2022 WV Governor's Energy Summit

'Building West Virginia's Energy Future'

Combined Heat & Power For Resilience & Microgrids

DOE Mid-Atlantic CHP TAP

October 26, 2022

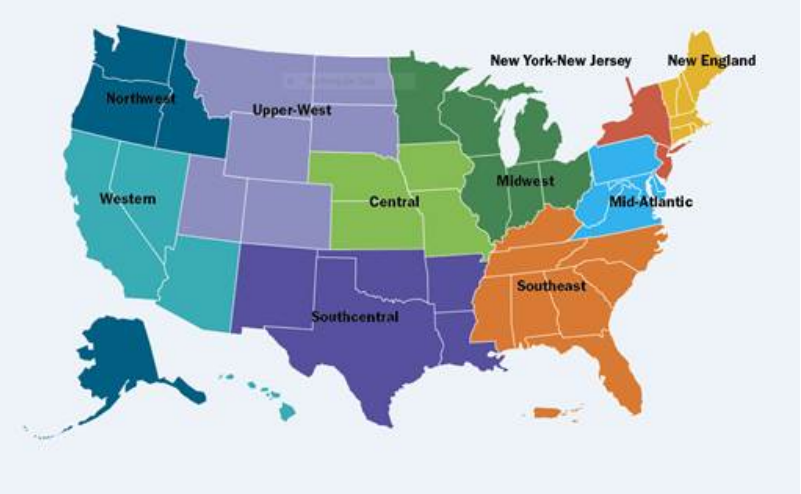
U.S. Department of Energy
CHP Technical Assistance Partnerships
MID-ATLANTIC

Outline

- Who is the MA-CHP TAP?
- What is CHP?
- CHP's role in Resilience and Microgrids

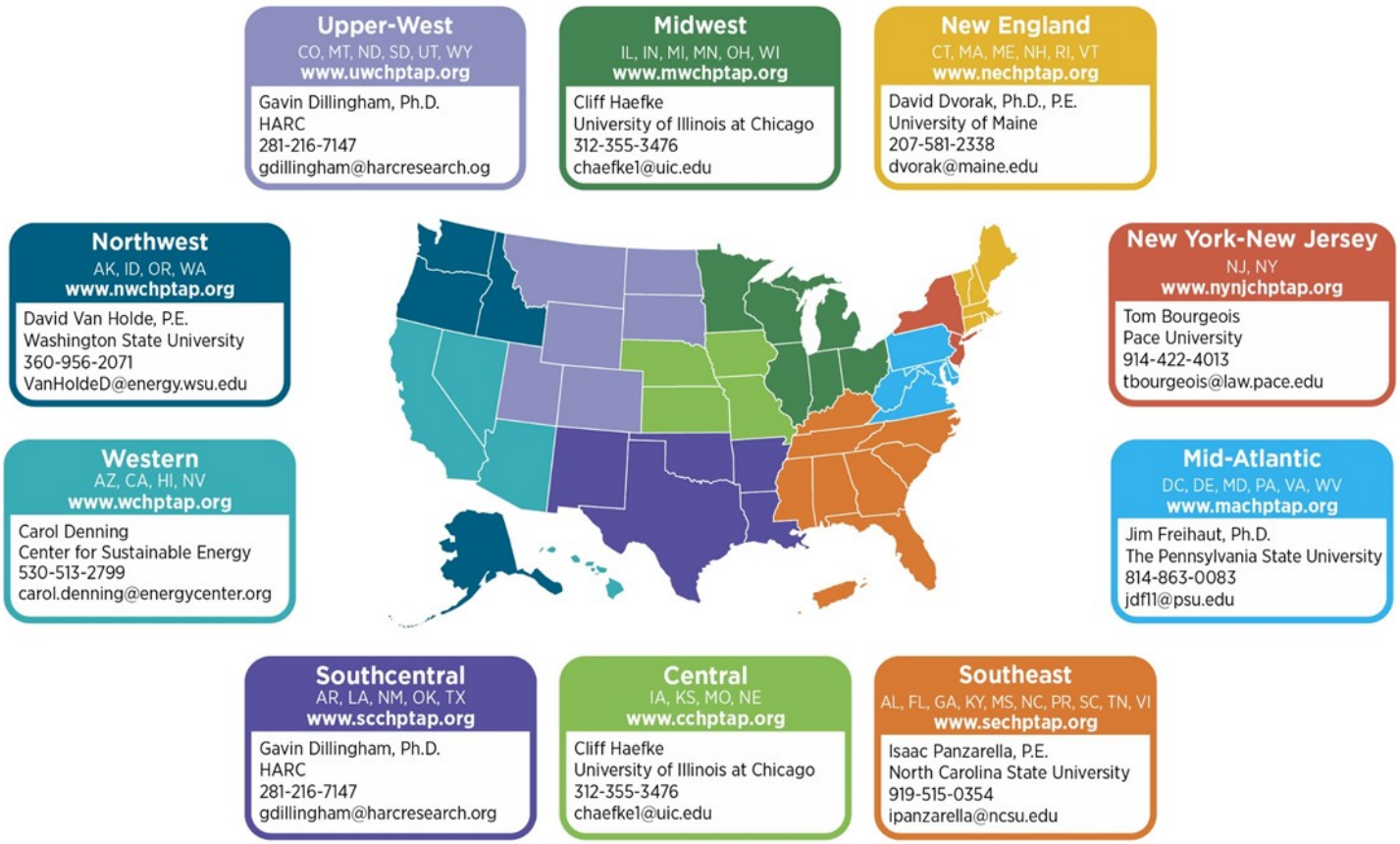
DOE CHP Technical Assistance Partnerships (CHP TAPs)

- **End User Engagement**
  Partner with strategic End Users to advance technical solutions using CHP as a cost effective and resilient way to ensure American competitiveness, utilize local fuels and enhance energy security. CHP TAPs offer fact-based, non-biased engineering support to manufacturing, commercial, institutional and federal facilities and campuses.
- **Stakeholder Engagement**
  Engage with strategic Stakeholders, including regulators, utilities, and policy makers, to identify and reduce the barriers to using CHP to advance regional efficiency, promote energy independence and enhance the nation's resilient grid. CHP TAPs provide fact-based, non-biased education to advance sound CHP programs and policies.
- **Technical Services**
  As leading experts in CHP (as well as microgrids, heat to power, and district energy) the CHP TAPs work with sites to screen for CHP opportunities as well as provide advanced services to maximize the economic impact and reduce the risk of CHP from initial CHP screening to installation.



