

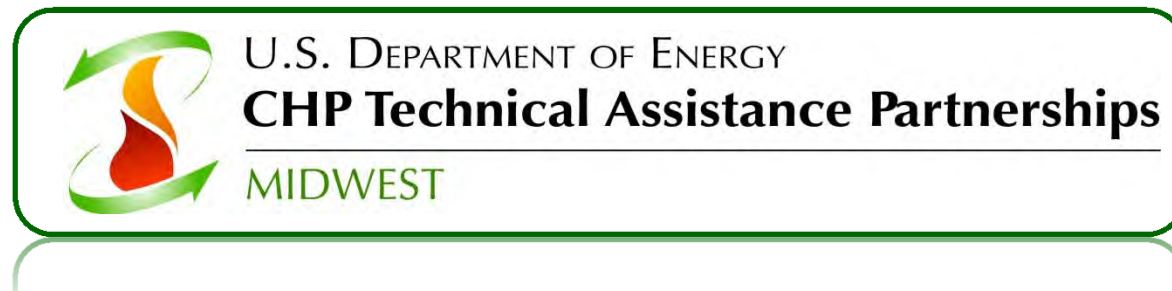
# Combined Heat and Power (CHP) Opportunities for Indiana

Presentation to the Indiana General Assembly  
Interim Study Committee on Energy, Utilities, and  
Telecommunication

September 2, 2015

Graeme Miller

US DOE Midwest CHP TAP



# DOE CHP Technical Assistance Partnerships (CHP TAPs)

DOE's CHP TAPs promote and assist in transforming the market for CHP, waste heat to power, and district energy or microgrid with CHP throughout the United States. Key services include:

- **Market Opportunity Analysis**

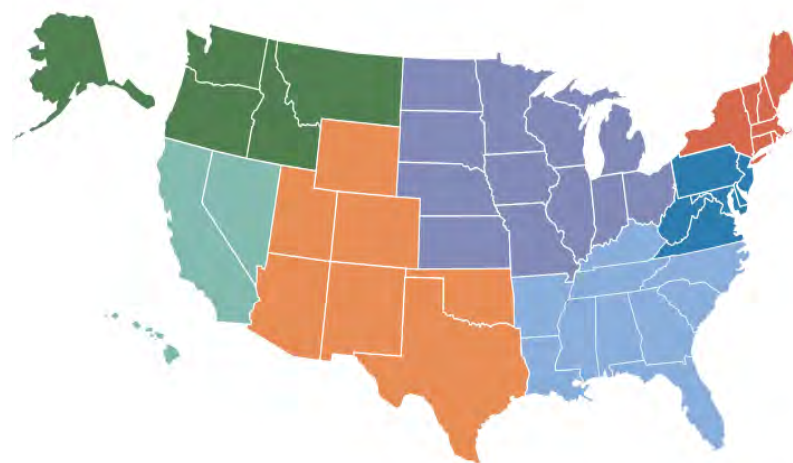
Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors

