



Market Transformation and CHP: What Are We Aiming For?

March 22, 2016

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What Is Combined Heat and Power?

Combined Heat and Power is an integrated energy system that:

1. Generates electrical and/or mechanical power
2. Recovers waste heat for:
 - Process heating and/or cooling,
 - Space heating and/or cooling,
 - Dehumidification
3. Is located at or near a factory or building
4. Can utilize a variety of technologies and fuels. Major technologies include:
 - Reciprocating engines, turbines, microturbines, and fuel cells.



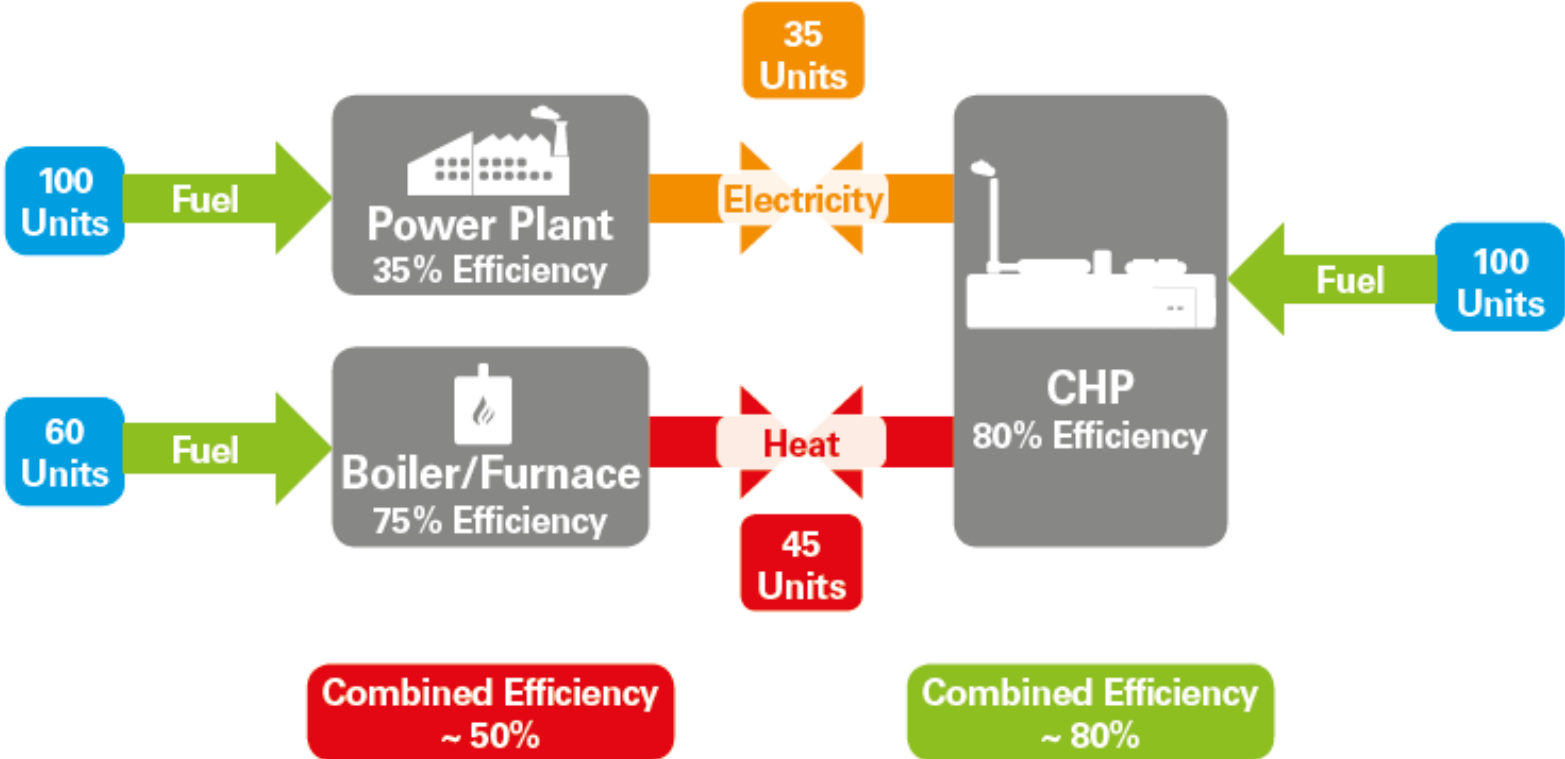
What Are the Benefits of CHP?