www.energy.gov/chp

DOE CHP Technical Assistance Partnerships (CHP TAPs)



DOE CHP Deployment Program Contacts

www.energy.gov/CHPTAP

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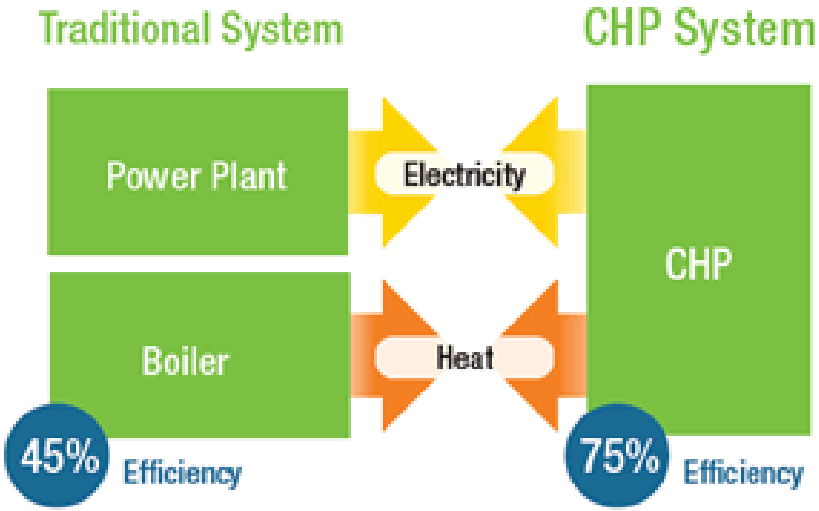
What is CHP

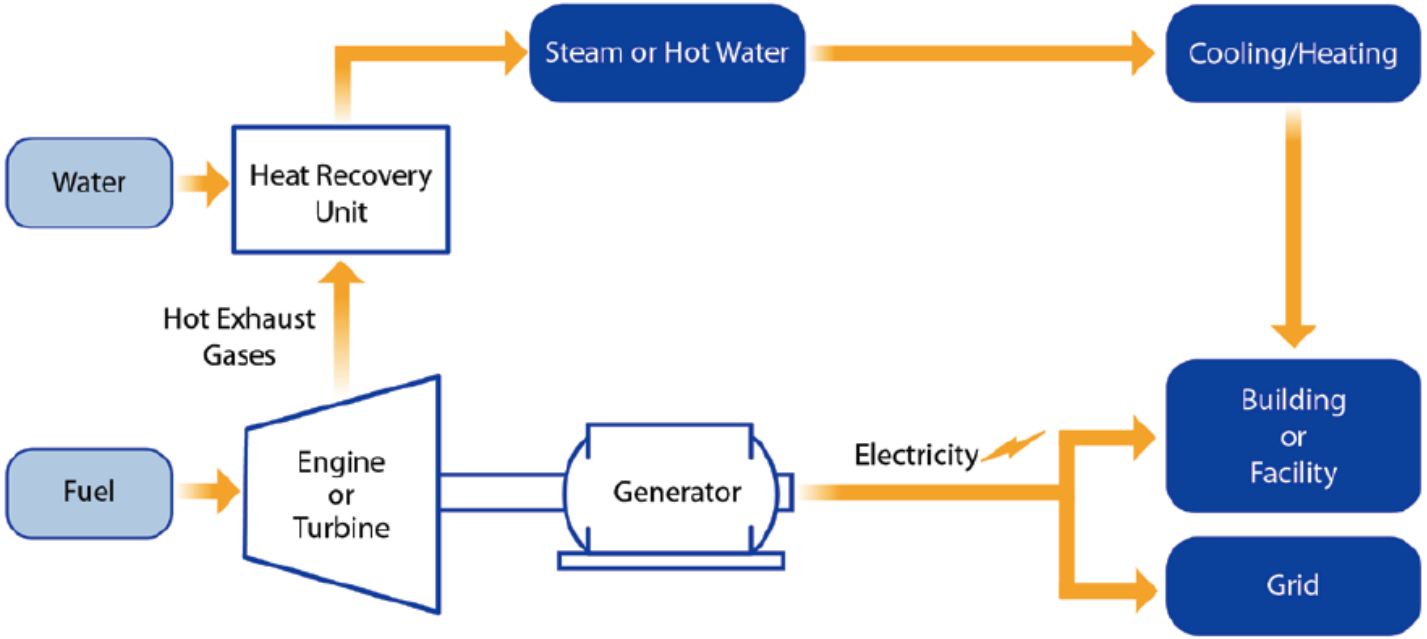
- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Refrigeration/Dehumidification