- **Education and Outreach**

Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

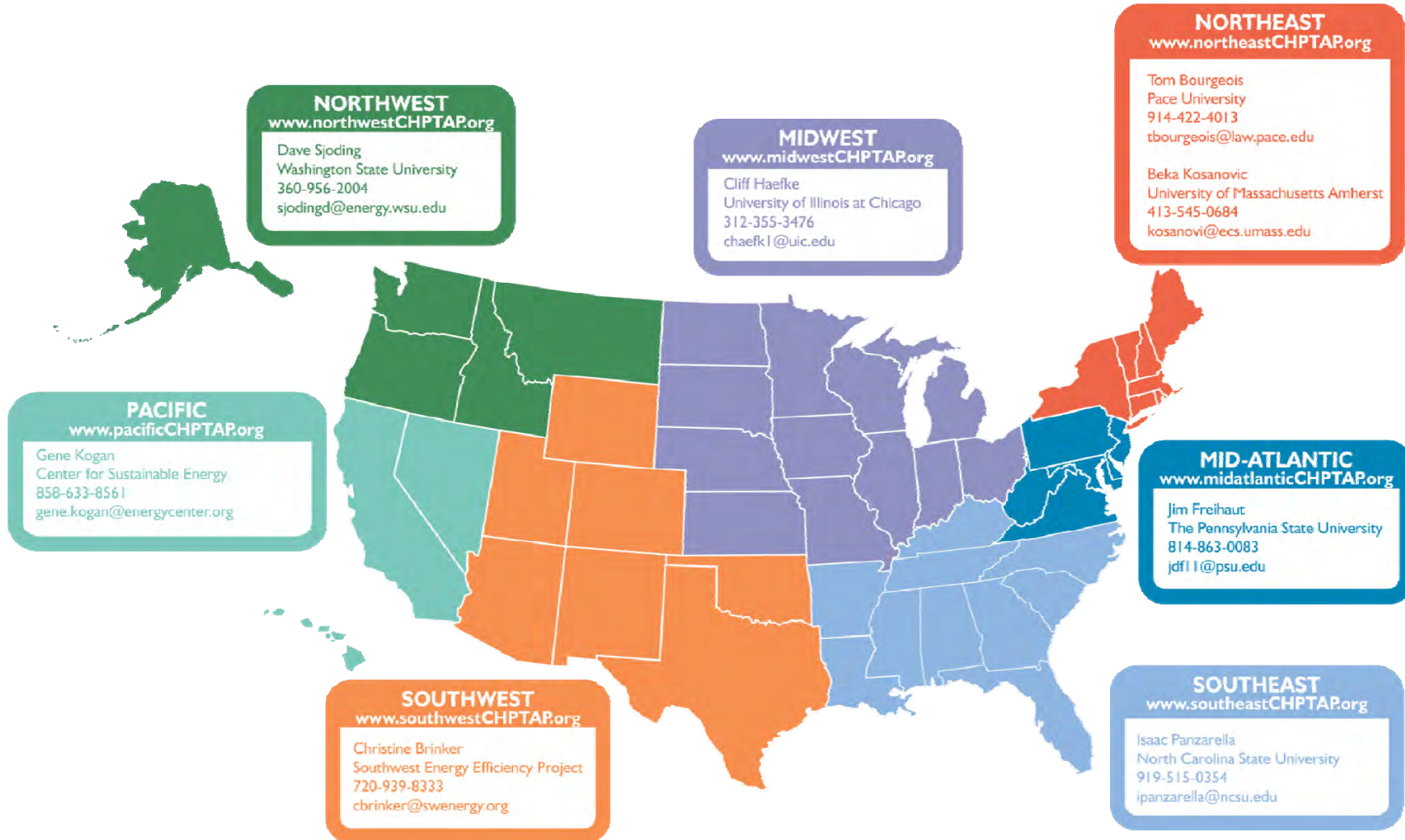
- **Technical Assistance**

Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy or microgrid with CHP in their facility and to help them through the development process from initial CHP screening to installation.



[www.energy.gov/chp](http://www.energy.gov/chp)

# DOE CHP Technical Assistance Partnerships (CHP TAPs)



**DOE CHP Technical Assistance Partnerships (CHP TAPs): Program Contacts**  
chp@ee.doe.gov

Claudia Tighe  
CHP Deployment Program Manager  
Office of Energy Efficiency and Renewable Energy (EERE)  
U.S. Department of Energy  
E-mail: claudia.tighe@ee.doe.gov

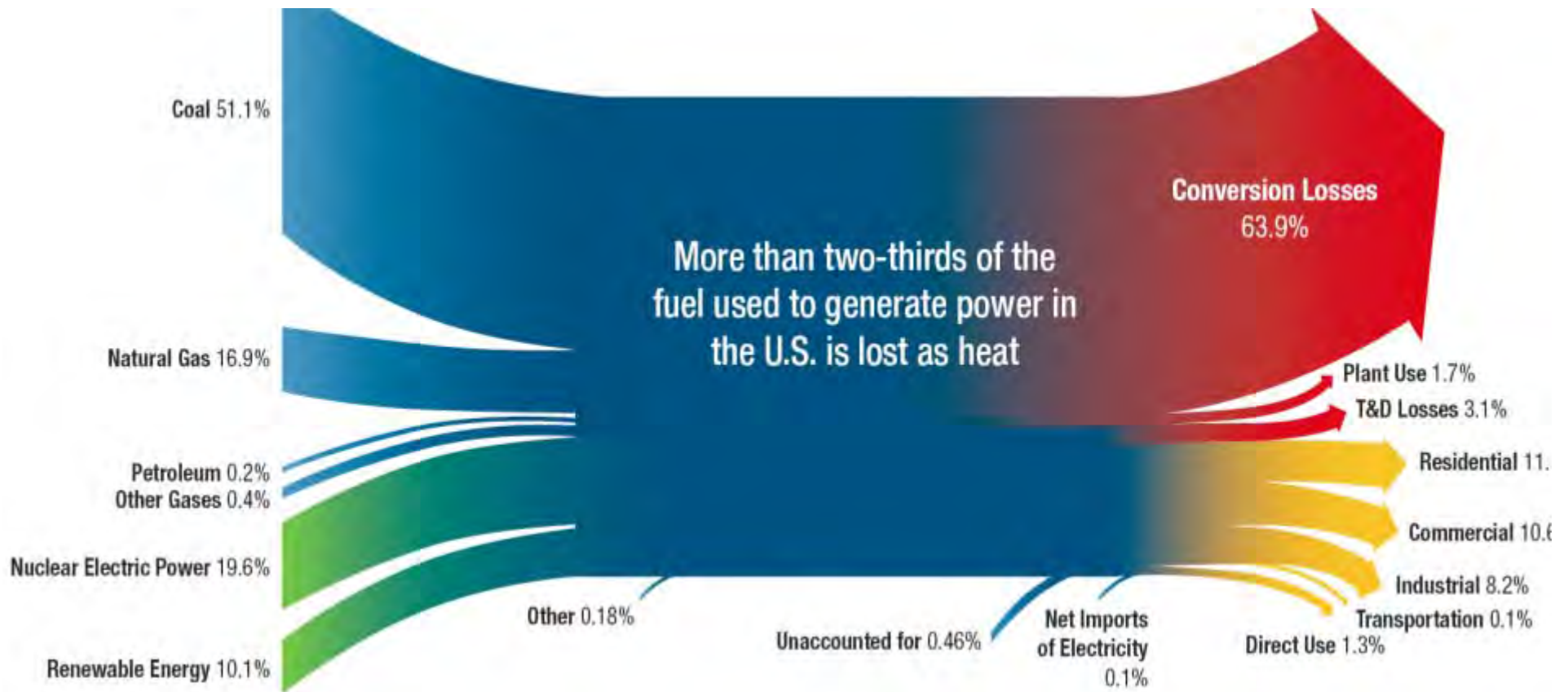
Jamey Evans  
Project Officer, Golden Field Office  
EERE  
U.S. Department of Energy  
E-mail: jamey.evans@go.doe.gov

