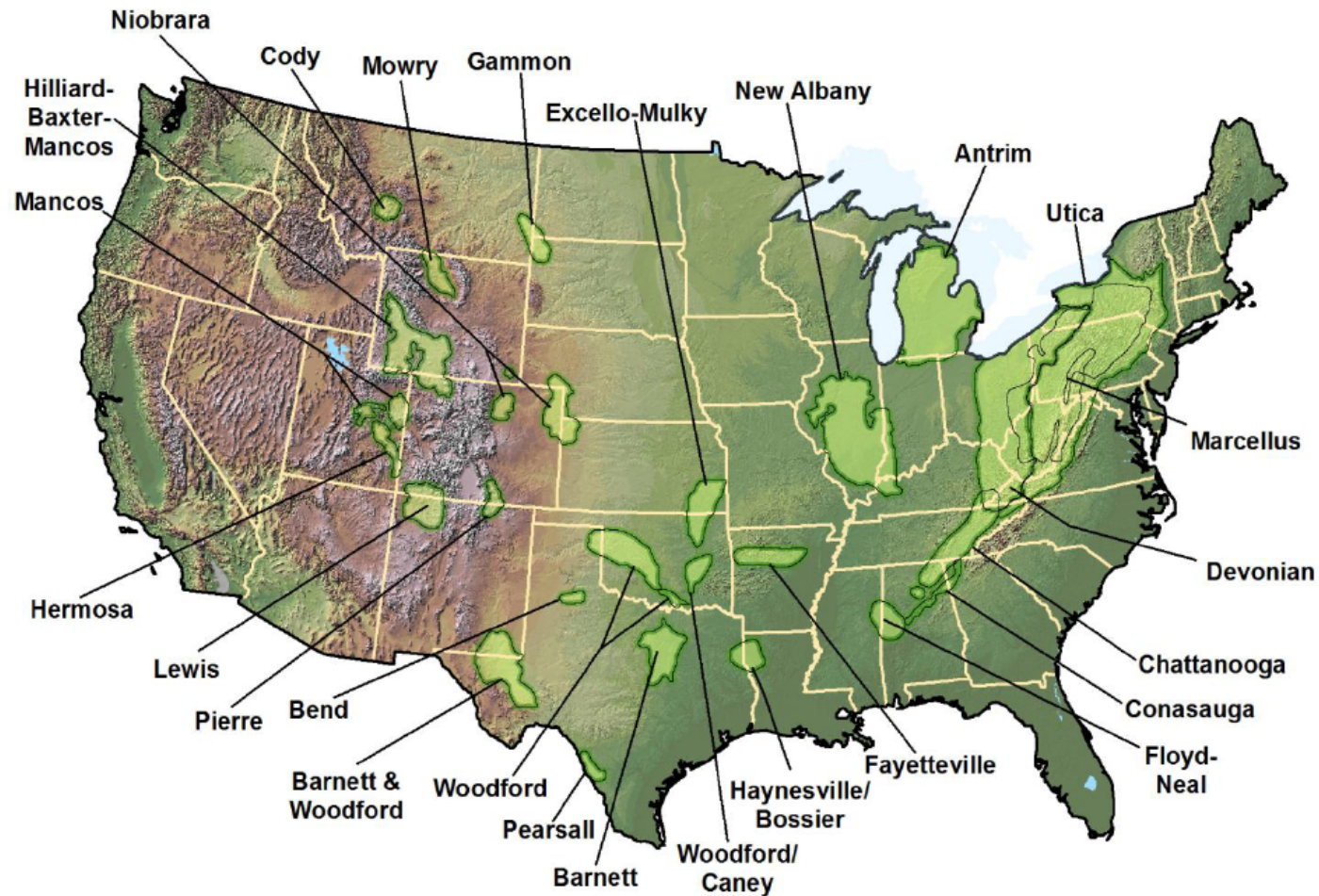
Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)	CO <sub>2</sub> Emissions Savings (MMT)
Coal	332	751	180,525	18,055	114.2
Heavy Liquid	170	367	48,296	4,830	22.9
Light Liquid	109	241	22,133	2,214	10.5
<b>Total</b>	<b>611*</b>	<b>1,359</b>	<b>250,954</b>	<b>25,099</b>	<b>147.6</b>