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/chp_basics.html

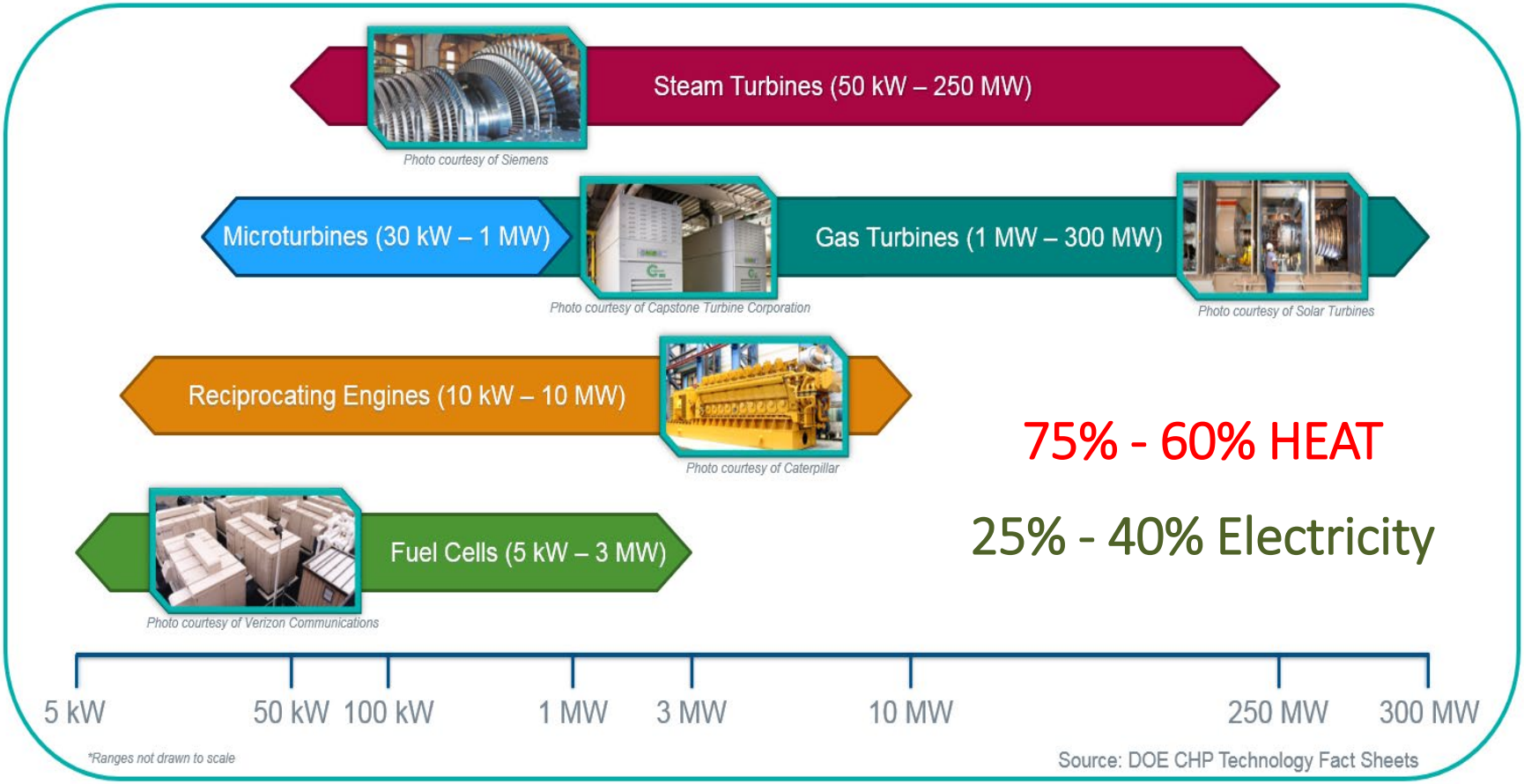
CHP provides cost-effective, clean and reliable energy – today and for the future.

CHP System Components

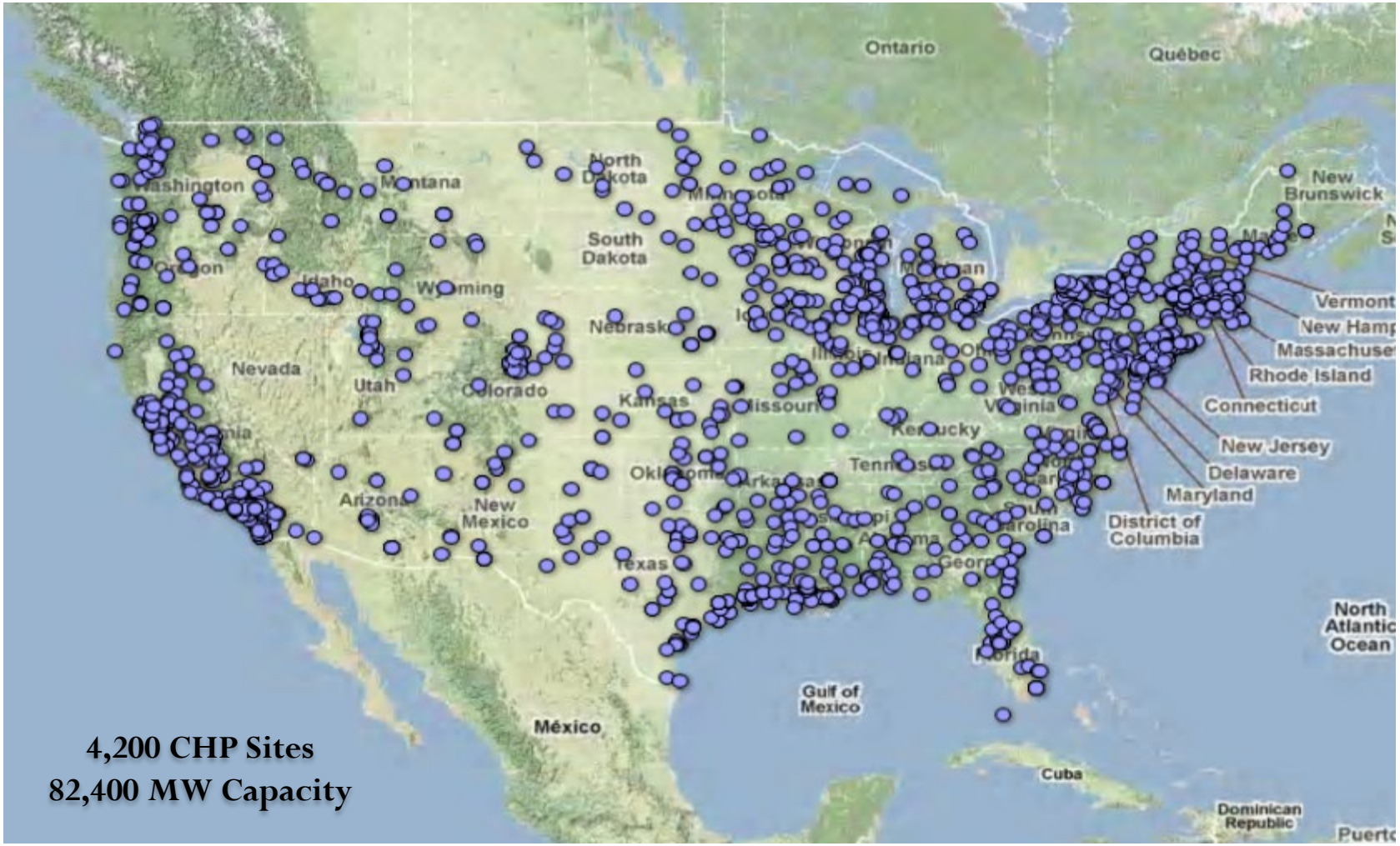


- Prime Mover
- Heat Recovery
- Thermal Technology
- Accessory Devices
- Switchgear
- Interconnection
- Fuel Supply
- Controls/M&V

