How Combined Heat and Power Can Support State Energy Planning

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

About this Presentation

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- National Savings Estimates
- Expansion Potential: Examples from States
- Cost-Effectiveness
- Evaluation, Measurement, & Verification
- DOE Support
- On the Horizon

This short presentation is intended give states and their stakeholders a vision for what it would look like to include combined heat and power in their energy plans.

Combined Heat and Power as an Energy Savings Approach

Possible Lead

- State energy offices
- City energy or sustainability office
- Community-based organizations
- Utilities / program administrators
- Industrial end-users

Energy Savings

- kWh / MWh generated on site compared to central power plant
- Therms / Btu saved from using waste heat compared to separately fueled heat

Potential Program Components

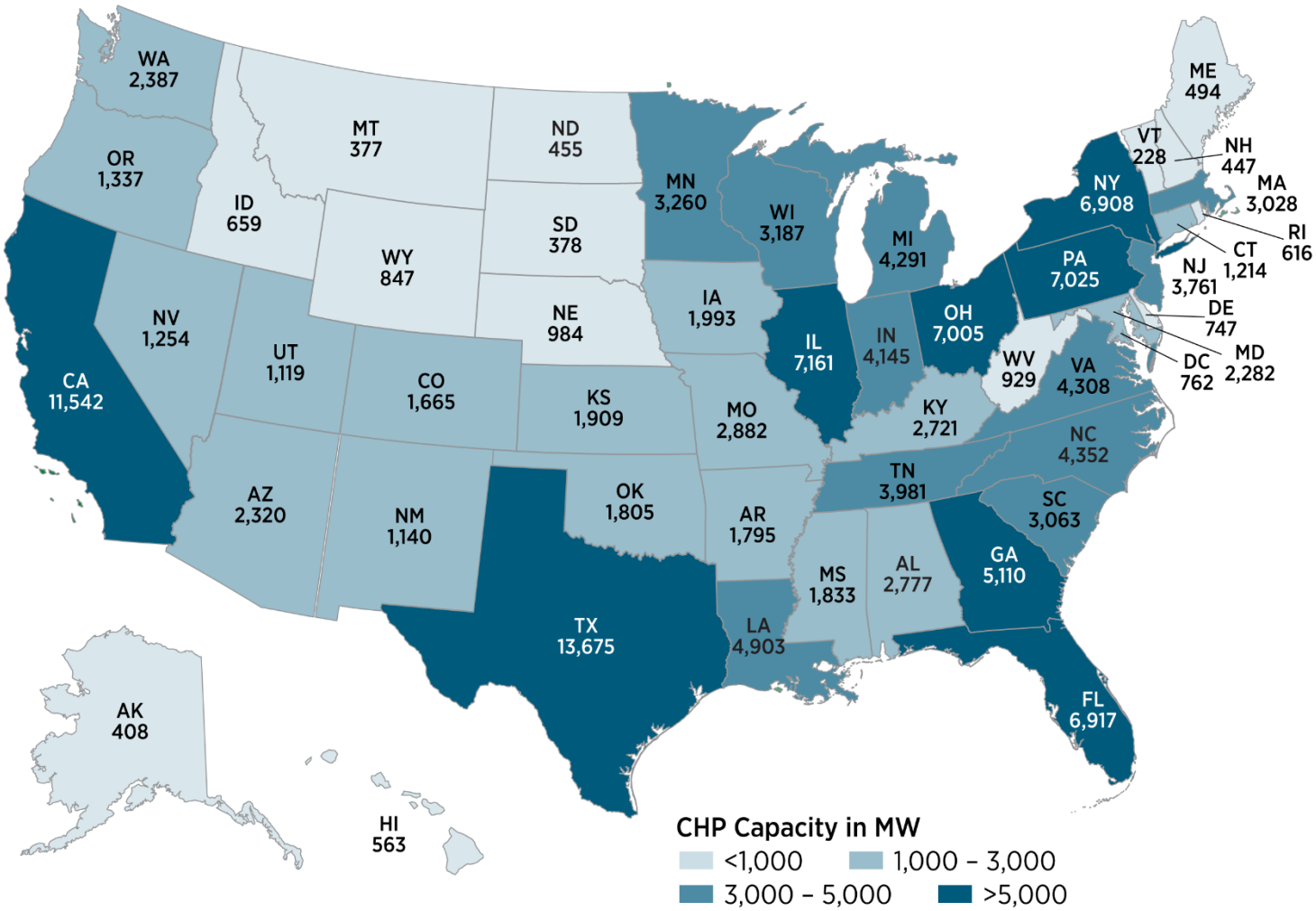
- District energy
- Microgrids
- Resiliency plans