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



How Does CHP Work?

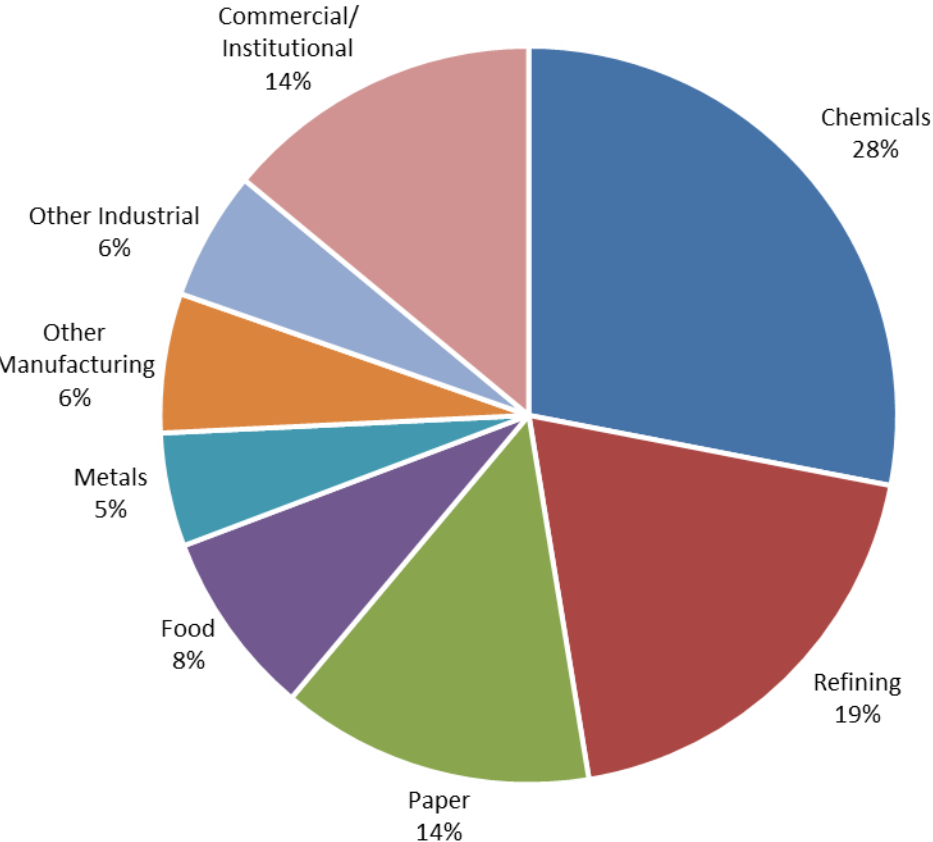
Comparison of Energy Efficient CHP to Typical Utility



Fuel Savings = Financial Savings and Emission Reduction

CHP Installed in All Sectors

Existing CHP Capacity (MW)