Patti Welesko Garland  
Enterprise Account POC  
CHP Deployment Program  
EERE, U.S. Department of Energy  
E-mail: Patricia.Garland@ee.doe.gov

Ted Bronson  
DOE CHP TAP Coordinator  
Power Equipment Associates  
Supporting EERE  
U.S. Department of Energy  
E-mail: tbronsonpea@aol.com



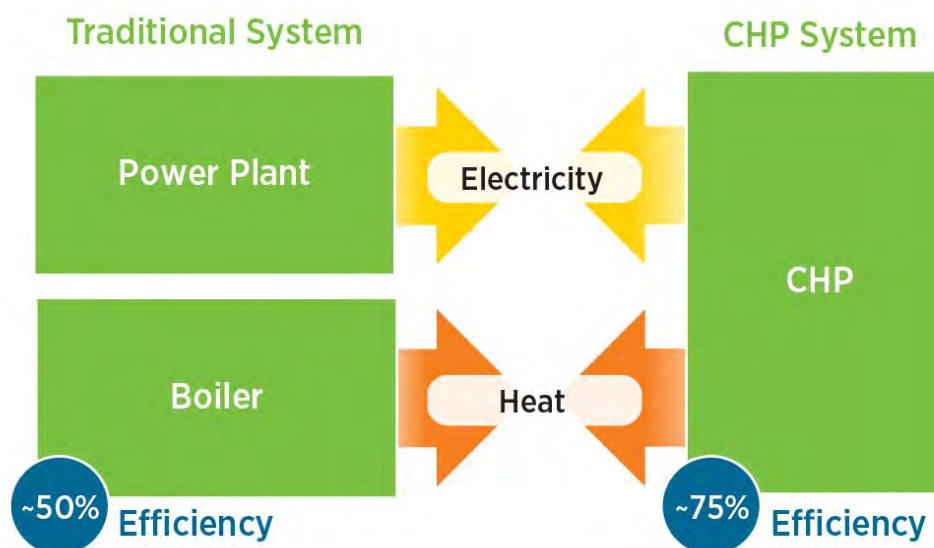
# Fuel Utilization by U.S. Utility Sector



Source: [http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp\\_report\\_12-08.pdf](http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf)

# CHP: A Key Part of Our Energy Future

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification



**CHP provides efficient, clean, reliable, affordable energy – today and for the future.**

# What Are the Benefits of CHP?

- CHP is more efficient than separate generation of electricity and heat
- Higher efficiency translates to lower operating cost, (but requires capital investment)
- Higher efficiency reduces emissions of all pollutants
- CHP can also increase energy reliability and enhance power quality
- On-site electric generation reduces grid congestion and avoids distribution costs

# CHP & Infrastructure Resiliency

*“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
- Telecom and data centers

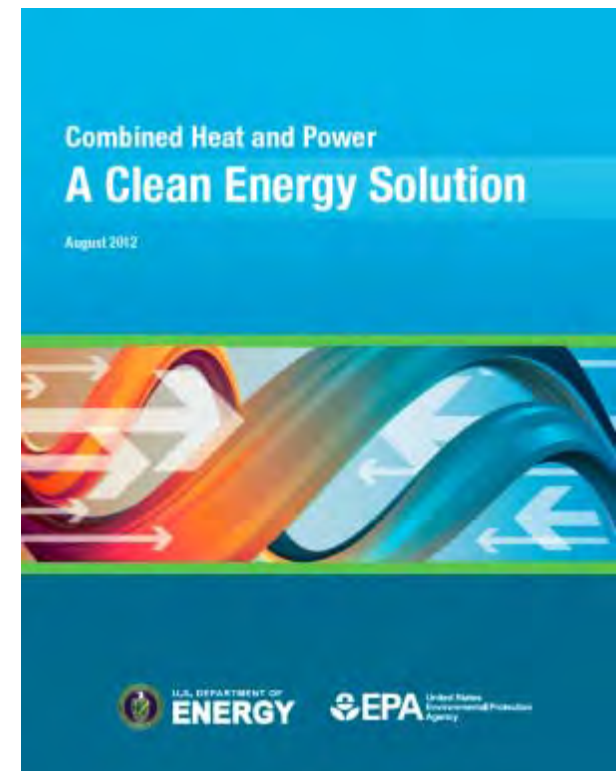
## **CHP** (if properly configured):

- Offers the opportunity to improve Critical Infrastructure (CI) resiliency
- Can continue to operate, providing uninterrupted supply of electricity and heating/cooling to the host facility

# Emerging National Drivers for CHP

- Benefits of CHP recognized by policymakers
  - President Obama signed an Executive Order to accelerate investments in industrial EE and CHP on 8/30/12 that sets national goal of 40 GW of new CHP installation over the next decade
  - State Portfolio Standards (RPS, EEPS), Tax Incentives, Grants, standby rates, etc.
- Favorable outlook for natural gas supply and price in North America
- Opportunities created by environmental drivers
- Utilities finding economic value
- Energy resiliency and critical infrastructure

*DOE / EPA CHP Report (8/2012)*



Executive Order: <http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency>

Report:

[http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp\\_clean\\_energy\\_solution.pdf](http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf)



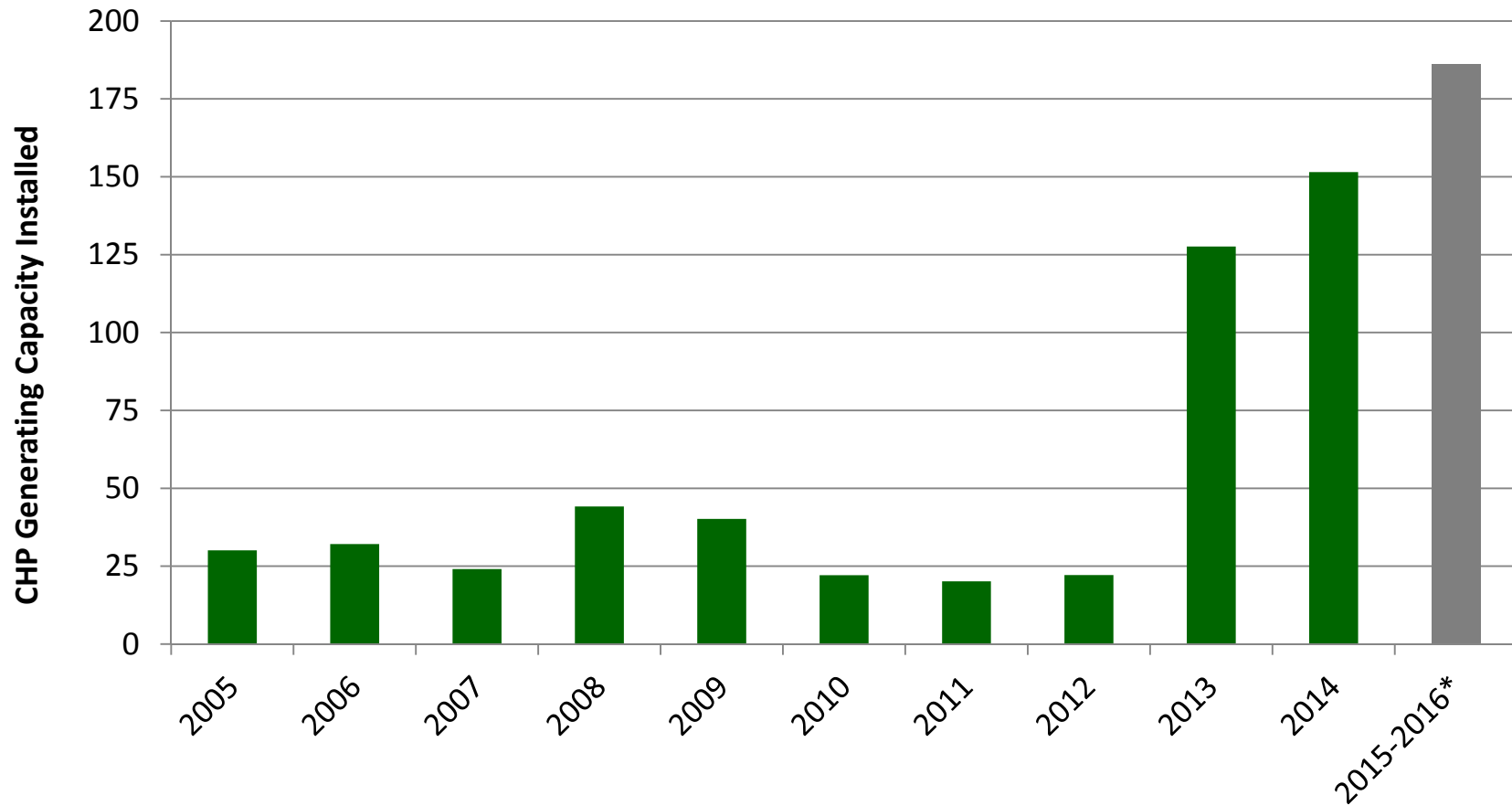
# CHP's Higher Efficiency Results in Energy and Emissions Savings

Category	10 MW CHP	10 MW PV	10 MW Wind	10 MW NGCC
Annual Capacity Factor	85%	22%	34%	70%
Annual Electricity	74,446 MWh	19,272 MWh	29,784 MWh	61,320 MWh
Annual Useful Heat Provided	103,417 MWh <sub>t</sub>	None	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft	N/A
Capital Cost	\$20 million	\$60.5 million	\$24.4 million	\$10 million
Annual Energy Savings, MMBtu	308,100	196,462	303,623	154,649
Annual CO <sub>2</sub> Savings, Tons	42,751	17,887	27,644	28,172
Annual NOx Savings	59.9	16.2	24.9	39.3

Source: *Combined Heat and Power A Clean Energy Solution: August 2012: DOE and EPA*

# CHP is Gaining Traction in the Midwest

Installed CHP Generating Capacity by Year (MW)



Source: DOE CHP Installation Database  
(2005-2013 data) ICF Internal Estimates

\* Preliminary Data based on public information.

