

Advanced Manufacturing Office

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Combined Heat & Power (CHP) Deployment
Technical Assistance Partnerships

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On behalf of Tarla Toomer
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CHP Nationwide Use

CHP Is Used Nationwide In Several Types of Buildings/Facilities



Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2016), May 2017

Industrial Combined Heat and Power (CHP) Barriers

- **Economic and Financial Barriers¹**
 - Internal competition for capital
 - Payback expectations and capital budget constraints influence CHP investment decisions
 - Accounting practices
 - Emphasis on minimizing upfront capital costs, and the “split-incentive” between capital improvement and operation and maintenance (O&M) budgets
 - Financial risk
 - Industrial facilities may have a hard time finding low-cost financing due to financial risks
 - Sales of excess power
 - The inability to sell excess power or access to reasonable sales agreements for excess power

Industrial Combined Heat and Power (CHP) Barriers

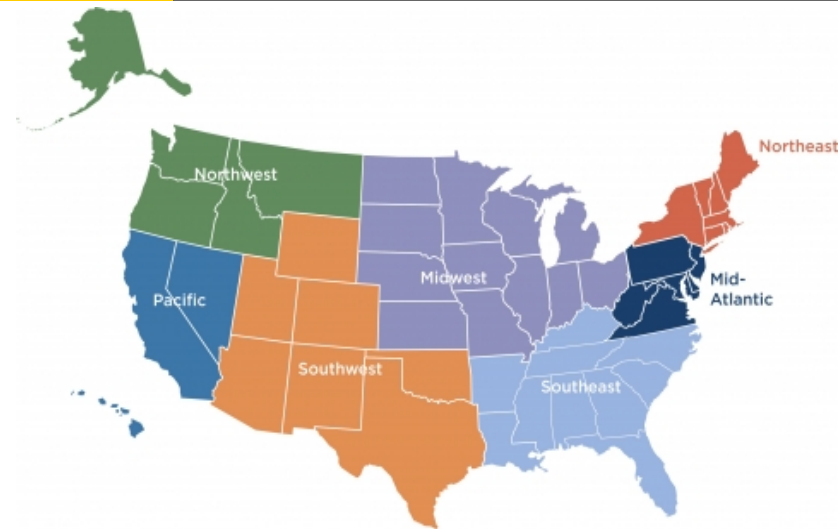
- **Regulatory Barriers¹**
 - Utility business model
 - The structure of utility cost recovery and lost revenue mechanisms can reduce a utility's interest in promoting industrial CHP projects
 - Environmental permitting and regulatory issues
 - Output-based regulations (lb/MWh versus lb/MMBTu) and New Source Review permitting requirements
 - Inconsistent interconnection requirements
 - Lack of standardized interconnection requirements can impede CHP
 - Lack of recognition of environmental benefits
 - Lack of financial value for the potential emissions benefits of CHP
 - Failure to recognize the full value of CHP in regulatory evaluations
 - Utility procurement and resource plans may omit some value streams provided by CHP
 - Standby rates
 - Structure of standby rates that are not designed to closely preserve the nexus between charges and cost of service
 - Exclusion from clean energy standards
 - CHP's eligibility under CEPS programs
 - Capacity and ancillary services markets
 - Electricity markets and programs may limit CHP's ability to participate

CHP TAPs Overview

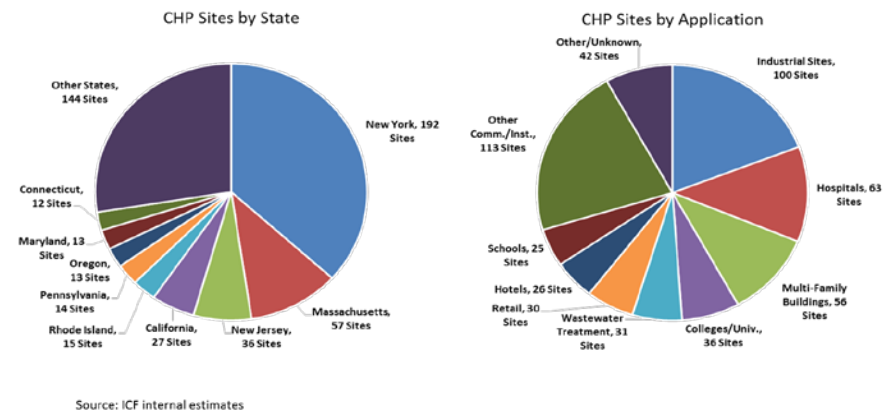
CHP TAPs are experts who provide fact based, unbiased information on CHP, including technologies, project development, project financing, local electric and natural gas utility interfaces, and related state/local best practice policies. The CHP TAPs are vendor, fuel, and technology neutral.