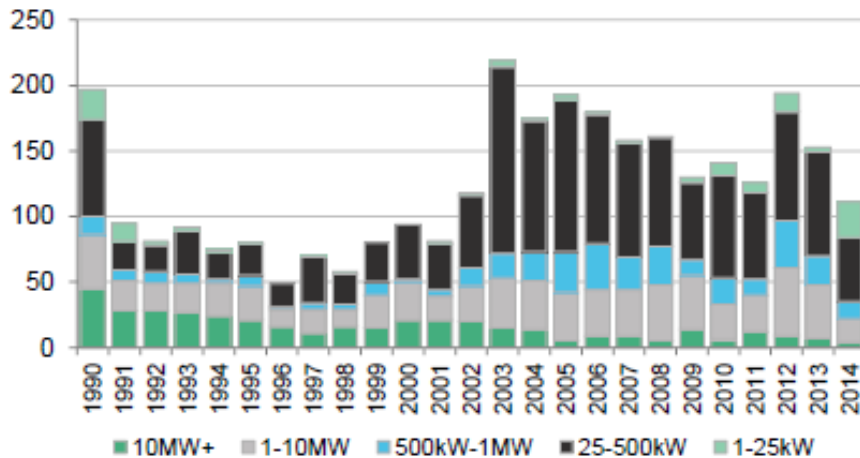


- **82.7 GW** of installed CHP at over 4,400 industrial and commercial facilities
- 8% of U.S. Electric Generating Capacity⁵
- Avoids more than **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **241 million metric tons of CO₂** compared to separate production

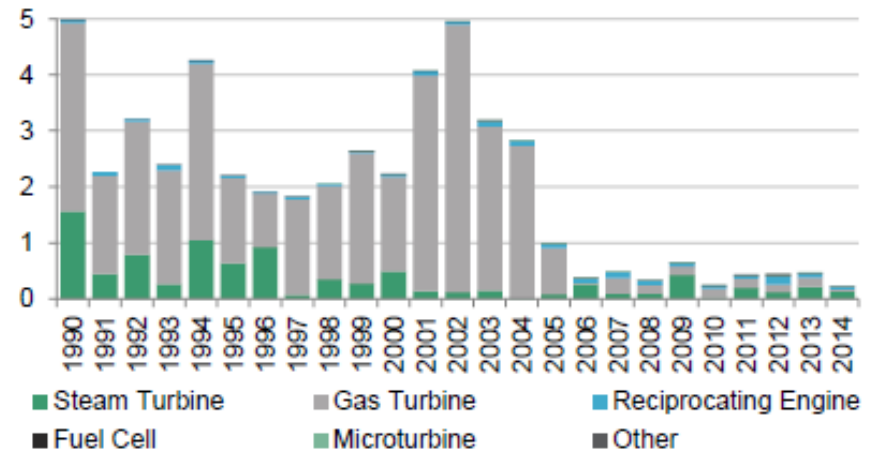
Sources: DOE/ICF CHP Installation Database (U.S. installations as of December 31, 2014); EIA <http://www.eia.gov/todayinenergy/detail.cfm?id=8250> Energetics, "US Manufacturing Energy Use and Greenhouse Gas Emissions Analysis, November 2012"

The CHP Install Story

US Annual CHP build by system size (# of projects)