*The data on this chart is still being refined*

\*Some facilities are listed in multiple categories due to multiple fuel types; there are 567 ICI affected facilities

- CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)
- GHG emissions savings based on 8000 operating hours for coal and 6000 hours for oil, with a CHP electric efficiency of 32%, and displacing average fossil fuel central station generation

# Shale Gas Revolution

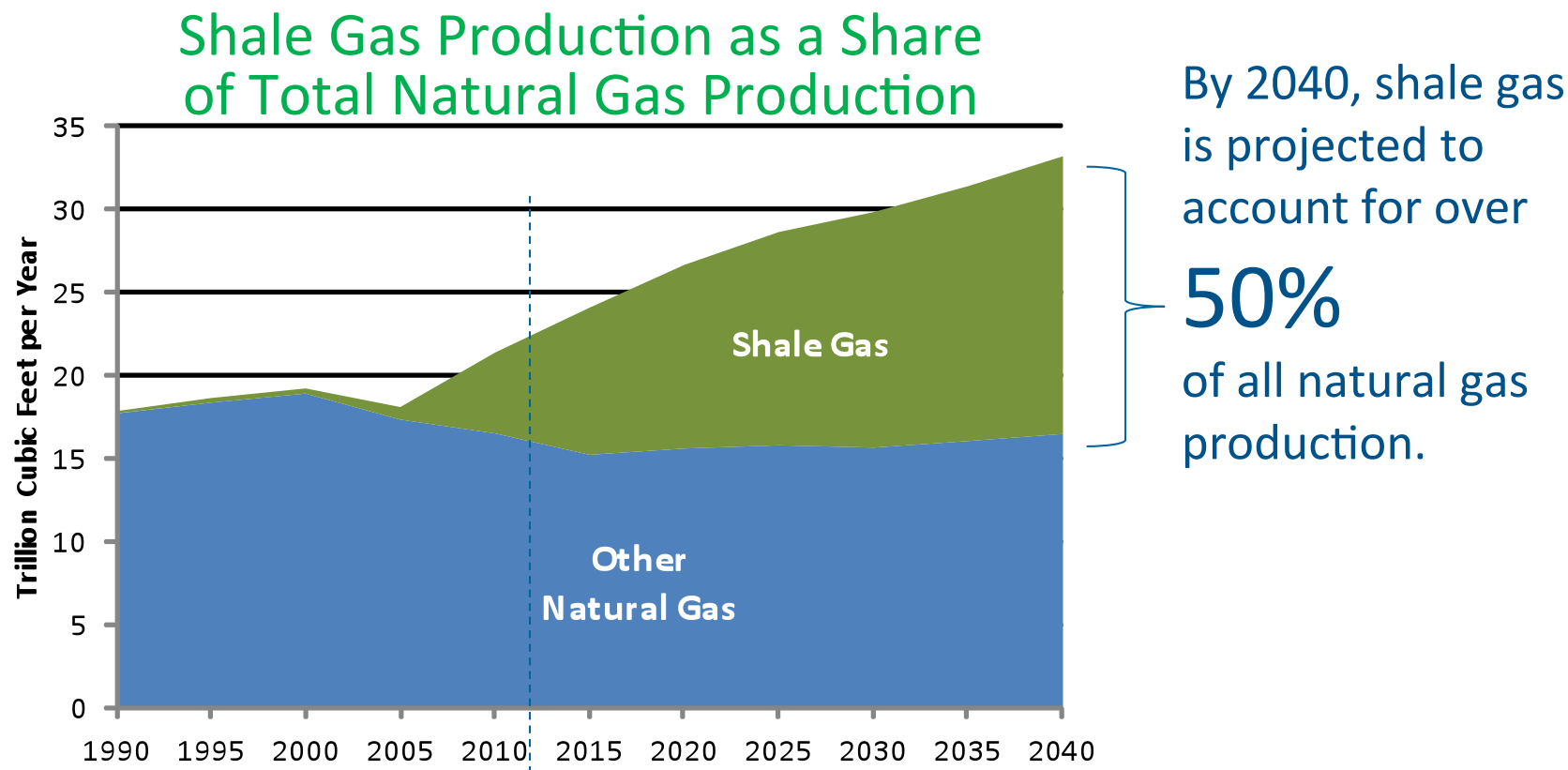


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Productivity**