CHP TAPs provide national support to the emerging CHP, waste heat to power technologies, microgrids and district energy throughout the United States by:

- Providing high level, mostly university-based, technology and packaged technologies opportunities for US facilities and sites
- Promoting CHP solutions for end-users seeking enhanced energy resiliency, greater reliability of energy, added energy independence or increased productivity
- Providing field validation and expert R&D and market support to policy makers and regulators on CHP's opportunities, values and potential solutions



CHP in Development (523 sites)

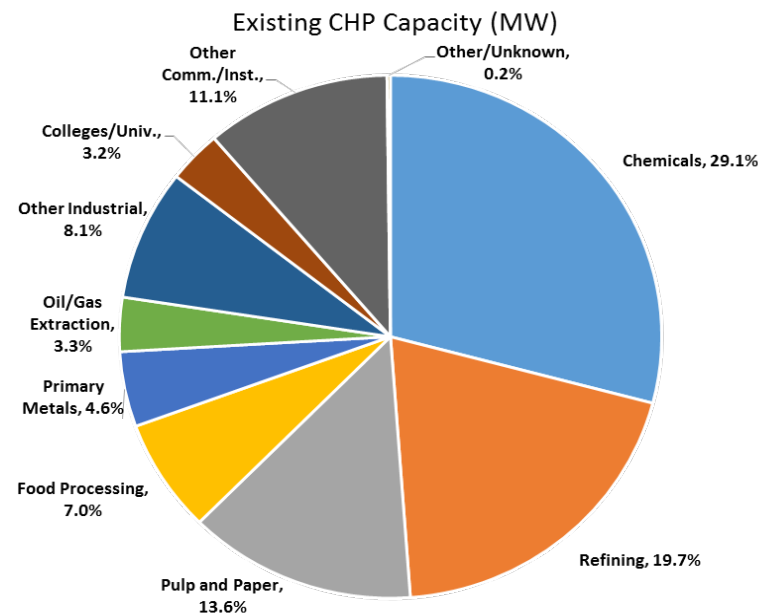


Note: There are 33 sites on the Watch List without capacity information May 2017

Combined Heat and Power TAPs Mission

- Mission
 - Connect potential end-user sites with technical and policy information to consider CHP as a solution for economic development, resiliency, higher energy quality (power factor), and capitalizing on local gas opportunities.

CHP Today in the United States



- **82.6 GW** of installed CHP at nearly 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 CO₂** compared to separate production

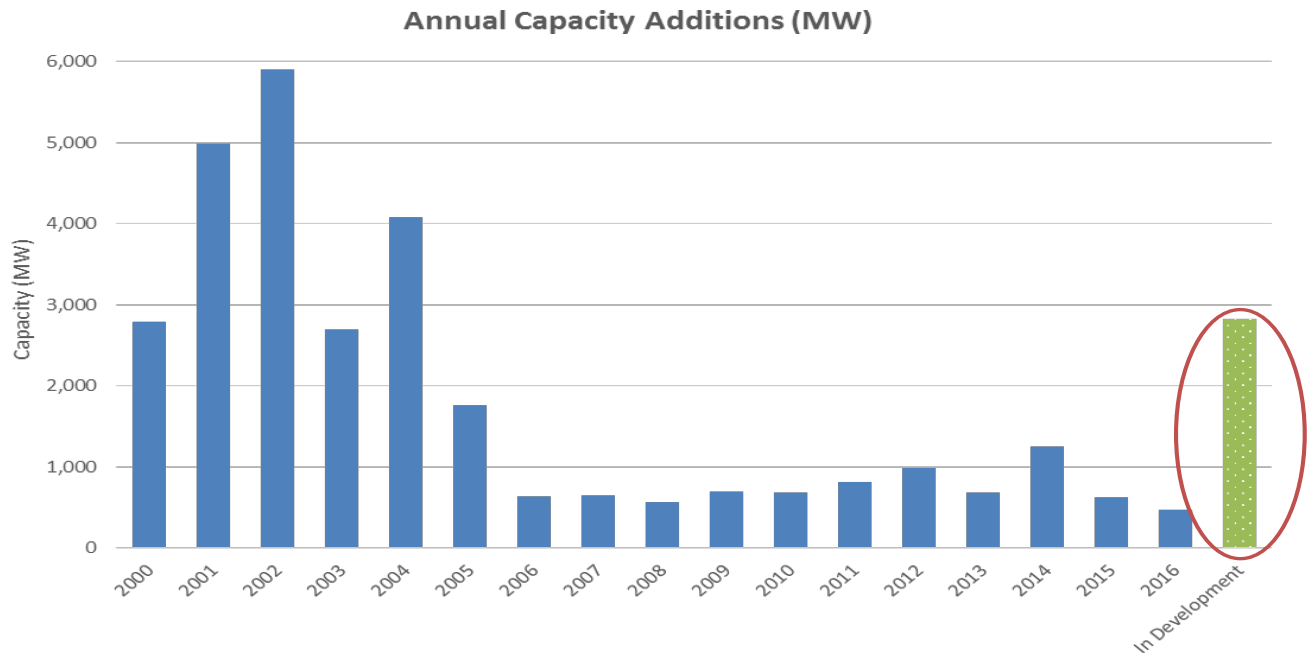
Source: DOE CHP Installation Database (U.S. installations as of December 31, 2016)