Opportunity:
148,936 MW national potential
400 to 14,000 MW per state

Activities	EM&V
Energy Savings Approaches	
• Large energy users, program administrators, or state / local energy offices generate energy savings from: - Incentives to support CHP installation in appropriate facilities	Recent resources provide guidance, including: – *Combined Heat and Power: Uniform Methods Project* – *Combined Heat and Power: A Clean Energy Solution* – *Guide to the Successful Implementation of State CHP Policies*
State Policy Options	
• Could include: - CHP in state energy resource standard (e.g., EERS, RPS) - Updated standby rates - CHP in utility resource plans - Interconnection standards - Embrace CHP Packaged System eCatalog (in development)	

Sizable Opportunity: On-Site CHP Technical Potential in States

Recent DOE analyses indicate significant potential for expanded CHP system installations across all states in the U.S.



Source: U.S. DOE, 2016. Combined Heat and Power (CHP) Technical Potential in the United States

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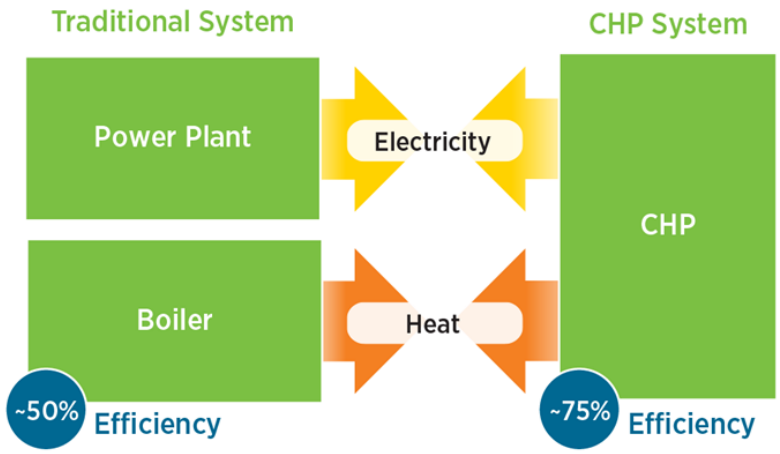
Why Combined Heat and Power?

How Combined Heat and Power Works

CHP is an *integrated energy system* that:

- Is located at or near a factory or building
- Generates electrical and/or mechanical power
- Recovers waste heat for
  - process heating or cooling
  - space heating or cooling
  - refrigeration
- Can utilize a variety of technologies and domestic fuels