Common CHP Technologies and Capacity Ranges



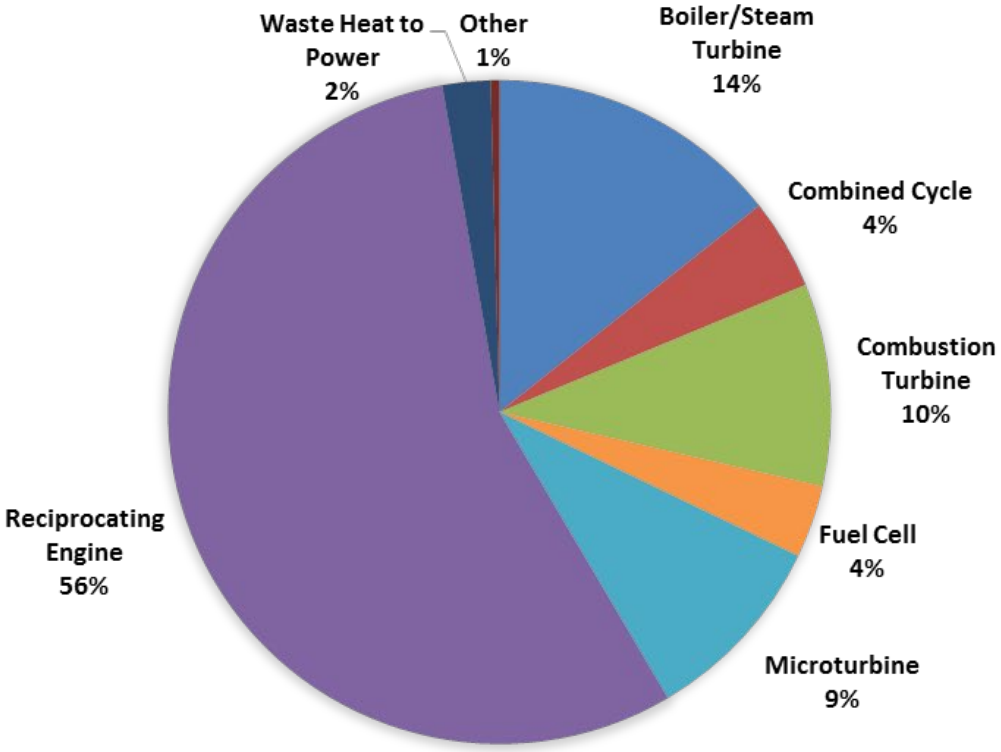
CHP Throughout the US



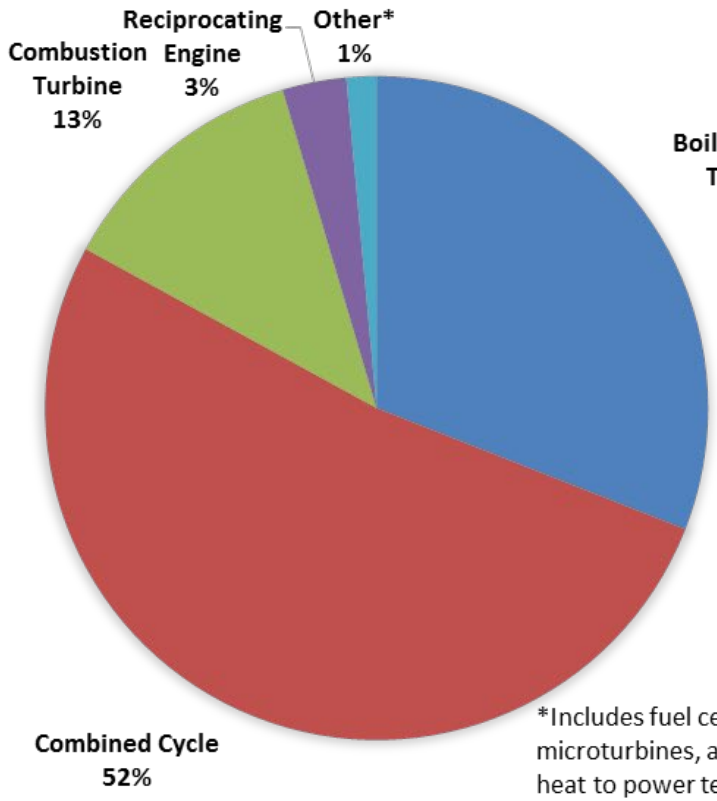
Source: ICF International

Existing CHP Installations in the U.S.

By Site – 4,434 Sites



By Capacity – 81.3 GW



*Includes fuel cells, microturbines, and waste heat to power technologies

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

CHP Drivers

- **Cost Savings**
  - Offset Utility/3rd Party kWh's + Therms #1
  - Reduce Utility Demand Charges - Demand Response
  - Offset Capital Costs – Require Redundancy
  - Improved Power Reliability/Quality

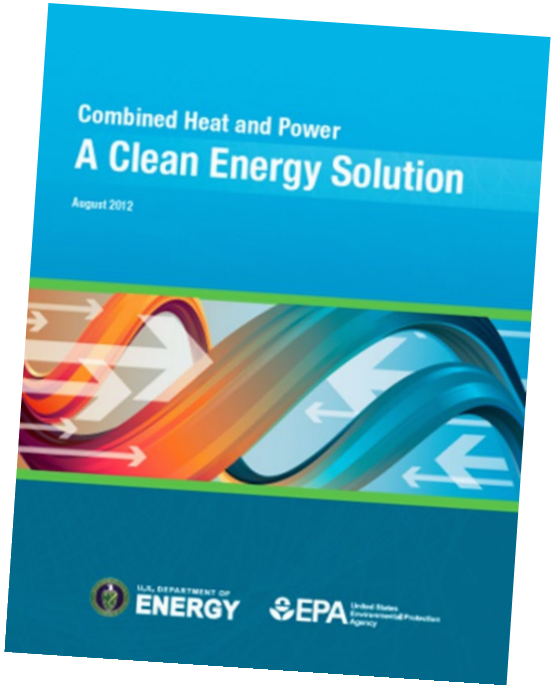
- **Environmental, Social, and Governance (ESG) Emissions Reductions / Grid Support**
  - In the same way that it saves fuel cost, CHP reduces pollution by using the fuel's energy twice, yielding half to a third of the emissions from separate fossil fuelled grid power and boilers.
  - Supported by US DOE & US EPA