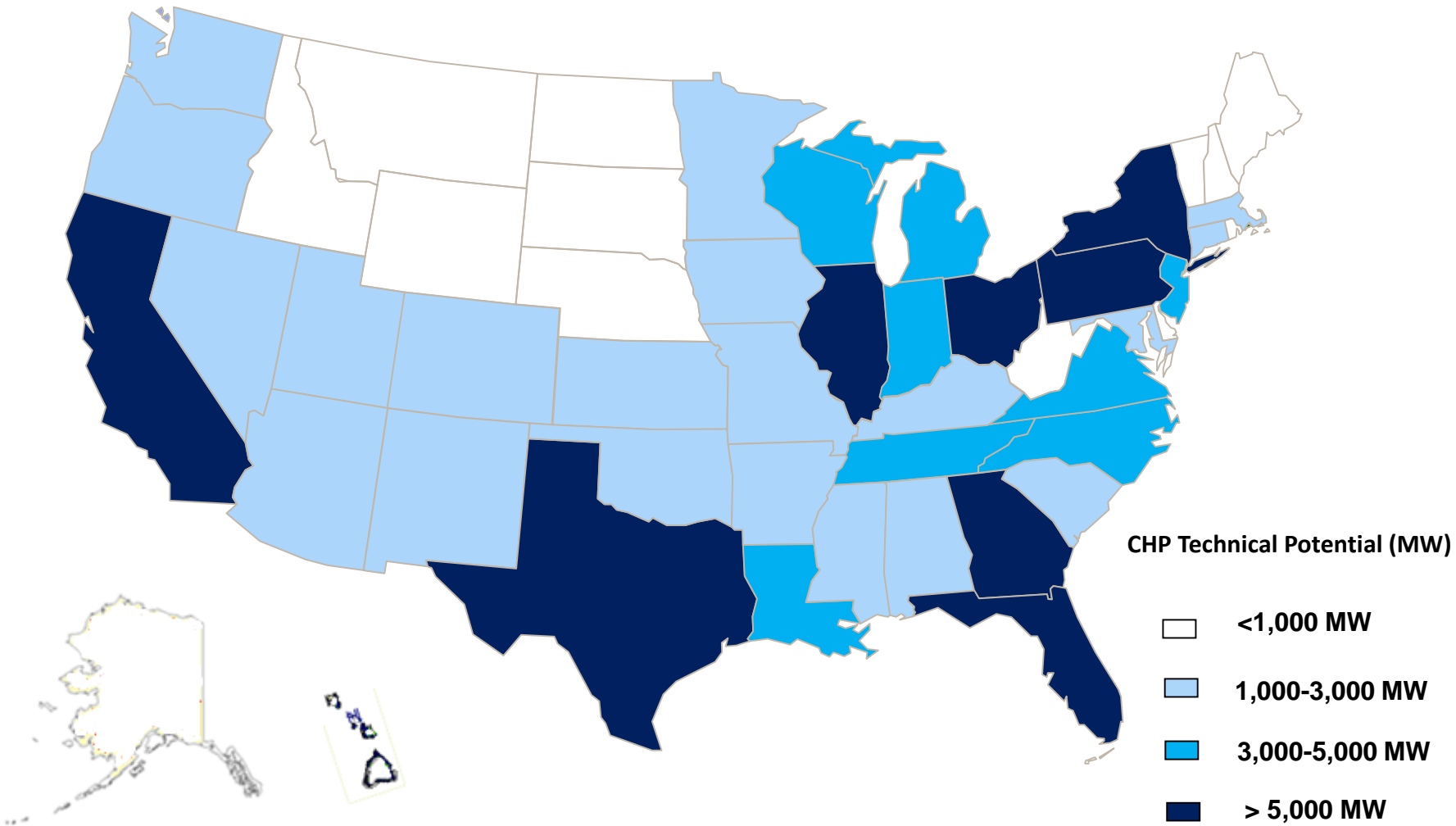
US Annual CHP build by technology (MW)



- Over the past twenty years, the average size of a CHP system shrank, suggesting a lack of market incentives for large-scale projects. 2003 saw total construction starts nearly double from the previous year (from 118 to 219 projects) amid an increase in projects sized between 500 and 1000 kilowatts.
- In the past decade, annual new build has been muted. Absent any financial enticements, facility owners appeared reluctant to upgrade to newer small-scale technologies like fuel cells and microturbines, when conventionally reliable technologies provide cheaper power at a larger scale.

Source: Bloomberg New Energy Finance, DOE CHP Installation Database (maintained by ICF International)