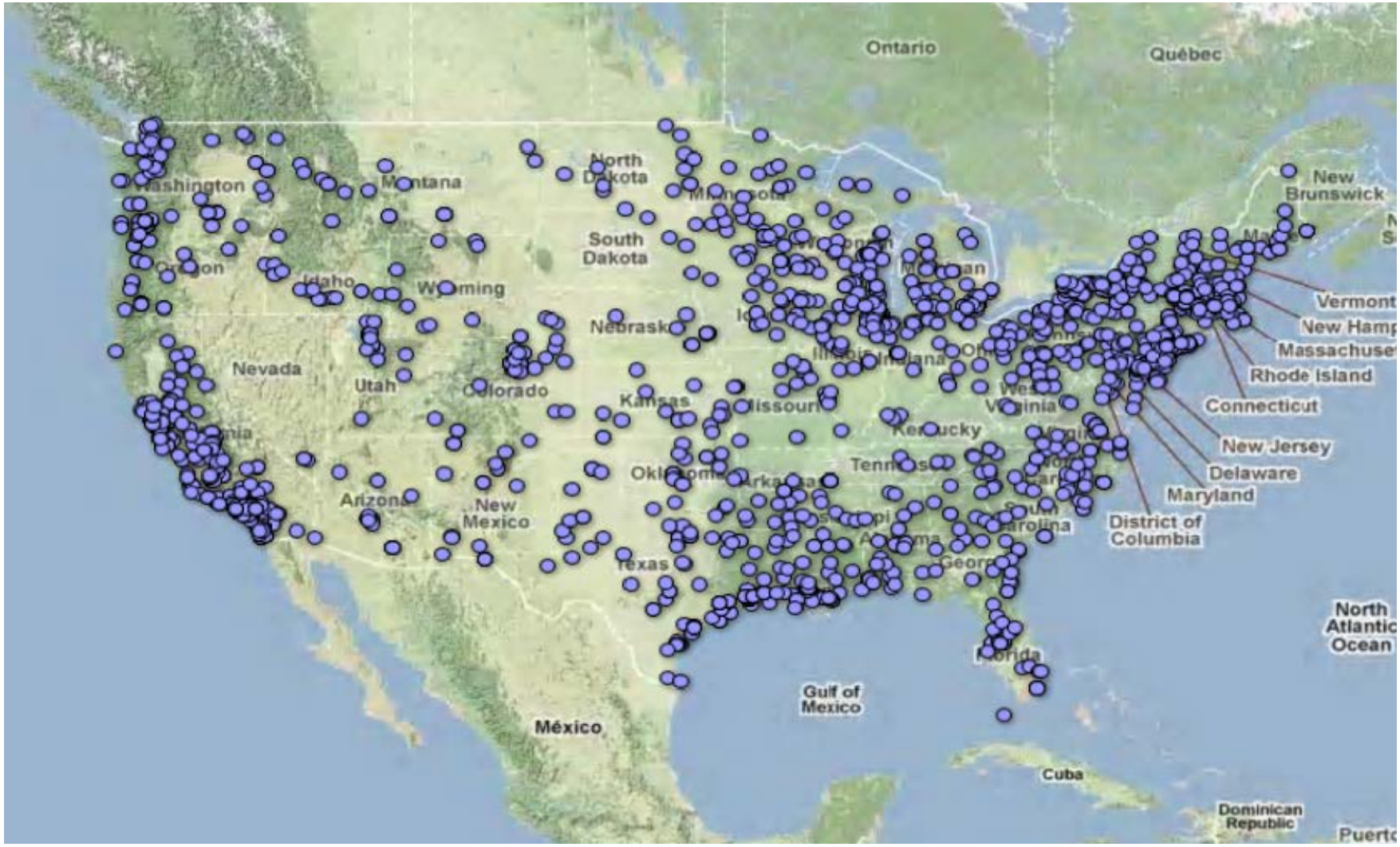


Benefits of Combined Heat and Power

- CHP is *more efficient* than separate generation of electricity and heat
- Increased efficiency and higher reliability of on-site CHP *lowers operating cost* and *enhances economic competitiveness*
- CHP *increases energy reliability for the user* and *enhances the resiliency of the surrounding grid*
- On-site CHP *reduces grid congestion and avoids or delays distribution investment*
- CHP can *keep critical infrastructure operating and support the grid* in times of emergency
- Higher efficiency and the use of clean domestic fuels *reduces emissions of all pollutants*

Current Status of Combined Heat and Power Adoption

CHP Is Used Nationwide – Map of Installations



Source: U.S. DOE CHP Installation Database (U.S. installations as of Dec. 31, 2015)