CHP Drivers

- **Reliability**
  - Provides local grid support and improves power quality
  - Can often be configured to provide power back-up
  - Natural Gas grid can be more reliable for long term outages
- **Decarbonization & Security**
  - Enables increased penetration of intermittent renewables
  - Reduced fuel usage - extends clean energy resources and reduces dependence on fossil fuels
  - Multiple points of power generation are less subject to catastrophic failure or attack

CHP Drivers

- **Benefits of CHP recognized by policymakers**
  - Federal Executive Order signed in 2012 to accelerate investments in industrial EE and CHP as a move to improve manufacturing competitiveness. (Tax credits)
  - State Portfolio Standards (RPS, EEPS, Tax Incentives, Grants, standby rates, etc.)
  - Utility EE & Demand Reduction Programs (Act129)
  - Economic Development (PA DCED CFA)
- **Corporate ESG and GHG Reduction Drivers**
- **Energy Resiliency and Critical Infrastructure**



Operating Economics Snapshots

Upper Chesapeake Medical Center, Bel Air, MD

- Installed in 2016
- 2.0 MW CHP with 350 ton chiller
- Natural gas reciprocating engine producing steam, chilled water, and hot water
- $450,000 in energy savings per year

Supreme Sports Club, Columbia, MD

- Installed in 2016
- 60 kW CHP with hot water heat recovery
- Natural gas reciprocating engine producing space, pool water and DHW heating
- $96,500 in energy savings each year

Project Snapshot:
Manufacturing

Proctor & Gamble

Mehoopany, PA

Application/Industry: Paper products

Capacity: 64 MW

Prime Mover: Combustion Turbine

Fuel Type: Marcellus Natural gas

Thermal Use: Manufacturing process (steam and drying)

Installation Year: 2013

Energy Savings: $16.5M each year

Highlights:

- Proctor& Gamble's largest manufacturing facility in the world
- CHP part of an effort to save money and reduce CO2 emissions
- Export 480 MWH per day

CHP System Emissions

A 2.5 MW CHP plant located in PA demonstrates a 26% reduction in CO_2e or 3,675 tons per year according to the US EPA CHP Emissions Calculator.

Figure 1. Conventional Production Energy Flow Schematic

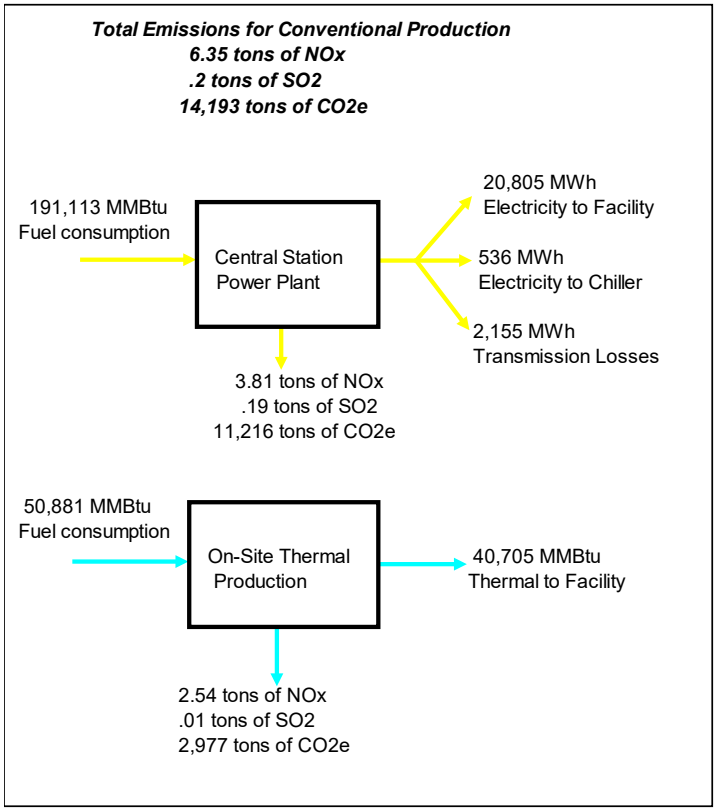
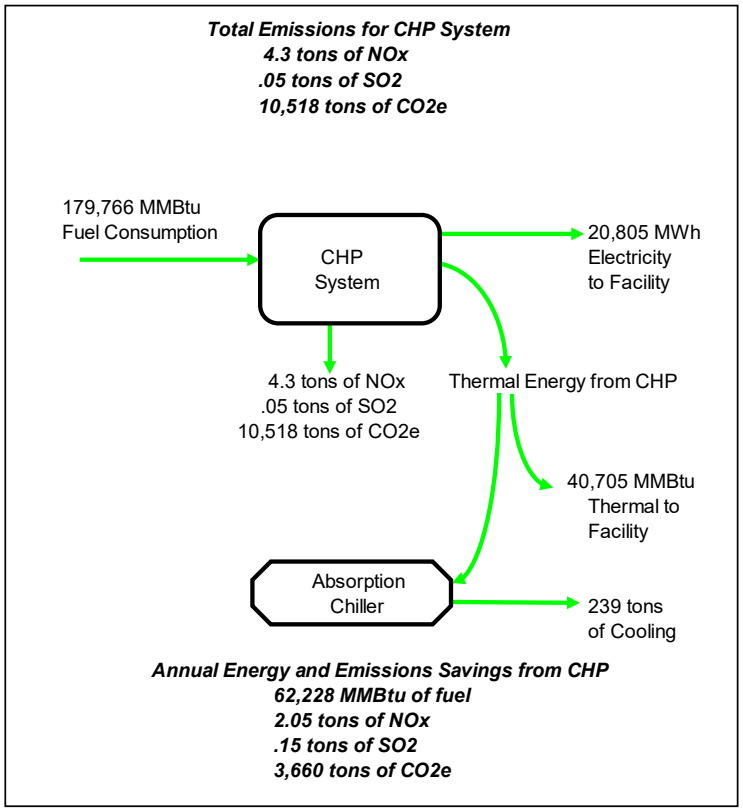


Figure 2. CHP System Energy Flow Schematic



Attractive CHP Markets

Industrial

Food processing
Petrochemicals
Pharmaceuticals
Plastics
Pulp and paper
Metals processing
Manufacturing