Combined Heat and Power TAPs Mission

• Mission

- Aggregate national information around need for CHP R&D and new applications to take advantage of domestic natural gas and increasing electricity prices
- Conduct field validation activities that identify the opportunities for use of advanced technologies to capture U.S. competitive advantage

CHP Market Activity



Source: DOE CHP Installation Database (U.S. installations as of December 31, 2016)
ICF internal estimates

May 2017

CHP TAPs Accomplishments 2017

- CHP TAPs Technical Assistance (TA)

- Completed over 228 CHP TAP Technical Assistance (TA) activities for prospective CHP sites
 - FY 2017 (Q2) - 228
- Completed education, outreach, and technical assistance to prospective end-users in targeted markets, including:
 - Colleges and Universities
 - Commercial Buildings
 - Food Processing facilities
 - Hospitals
 - Government and Military facilities
 - Waste Water Treatment Plants
 - Better Plants Partners

CHP TAP Technical Assistance Activities

FY 2014 thru FY2016 Technical Assistance Activities			
Activity	Quantity (FY 2014)	Quantity (FY 2015)	Quantity (FY 2016)
Site Qualification Screenings	180	383	442
Feasibility Assessment		17	6
Third Party Reviews	31	37	17
Advanced Technical Assistance		85	129
Project Profiles	NA	72	22
Total	211	594	616

Source: Internal DOE CHP TAP'S Data May 2017

CHP Technical Solutions: CHP TAP Direct End-User Technical Assistance

Project Military Snapshot

Project Snapshot: Military

Location: Aberdeen Proving Grounds

Edgewood, MD

Application/Industry: Military

Capacity (MW): 7.9 MW

Prime Mover: Combustion Turbine

Fuel Type: Natural Gas

Thermal Use: Process Steam, Heating and Hot Water

Installation Year: 2016

Energy Savings: \$4.4 million in energy savings each year

Testimonial: “I can think of no better example of what innovation looks like,” said APG Senior Commander Maj. Gen. Bruce T. Crawford during the groundbreaking ceremony.



CHP Technical Solutions: CHP TAP Direct End-User Technical Assistance

Project Hospital Snapshot

Upper Chesapeake Medical Center

Bel Air, MD

Application/Industry: Hospital

Capacity (MW): 2.0 MW & 350 Ton Chiller

Prime Mover: Recip Engine

Fuel Type: Natural Gas

Thermal Use: Steam, Chilled Water and Hot Water

Installation Year: 2016

Energy Savings: \$450,000 in energy savings each year

Testimonial: Provides 45% of the existing electricity for the main interconnected loads. Supplies more than 65% of campus electricity with existing diesel generator. Provides 95% of hospital loads with diesel when grid unavailable



Source: <http://www.baltimoresun.com/news/maryland/harford/aegis/ph-ag-apg-cogeneration-plant-start-0720-20160719-story.html>

CHP Risk Solution: DOE Packaged CHP System eCatalog

- Risk, Reduction, Risk Reduction and Time Saving
- Patterned after NYSERDA's successful Packaged CHP System catalog effort to:
 - Standardize system design
 - Realign sales and design practices through recognized system developers
 - Single source responsibility through installation
 - Commissioning and maintenance
- The eCatalog is a web-based system that will host US DOE recognized packaged CHP systems that will include the features designed to reduce economic and performance risk for the industrial user
- The CHP eCatalog will be a public/private partnership focusing on packaged CHP systems less than 10 MW in individual prime-mover capacity
- The eCatalog will be hosted by state and local jurisdictions, as well as utilities