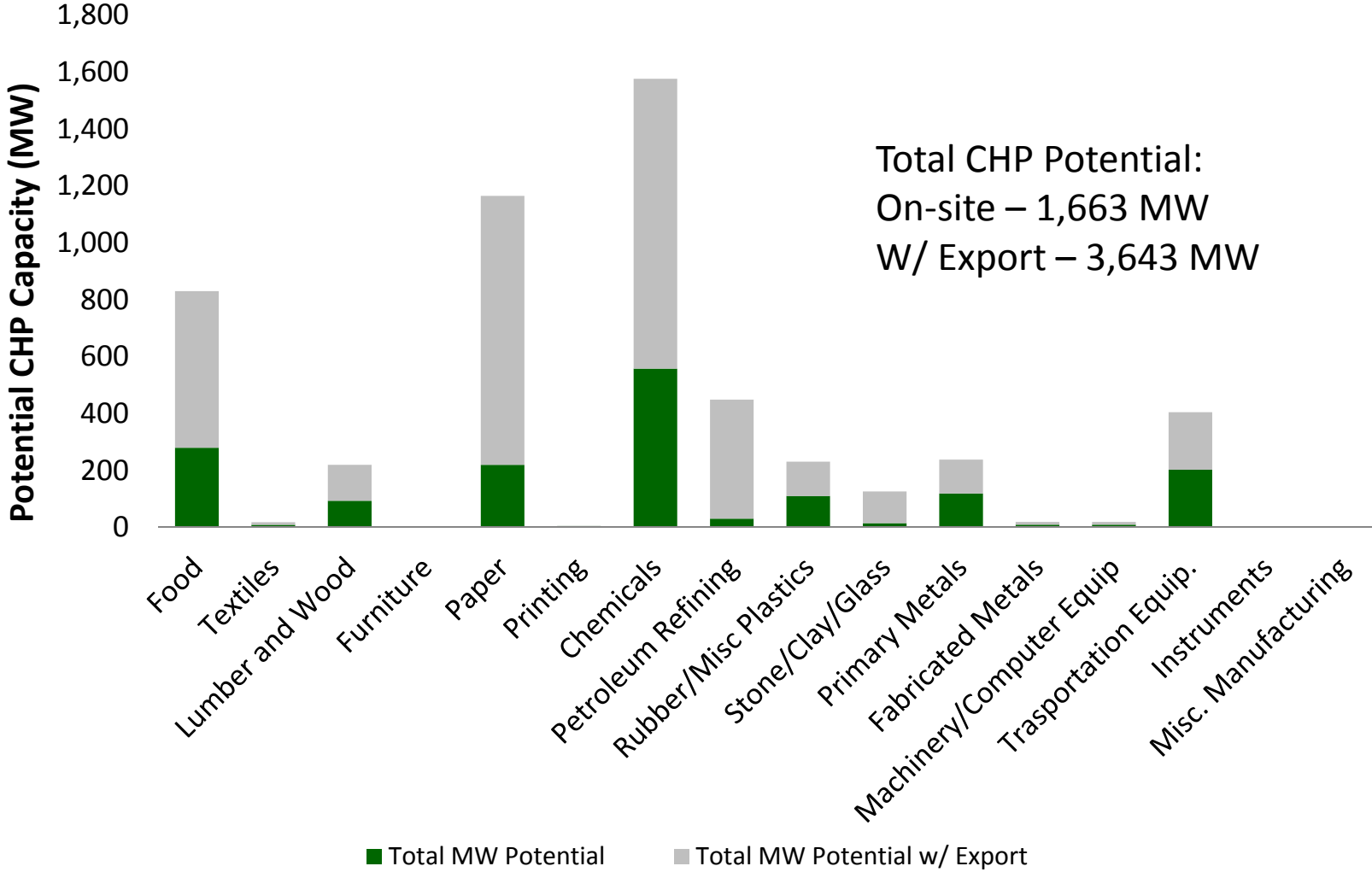
# Some Examples of Midwest State and Utility CHP Activities

- **State Energy Plans**
  - Ohio – presence of CHP in state energy plan increased opportunities
- **Portfolio Standards**
  - Illinois / Ohio – CHP is an eligible Energy Efficiency (EE) technology
  - Iowa – utilities include Waste Heat to Power CHP in the EE Portfolio Standard (EEPS)
  - Ohio – includes Waste Heat to Power CHP in EEPS and Renewable Portfolio Standard
  - Minnesota – holding stakeholder meetings to discuss CHP in their Conservation Improvement Program (CIP)
- **Utility CHP Programs**
  - Illinois – DCEO Public Sector CHP Pilot Program – Up to \$2M per project; 5 projects awarded
  - Illinois – ComEd CHP Program – Up to \$2M per project and \$25K for studies
  - Ohio – Dayton Power & Light – Up to \$500K per project and \$10K for studies
- **Standby Rates**
  - Minnesota – potential docket on standby rates this year
  - Missouri – Ameren-Missouri holding stakeholder workshops
  - Iowa – Mid-American updated utility rates in 2014