## U.S. Shale Gas Resources

| [iipnetwork.org](http://iipnetwork.org)

# Shale Gas Revolution



Shale gas production increased by **1400%** from 2005 to 2011.



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Productivity**

| [iipnetwork.org](http://iipnetwork.org)

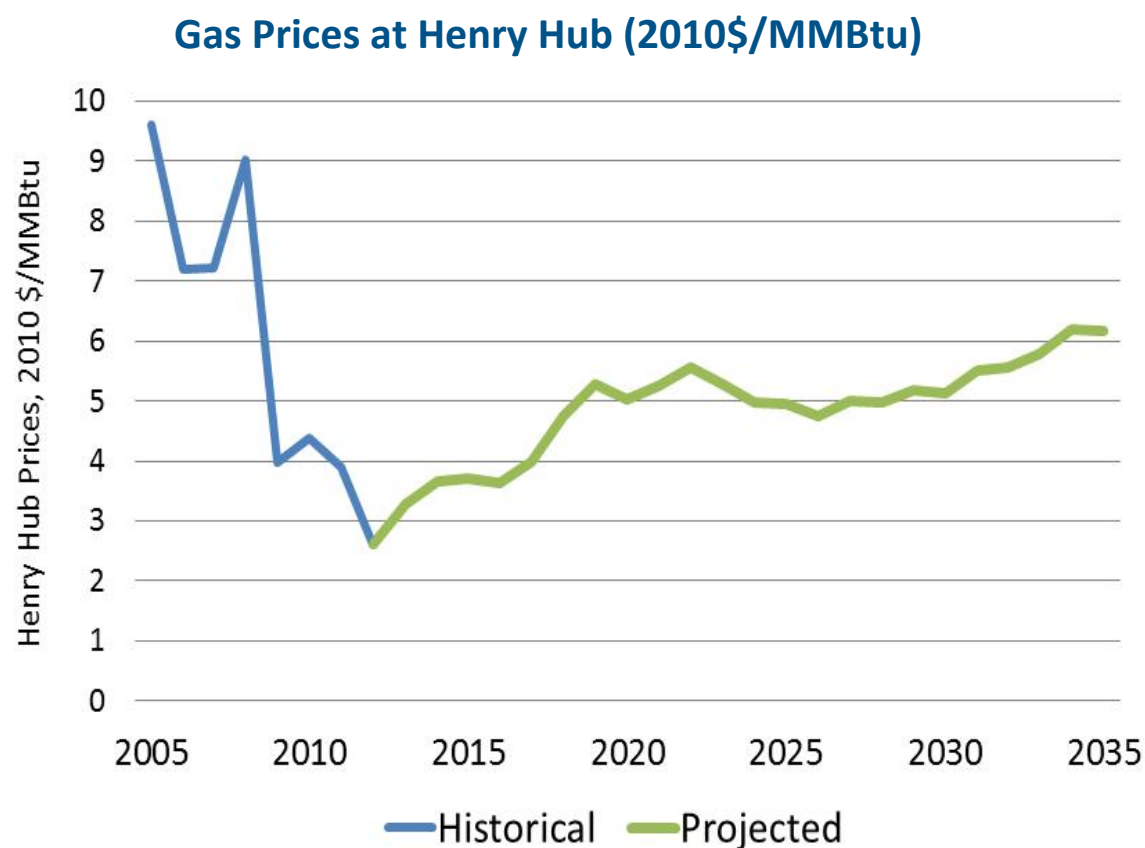
Source: Energy Information Administration (EIA) Annual Energy Outlook 2013

# Modest Gas Prices will Support Expanded CHP Markets

Henry Hub natural gas prices are projected to average between \$4 and \$6 per MMBtu throughout much of the projection.