Commercial

Data centers
Hotels and casinos
Multi-family housing
Laundries
Apartments
Office buildings
Refrigerated warehouses

Institutional

Hospitals
Universities & colleges
Wastewater treatment
Correctional Facilities

Agricultural

Dairies
Wood waste (biomass)
Controlled Environmental Agriculture

Infrastructure Resilience

- A key principle of disaster preparedness and planning
- Ability to maintain operation despite a devastating event – business continuity
- CHP (if properly configured):
  - Offers the opportunity to improve CI resiliency
  - Can continue to operate, providing uninterrupted supply of electricity and heating/cooling to the host facility

Critical Infrastructure and Resilience Benefits of CHP

"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 Provides Energy Reliability and Resiliency Benefits

- CHP System operates on a daily basis
- CHP provides continuous benefits to host facilities
- Critical Infrastructure Applications:
  - Healthcare centers
  - Wastewater treatment plants
  - Police, fire, and public safety
  - Centers of refuge
  - Military

Resiliency Planning

- Mitigate the effects of natural disasters
- Develop secure, resilient electrical power infrastructure
- Ensure critical infrastructure remains operational

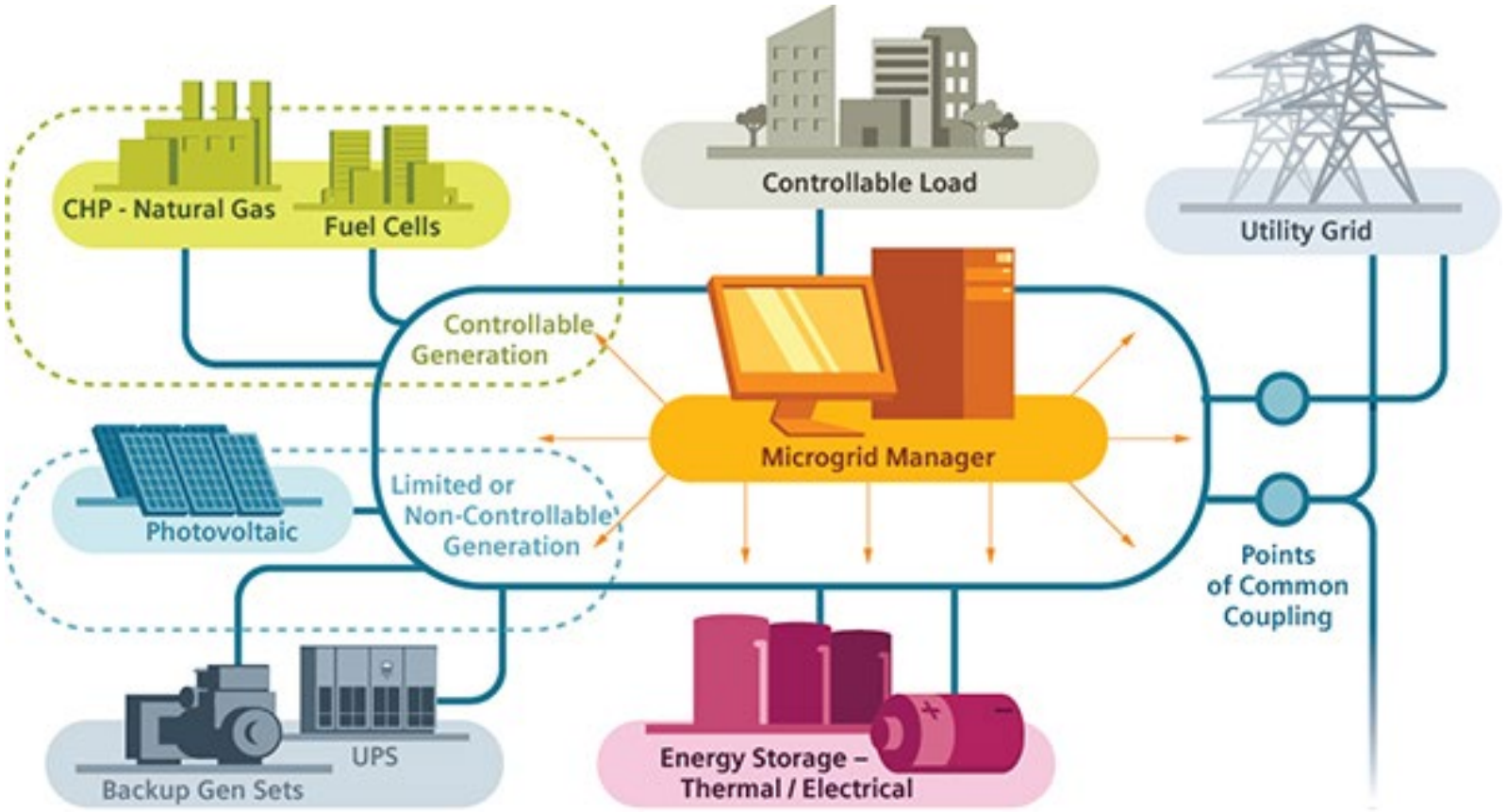
DOE DG for Resilience Planning Guide

- Provides information and resources for decision makers, state and local policy makers, and utilities on:
  - Role of DG/CHP and CI in resilience planning
  - Best fit DG for CI applications
  - How to incorporate DG into Resilience Plans
- https://resilienceguide.dg.industrialenergytools.com/

What is a Microgrid?

- A group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries.
- A single controllable entity with respect to the grid.
- Can connect and disconnect from the larger utility grid to operate in either grid-connected or island mode.
- CHP can be integrated with solar, wind and storage resources.