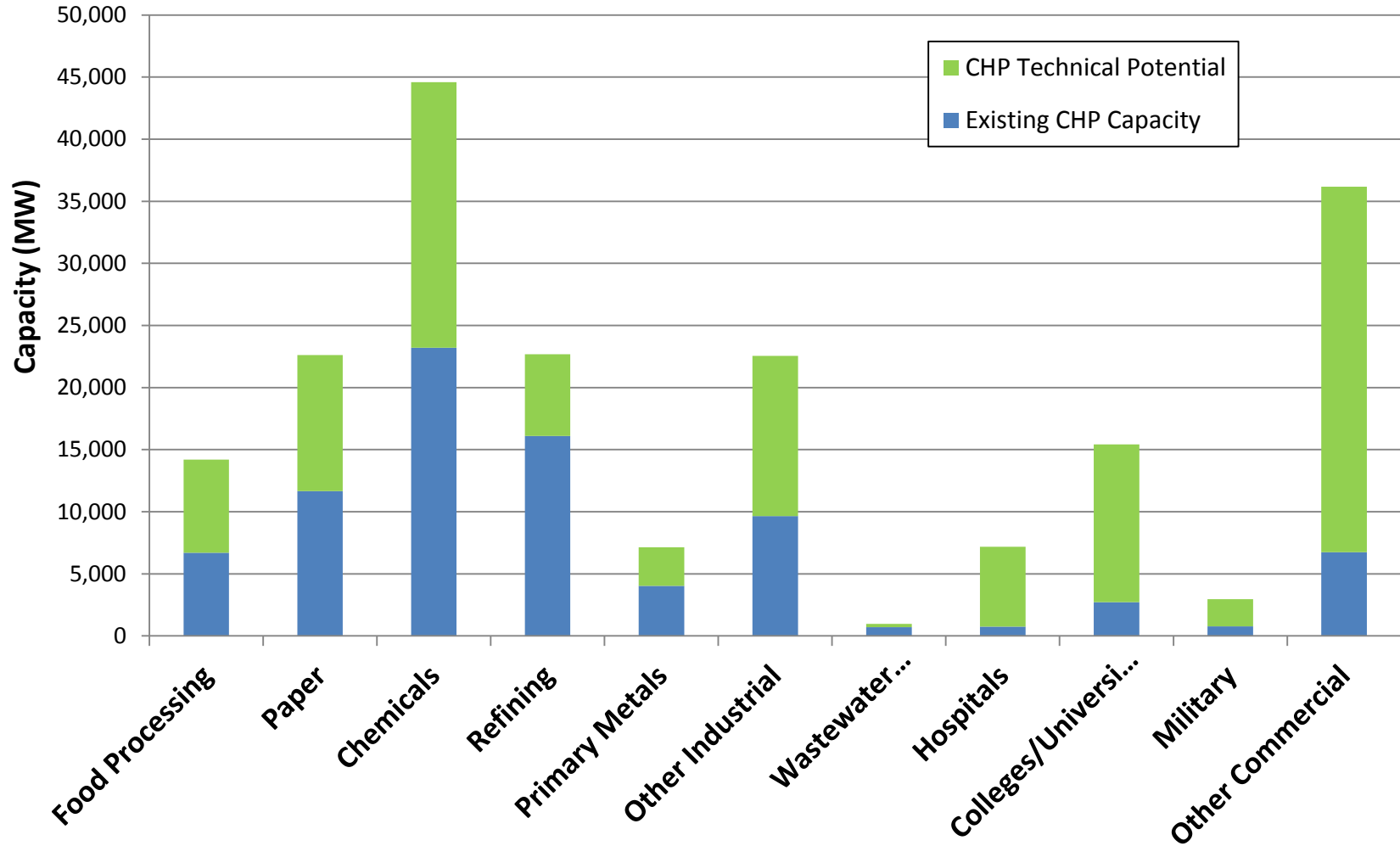
The Potential for Additional CHP Is Nationwide



Source: ICF Internal Estimates (2014)

Where is the Remaining Potential for CHP?

Existing CHP Capacity vs Technical Potential



Source: ICF internal estimates (2014)

Dept Of Energy CHP Deployment Program

- 1. Market Analysis*
- 2. Technical Assistance*
- 3. Packaged CHP eCatalog*
- 4. CHP Resiliency Accelerator*



CHP Market Analysis and Tracking

- ▶ **DOE CHP Installation Database:** on-line, searchable database of CHP systems currently operating in the United States (locations, facility, CHP system characteristics)
 - www.energy.gov/chp-installs
- ▶ **DOE CHP Project Profile Database:** highlights more than 140 actual CHP installations
 - www.energy.gov/chp-projects
- ▶ **DOE CHP Market Analysis:** Waste Heat to Power Market Assessment - 2015
CHP Technical Potential Assessment – 2016
 - www.energy.gov/chp-potential