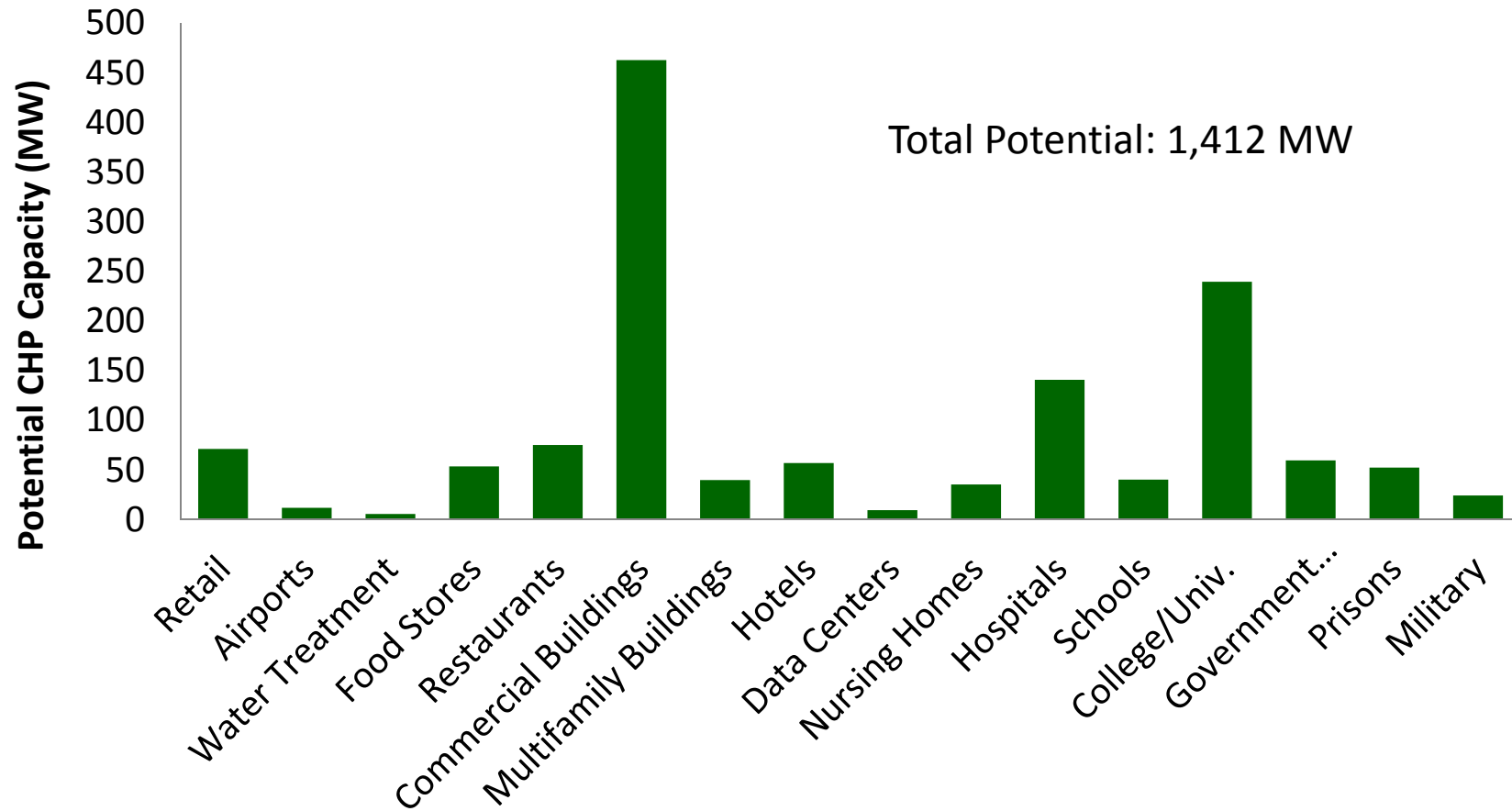
# Installed CHP Summary – Indiana & U.S.

Org. Type	Indiana		U.S.	
	# of Sites	Installed CHP Capacity (MW)	# of Sites	Installed CHP Capacity (MW)
Agriculture	6	8.6	225	1,027.4
Amusement/Recreation	2	0.3	125	107.9
Chemicals	1	4.9	272	23,203.2
Colleges/Univ.	4	80.3	270	2,672.2
District Energy	1	3.4	49	2,626.4
Food Processing	4	26.6	253	6,726.2
Hospitals/Healthcare	2	3.5	221	856.7
Machinery	1	3.5	22	240.4
Misc. Education	1	1.1	5	4.7
Misc. Manufacturing	2	0.2	55	314.3
Primary Metals	9	1,492.0	54	4,120.4
Refining	1	660.6	104	15,998.2
Restaurants	1	0.1	14	2.2
Schools	1	1.8	252	68.7
Solid Waste Facilities	2	6.6	84	755.3
Transportation Equipment	3	29.6	24	1,270.9
Wastewater Treatment	1	0.1	211	707.4
Other	-	-	2,198	22,025.2
<b>Total</b>	<b>42</b>	<b>2,323.1</b>	<b>4,438</b>	<sup>12</sup> <b>82,727.9</b>