Microgrids Can Incorporate Many Technologies



Benefits of CHP Enabled Microgrids

Reliability

- Close to loads reducing potential for distribution related outages
- Fast ramping allows quick response to grid supplied power changes
- Reduces stress on local grid

Resilience

- Operates continuously and will provide firm backup power during outages
- Island capable which can maintain heat and power loads during extended outages

Power Quality

- Provides high quality power with out service interruptions or voltage dips for power quality sensitive commercial and industrial customers
- Located close to loads which prevents voltage fluctuations and power quality issues that arise on utility distribution systems

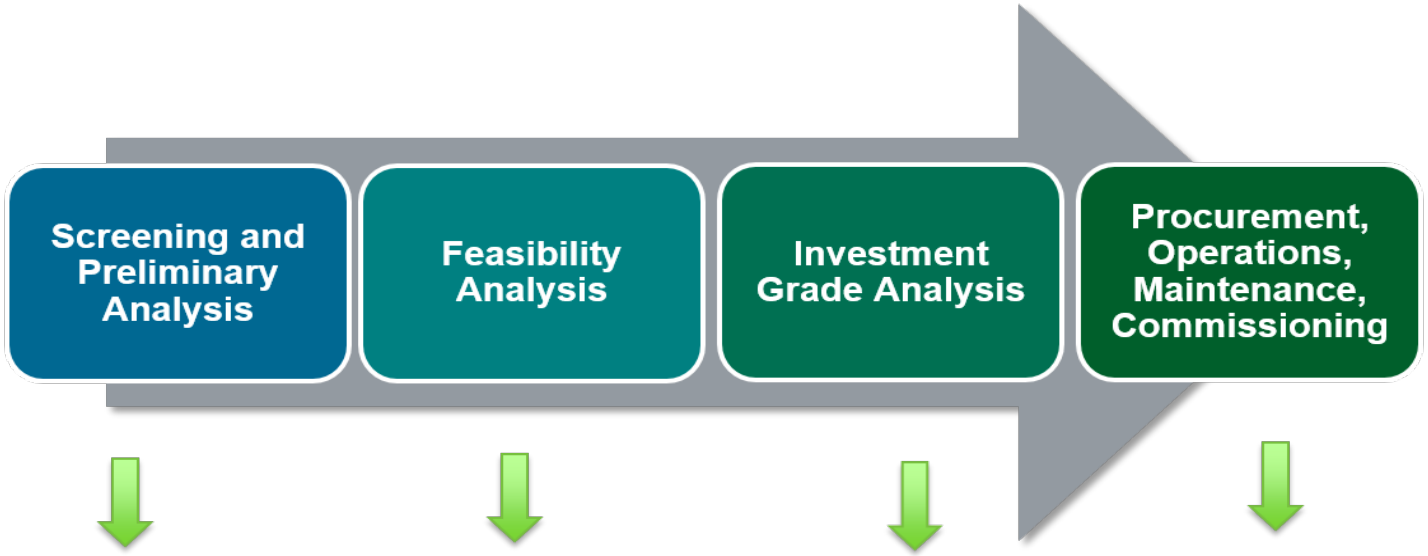
Montgomery County Public Safety Headquarters

- County Police and County Fire and Rescue Services
- Office of Emergency Management and Homeland Security (OEMHS),
- 1st District Police Station
- Department of Transportation
- Microgrid Development Project
  - 850 kW CHP
  - 2 MW Solar PV
  - Microgrid as a Service - Duke Energy

Summary

- CHP and Microgrids can play a significant role in Critical Infrastructure Resilience
- CHP enabled microgrids are a proven technology for Critical Infrastructure
- CHP enabled micro grids provide a variety of benefits:
  - Resiliency
  - High efficiency
  - Reduced emissions
  - Reduced grid congestion

CHP TAP Role: Technical Assistance



Quick screening questions with spreadsheet payback calculator; Advanced technical assistance to explore equipment or operational scenarios.

Perform 3rd Party reviews of site feasibility assessments: Estimates on savings, installation costs, simple paybacks, equipment sizing, and type.

Perform 3rd Party reviews of Engineering Analysis. Review equipment sizing and choices.

Review specifications and bids.

Next Steps

Contact the Mid Atlantic CHP TAP for assistance if:

- **You are interested in having a Qualification Screening performed to determine if there is an opportunity for CHP or a Microgrid at your site**
- **You already have an existing CHP plant and interested in expanding it**
- **You need an unbiased 3rd Party Review of a proposal**

Thank You
Stop by our booth!

Questions?