Project Snapshot:

Energy Savings

Medina High School
Medina, OH

Application/Industry: High School
Capacity (MW): 125 kW
Prime Mover: Reciprocating Engine
Fuel Type: Natural Gas
Thermal Use: Heating, Hot Water
Installation Year: 2014
Energy Savings: \$82,944/year

Testimonial: The engine at Medina High School will be able to run 48,000 hours before needing replacement and has an eight year payback. It will offset the 1 million kilowatts of electricity the school purchased each year.

Source: http://www.cleaveland.com/medina/index.csf/2014/02/medina_city_school_district_hu.html



Project Snapshot:

Dairy Farm Cogeneration

Sievers Family Farm
Stockton, IA

Application/Industry: Dairy Farm
Capacity (MW): 1 MW
Prime Mover: Reciprocating Engine
Fuel Type: Biomass
Thermal Use: Heating the Digesters
Installation Year: 2013

Testimonial: The 1 MW engine at Sievers Family Farm was awarded a \$500,000 USDA REAP grant, a \$250,000 NRCS EQIP grant, and a \$200,000 Alliant Energy grant. After the farm's electric needs are met, the remainder of the power is sold to Interstate Light and Power (Alliant Energy).



(L to R) Bryan Sievers, Phil Osmer (DIT Financial), Ben Sievers, David Harris (Alliant)

Source: <http://www.americanbusiness.com/project/Profiles/stockton.asp>

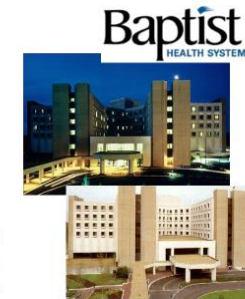
Project Snapshot:

Resiliency and Disaster Relief

Mississippi Baptist Medical Center
Jackson, Mississippi

Application/Industry: Healthcare
Capacity (MW): 4.2 MW
Prime Mover: Solar Centaur Gas Turbine
Fuel Type: Natural Gas
Thermal Use: Hot water
Installation Year: 1991

Testimonial: For more than four days after Hurricane Katrina hit the region, MBMC's CHP system provided power and thermal energy to the hospital. MBMC was the only hospital in the Jackson metro area to remain nearly 100% operational following the storm. MBMC was able to receive displaced patients from other hospitals and serve as an operations center for emergency responders.



Source: https://www.healthcarebaptist.com/Data/Static/4/6/documents/profiles/MISSISSIPPI_Baptist_Medical_Center-CHP_Profile.pdf

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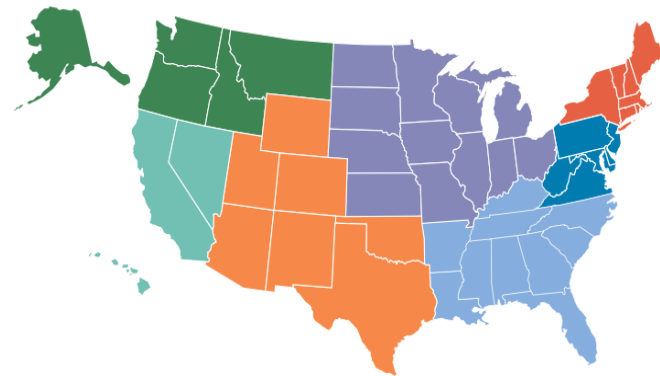
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DOE CHP Technical Assistance

Seven DOE CHP Technical Assistance Partnerships (CHP TAPs) provide local, hands-on assistance for the installation of CHP, waste heat to power, and district energy or microgrid with CHP.