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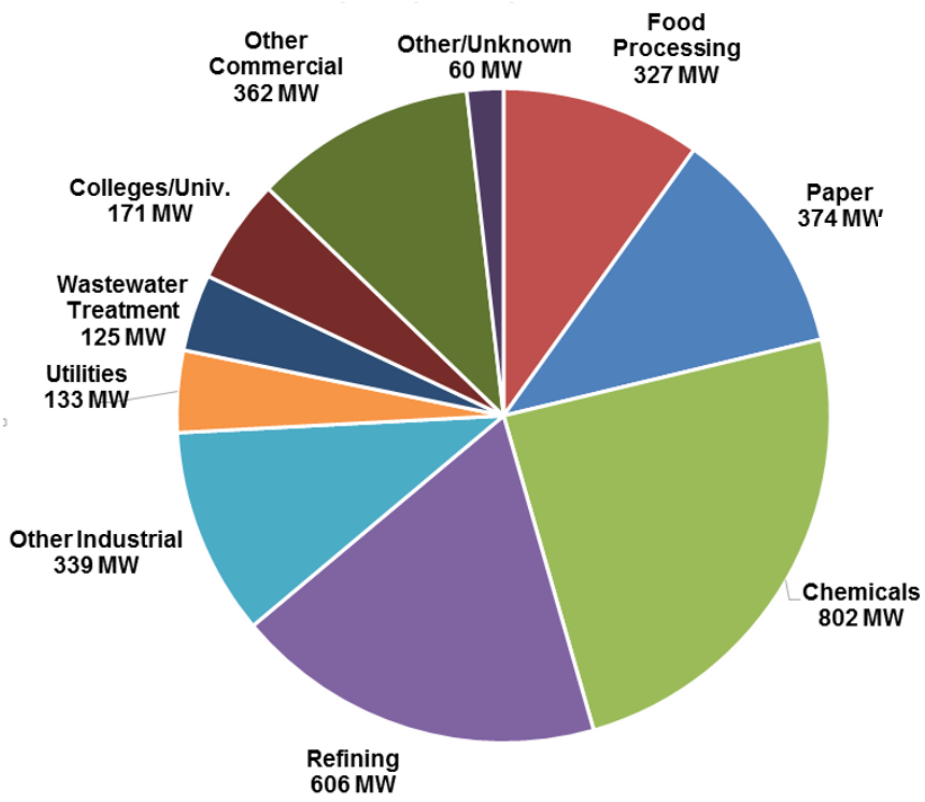
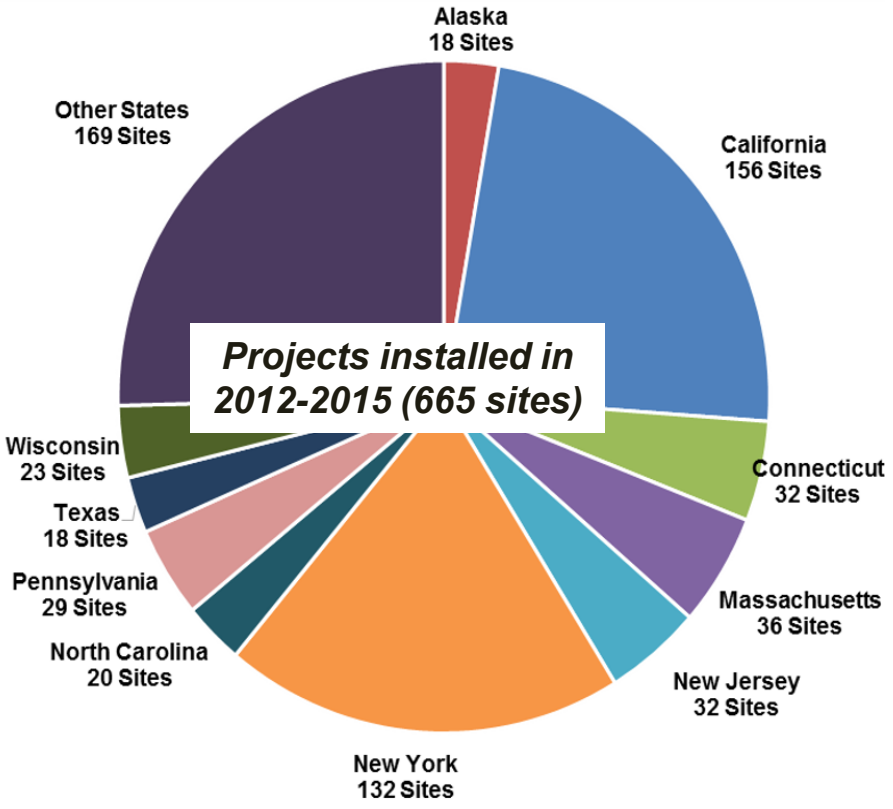
Current Status of Combined Heat and Power Adoption

- **81 GW** of installed CHP at over 4,400 industrial and commercial facilities
- 8% of U.S. Electric Generating Capacity; 12% of annual generation
- Avoids more than **1.8 quadrillion BTUs** of fuel consumption and **240 million metric tons of CO_2 annually** compared to separate production of heat and power

Application (Sites)



State (Sites)



7 Source: U.S. DOE CHP Installation Database (U.S. installations as of Dec. 31, 2015)

State and Local Role in Combined Heat and Power

CHP adoption can be supported by state and local action

Policy Actions

- State public utility commissions can facilitate CHP installations by:
  - Including CHP as a qualified resource in EE or renewable resource standards
  - Including CHP in utility or state ratepayer-funded efficiency programs
  - Standardizing interconnection requirements
  - Establishing fair and reasonable standby rates based on cost of service
  - Pursuing models of utility ownership, including CHP in utility resource plans
  - Incorporating the non-energy benefits of CHP into cost-effectiveness calculations, including resiliency and grid stability
- Local policymakers can streamline CHP installations by including CHP in local permitting codes and inspector training.