# Indiana Industrial CHP Technical Potential



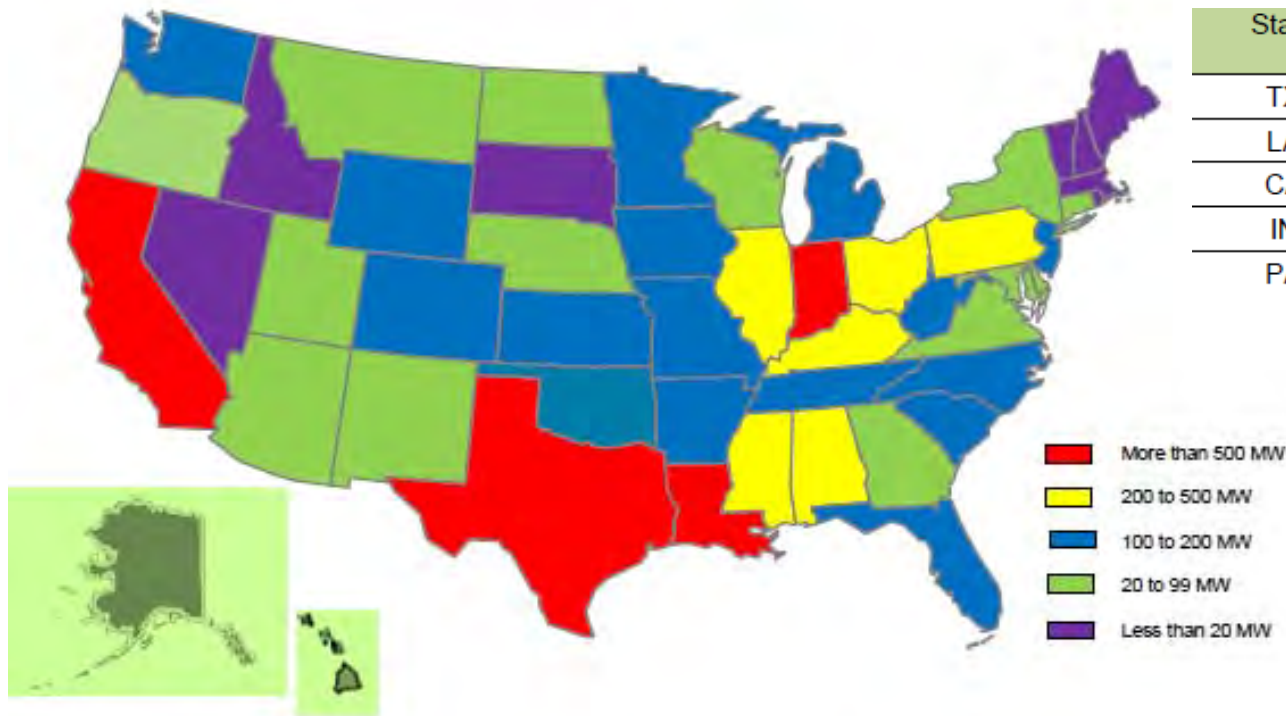
# Indiana Commercial CHP Technical Potential



Source: ICF Internal Estimates 2014

# Indiana Waste Heat to Power CHP Technical Potential

- 501.4 MW of Waste Heat to Power CHP Technical Potential In Indiana
- 74 potential Waste Heat to Power CHP sites identified



State	Capacity (MW)	Share of Total
TX	1,515.19	17.1%
LA	883.8	10.0%
CA	763.4	8.6%
IN	501.4	5.7%
PA	482.6	5.5%

Average project payback is 3.5 years for Indiana WHP

Source: Oak Ridge National Laboratory, "Waste Heat to Power Market Assessment," March 2015. <http://info.ornl.gov/sites/publications/files/Pub52953.pdf>

## CHP System Highlights:

Conversion from Coal to Natural Gas

## SABIC Innovative Plastics Mt. Vernon, IN

Status: **Under Development**

Capacity: **80 MW**

Fuel: **Natural Gas**

Prime Mover:

Expected Completion: **2017**

*The CHP facility is expected to reduce annual emissions by an amount equivalent to 110,000 automobiles.*



Source: [https://www.sabic-ip.com/gep/en/NewsRoom/PressReleasePrint/december\\_03\\_2013\\_sabicsinnovativeplastics.html](https://www.sabic-ip.com/gep/en/NewsRoom/PressReleasePrint/december_03_2013_sabicsinnovativeplastics.html)



# CHP System Highlights:

Waste Heat to Power CHP Project

## CokeEnergy – ArcelorMittal USA East Chicago, Indiana

Capacity: **95 MW**

Fuel: **Waste Heat**

Prime Mover: **Steam Turbine**

Installed: **1998**



SunCoke Energy Coke Battery



Cokenery's Installed WHP System at ArcelorMittal

### *Fuel Free System*

*Offsets ~50% of the plant's process heating needs and ~25% of its power requirements*

## CHP System Highlights:

Utility & Industry Partnership

### WE Energies (Domtar Paper Mill)

Rothschild, WI

Capacity: **50 MW**

Fuel: **Biomass**

Prime Mover: **Boiler / Steam Turbine**

Installed: **2013**

*Expected to create approx. 400 construction jobs and 150 permanent jobs in the surrounding community, including independent wood suppliers and haulers from northern and central Wisconsin who would secure waste wood for the project.*

*"The addition of the biomass plant enables us to produce renewable energy on demand. That benefit is simply not available with solar or wind generation."*

*Gale Klappa, the chairman, president and CEO of Milwaukee-based We Energies.*



Source: <http://www.jsonline.com/business/power-plant-to-run-on-wisconsin-biomass-b9985790z1-221960911.htm> |  
<http://www.bizjournals.com/milwaukee/news/2013/11/12/we-energies-launches-biomass-plant.htm> |  
<http://www.risiinfo.com/techchannels/powerenergy/Domtar-partners-for-250M-biomass-power-plant-at-Rothschild-WI-paper-mill.html>