Growth in gas demand will eventually apply upward pressure on gas prices.

\$4 to \$6 gas prices are sufficient to support the levels of supply development in the projection, but not so high as to discourage market growth.



**Source: ICF Estimates, 2013**

# Critical Infrastructure

*“Critical infrastructure” refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety.”*

Patriot Act of 2001 Section 1016 (e)



## Applications:

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers



# Emergence of Resiliency as a Policy Priority

## Critical Infrastructure Resiliency is a Fast 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

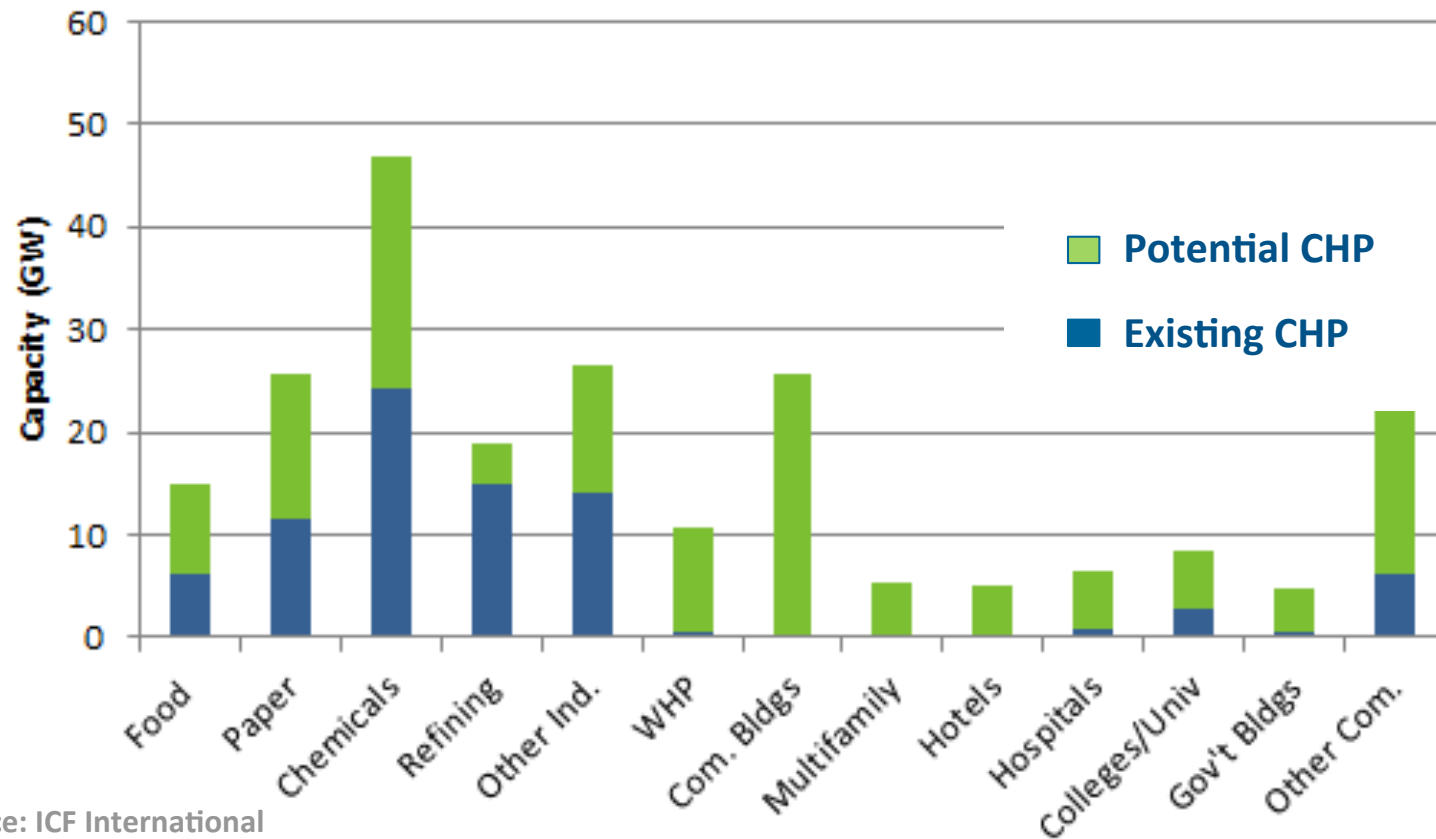
- Business downtime, economic losses (beyond traditional CI definition)
- Cascading problems affecting transport (unavailability of gas in NJ post Sandy)