- **Technical Assistance (Top priority!)**
Providing technical assistance to potential CHP host sites from initial CHP screening to installation.
- **Market Opportunity**
Supporting key end-user stakeholders (trade associations, utilities, commissions) to further the installation of CHP.
- **Education and Outreach**
Providing information on the benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

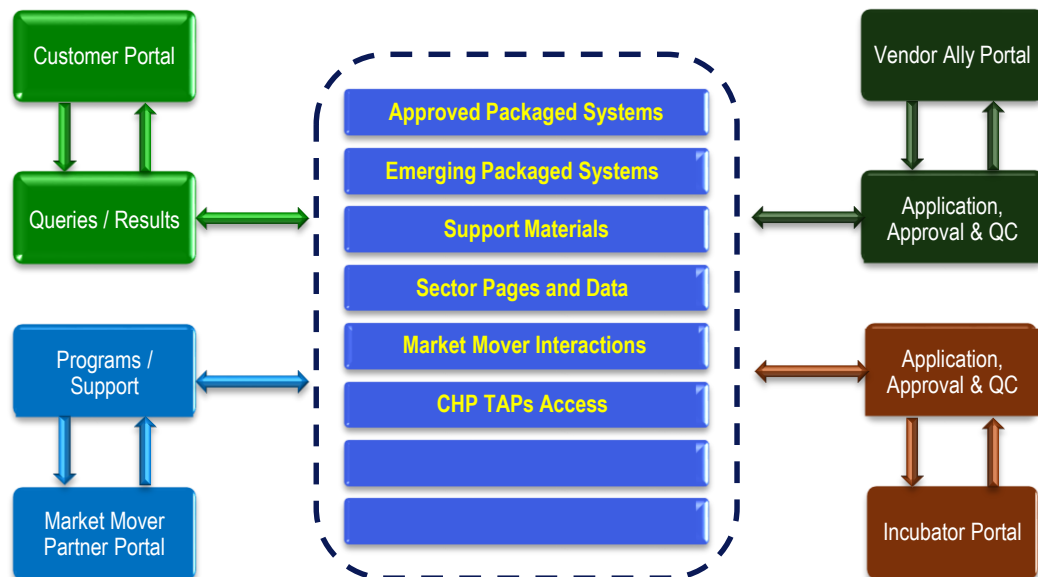
CHP TAP Regions



www.energy.gov/chp-contacts

DOE's New Packaged CHP System Challenge (AMO/BTO)

- ▶ Purpose: Increase deployment of packaged CHP by reducing the technical risks.
- ▶ Electronic Catalog (eCatalog) of approved packaged CHP systems
 - Market Mover Partners. State, local and utility actors with CHP programs and policies
 - Vendor Allies. System integrators proposing packaged, tested CHP solutions with applicable service agreements
 - Modeled on the NYSERDA Packaged CHP program but up to ~10-20 MW
- ▶ Timeline
 - eCatalog Mock-up Summer 2016
 - **Vendor and Market Mover Partner Recruitment – beginning now**



DOE's New CHP for Resiliency Accelerator

Purpose: Produce resource of best practices in including CHP in Resiliency Planning

Offerings

- Partners share barriers and solutions
- Tools and templates to promote deployment of CHP/distributed generation in Critical Infrastructure
- Streamlined CHP project development process
- Direct technical support through DOE's CHP TAPs
- National recognition and visibility

Outcomes

- Integrated resiliency plans considering CHP (local, state, utility)
- Template with collective lessons learned for replicability

Timeline

- Launch May 2016
- Two-year commitment
- **STILL LOOKING FOR PARTNERS**

CHP kept the lights (and more!) on during Sandy:

- ✓ South Oaks Hospital (LIH) - Amityville, NY, 1.25 MW
- ✓ The College of New Jersey - Ewing, NJ, 5.2 MW
- ✓ Public Interest Data Center - New York, NY, 65 kW
- ✓ Bergen County Wastewater – Little Ferry, NJ, 2.8 MW
- ✓ New York University – New York, NY, 14 MW
- ✓ Princeton University - NJ, 15 MW
- ✓ Sikorsky Aircraft Corporation – Stratford, CT, 10 MW



Thank You!

energy.gov/chp

or

send us an email at: CHP@ee.doe.gov



Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2014)

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