# CHP System Highlights:

University Campus District Energy System

## University of Minnesota

Minneapolis, MN

Status: **Under Development**

Capacity: **25 MW**

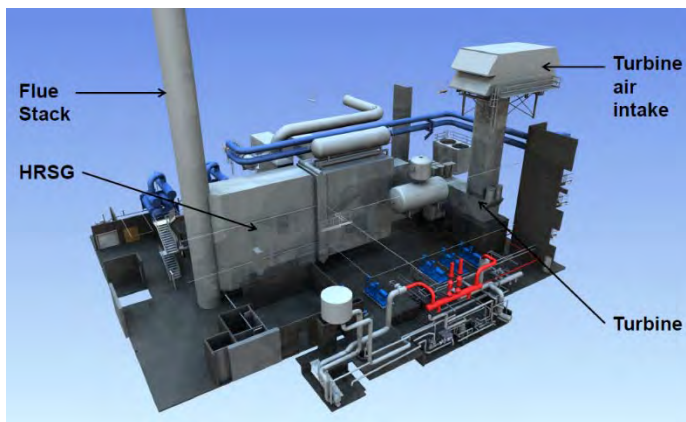
Fuel: **Natural Gas**

Prime Mover: **Combustion Turbine**

Expected Completion: **2016**



Minimal changes will need to be made to the existing building's exterior



Rendering of Turbine and Heat Recovery Steam Generator

***8 Year Return on Investment***

***Decreases the Twin Cities Campus  
carbon footprint by 15%***

Source: <http://www1.umn.edu/regents//docket/2012/february/heatandpower.pdf>

## CHP System Highlights:

Increased ENERGY STAR Building Score

## ProMedica Health System - Wildwood

Toledo, OH

Capacity: **130 kW**

Fuel: **Natural Gas**

Prime Mover: **Microturbines**

Installed: **2013**



*Benefits include a reduction in annual energy costs and greenhouse gas emissions as well as a higher ENERGY STAR building score*

# Concluding Thoughts

- Significant CHP potential in Indiana can spur on and maintain Indiana industry growth, jobs, resiliency, etc.
- Engage US DOE Midwest CHP TAP on project specific CHP technical assistance opportunities

## Contact Information:

US DOE Midwest CHP TAP  
[www.MidwestCHPTAP.org](http://www.MidwestCHPTAP.org)

Graeme Miller  
Policy Analyst  
(312) 996-3711  
[gmille7@uic.edu](mailto:gmille7@uic.edu)

Cliff Haefke  
Director  
(312) 355-3476  
[chaefk1@uic.edu](mailto:chaefk1@uic.edu)



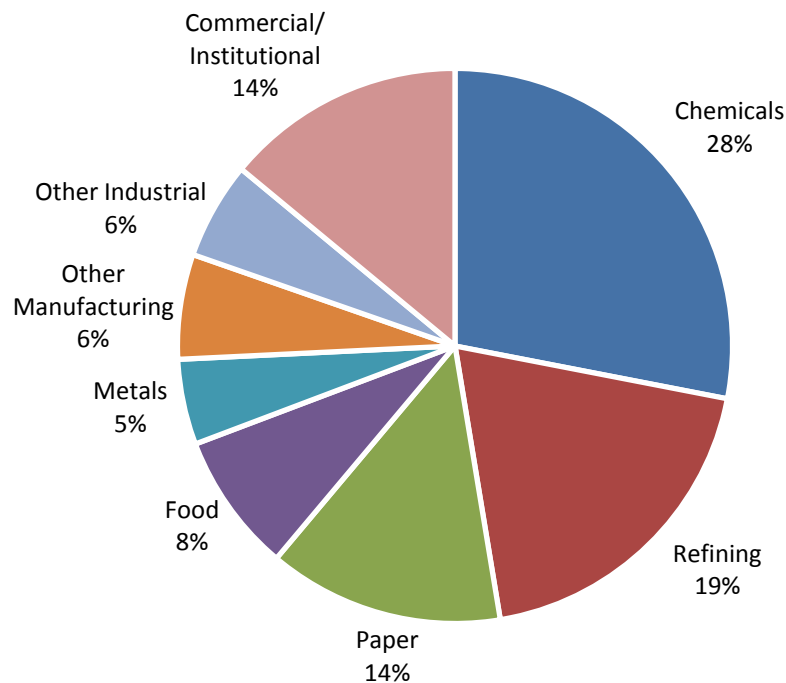
U.S. DEPARTMENT OF ENERGY

**CHP Technical Assistance Partnerships**

MIDWEST

# CHP Today in the United States

Existing CHP Capacity (MW)



- **82.7 GW** of installed CHP at over 4,400 industrial and commercial facilities
- 8% of U.S. Electric Generating Capacity; 14% of Manufacturing
- 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

Sources: DOE/ICF CHP Installation Database (U.S. installations as of December 31, 2014);

EIA <http://www.eia.gov/todayinenergy/detail.cfm?id=8250>

Energetics, "US Manufacturing Energy Use and Greenhouse Gas Emissions Analysis, November 2012"

# Large CHP Users in Indiana & U.S. Facilities

## Largest CHP Users (Nationwide)

- Chemicals (23,203 MW)
- Petroleum Refining (15,998 MW)
- Commercial/Institutional (11,578 MW)
- Pulp and Paper (11,363 MW)
- Food Processing (6,726 MW)

## Largest CHP Users (Indiana)

- Primary Metals (1,492 MW)
- Petroleum Refining (660 MW)
- Colleges / Universities (80 MW)
- Transportation Equipment (29 MW)
- Food Processing (26 MW)

Source: US DOE Combined Heat and Power Database,  
<https://doe.icfwebservices.com/chpdb/>