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http://www.machptap.org/

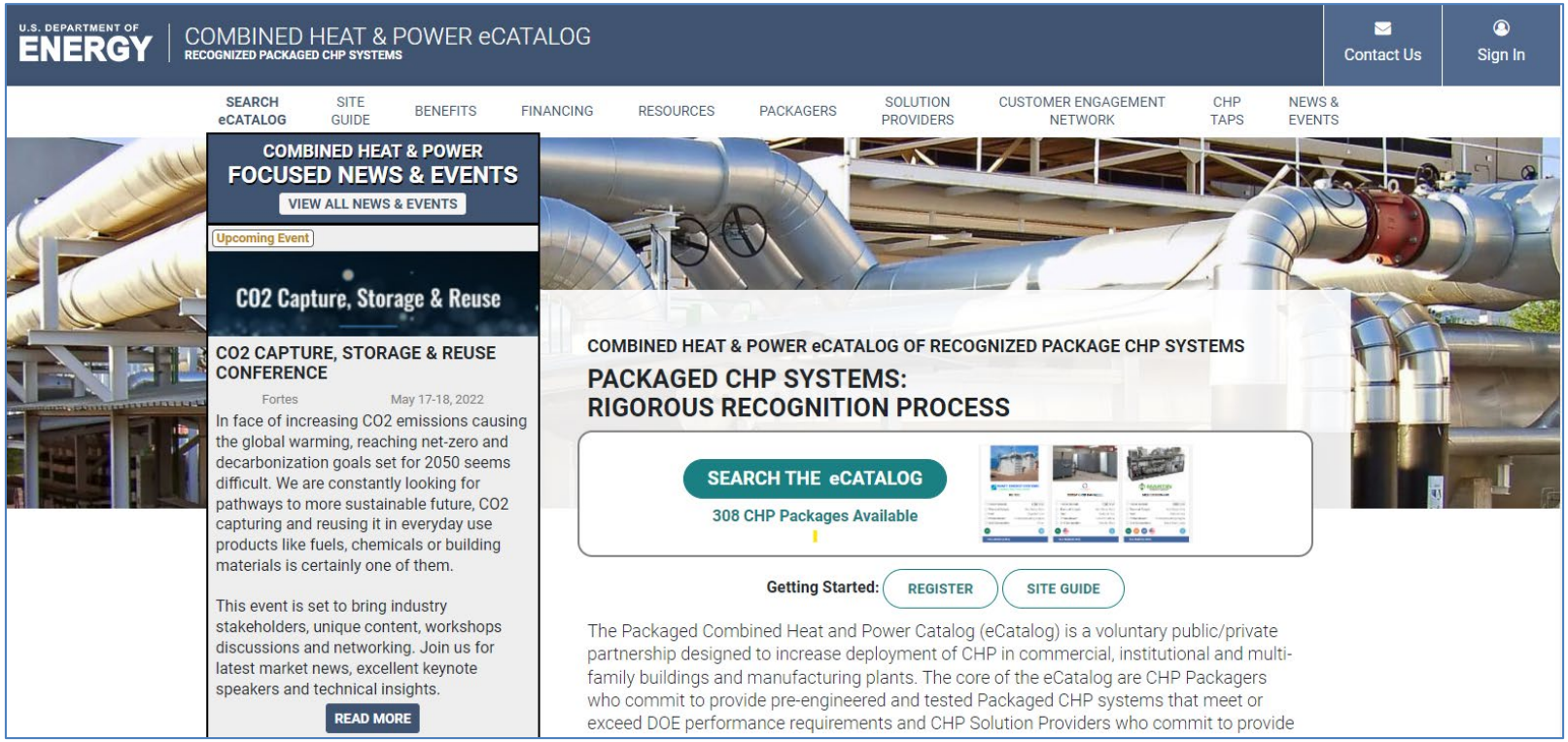
A program sponsored by

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

www.energy.gov/chp

CHP Project Resources

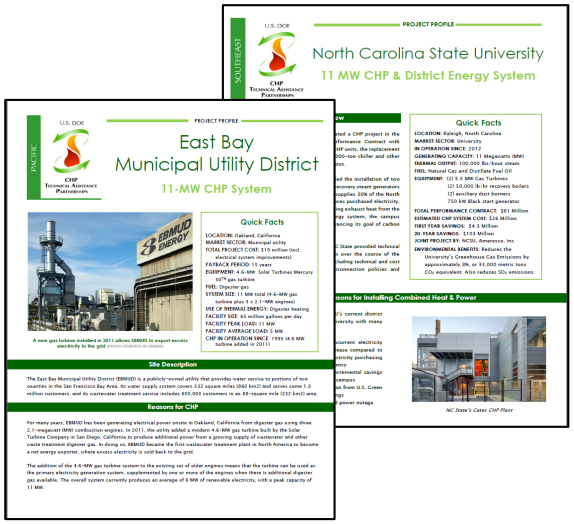
DOE's eCatalog - CHP Packages, Providers & Events



https://chp.ecatalog.ornl.gov/

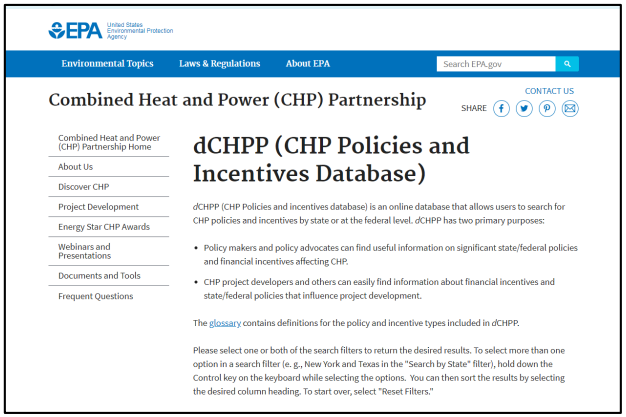
CHP Project Resources

DOE Project Profile Database



energy.gov/chp-projects

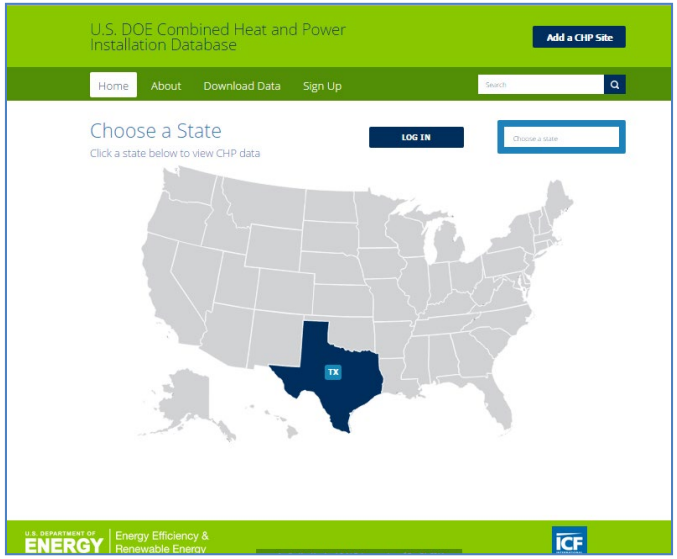
EPA dCHPP (CHP Policies and Incentives Database)



www.epa.gov/chpdchpp-chp-policies-and-incentives-database

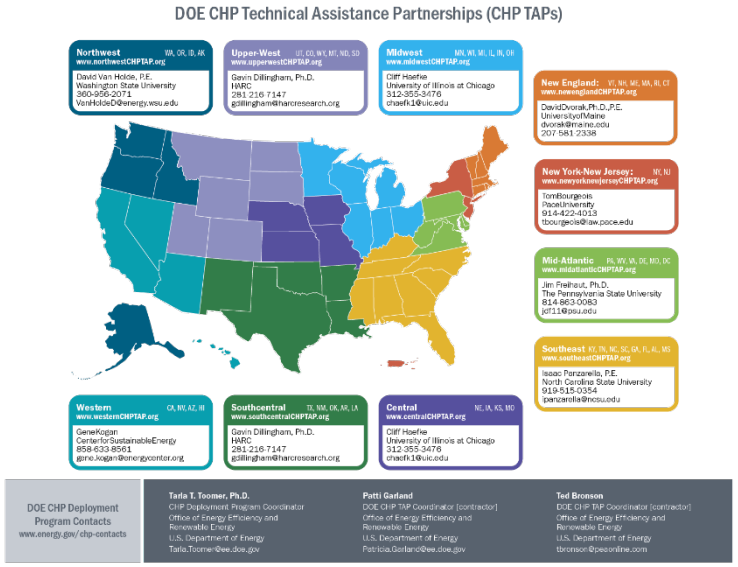
CHP Project Resources

DOE CHP Installation Database (List of all known CHP systems in U.S.)



energy.gov/chp-installs

Low-Cost CHP Screening and Other Technical Assistance from the CHP TAP



energy.gov/CHPTAP