## 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”

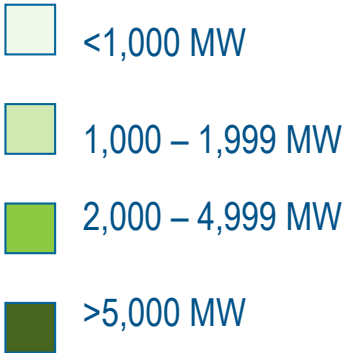
# Technical Potential of 140,000 MW

## Existing CHP vs Technical Potential



Source: ICF International





iipnetwork.org

# Re-shoring U.S. Manufacturing

Rising production of shale gas is improving the prospects for U.S. manufacturing:

*The Economist:*

*“...lower American energy prices could result in 1 [million] more manufacturing jobs...”*

*“Companies such as Dow Chemical...and Vallourec [steel-tube producer]...have announced new investments in America to take advantage of **low gas prices** and to supply extraction equipment.”*



# Policy Issues

- Policy actions for CHP can:
  - Improve overall economics and increase the economic potential, and
  - Reduce perceived risks to users
- Spark spread is a critical factor in economic competitiveness for CHP and could be positively affected by:
  - Reduction in standby charges
  - Payments for CHP grid support
  - Retirements of embedded coal capacity
  - Future increases in electric costs

# Policy Issues

- Possible federal policies
  - Expansion of investment tax credit
  - Include CHP as a qualified resource in national clean energy standards
  - Federal procurement requirements
  - Encourage CHP participation in ancillary services markets
- Possible state policies
  - Include CHP as a qualified resource in clean energy portfolio standards or electric utility energy efficiency resource standards
  - Review tariff structures that prohibit CHP
  - Standardized interconnection requirements
  - Specific incentives for CHP projects
  - Win win win scenarios with utilities?

# Action in the Midwest

## Illinois:

- HB2515/SB2191 - Includes as energy efficiency the reduction in heat rate. This would apply to most DG/CHP.

## Iowa:

- Alliant is proposing to include CHP in their next EEPS 3 year plan.
- SF 315 - Would require IOUs to purchase 2% of their needed power from DG.
- MidAmerican is currently consolidating their three Iowa tariff zones to fall under one tariff. This includes consolidating and updating their standby rate. Midwest CEAC is working with the Iowa Environmental Council and the ELPC to help remove barriers to CHP in this new standby rate.

## Minnesota:

- HF 0955 - Would increase net metering limit to 1 MW.
- HF 0956 - Would allow for aggregate net metering.
- HF 0780 - Waste heat recovered and used as thermal energy and biomass-generated thermal energy permitted to be counted towards energy savings goals.

## Missouri:

- HB 844 - Remove size limits to utility interconnection.

## Ohio:

- HB 315 - Recently passed - Includes WHR and CHP as a part of the energy efficiency portfolio and WHR as a renewable energy source. PUCO is determining the rules.

NGA Policy Academy – Illinois and Iowa

# Thank you

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