Implementation Actions

State and local CHP implementation is supported by offering:

- Training, outreach, and enforcement of building efficiency policies and codes
- Outreach and technical assistance regarding the energy efficiency and non-energy benefits of CHP

Best Practices for Combined Heat and Power Programs

- The SEE Action *Guide to the Successful Implementation of State CHP Policies* highlights successful state CHP policy implementation approaches for:
  - Design of standby rates
  - Interconnection standards for CHP
  - Excess power sales
  - Clean energy portfolio standards (CEPS)
  - Emerging market opportunities—CHP in critical infrastructure and utility participation in CHP markets.

- Best Practice Program Examples:
  - **NYSERDA's** CHP programs promote cleaner and more-efficient electrical power generation, heating and cooling for buildings, and industrial processes. NYSERDA's CHP Acceleration Program provides financial incentives for CHP installations
  - The **Maryland BG&E Smart Energy Savers** program provides incentives up to $2.5 million to industrial and commercial customers who install onsite CHP.

Partners

Potential partners for successful CHP programs include:

- Capital providers to capitalize clean energy loan programs
- State and local governments as well as electric and gas utilities to provide data, information, financial and non-financial incentives (e.g., quicker permitting processes), and to create CHP programs
- Energy service companies (ESCOs) to include CHP financing in their product offerings
- Manufacturing, building and, other trade organizations to assist with outreach to their membership
- National and local foundations to promote best practices

Combined Heat and Power is a Cost-Effective Resource

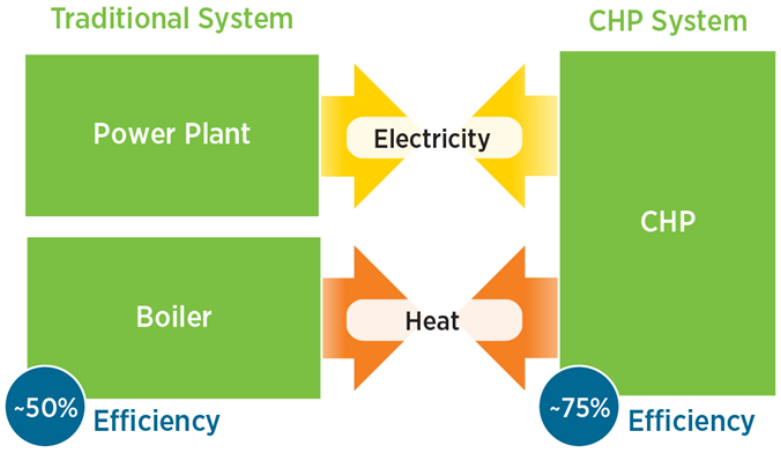
- Bloomberg Energy's *2015 Factbook: Sustainable Energy in America* notes that CHP has one of the lowest levelized costs of electricity across power generation technologies at an unsubsidized rate of around $45/MWh in 2014.

- McKinsey and Company's *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost? (2007)* states that CHP is one of the more cost effective available technologies for achieving reductions in CO_2 emissions.
  - The authors project that CHP will achieve reductions in CO_2 emissions at negative cost by 2030: -$36/ton CO2e in commercial applications; -$15/ton CO2e in industrial applications

EM&V Methods for Combined Heat and Power

Energy savings from CHP are calculated in comparison to traditional, central station-generated electricity and separate onsite heating fuel.

Electricity and heat production from fuel used by CHP projects can be directly measured onsite.



The following resources provide specific information:

- *Combined Heat and Power, The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures*, 2016
- U.S. Environmental Protection Agency, *Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems, 2015*
- NYSERDA *Distributed Generation Integrated Data System* includes monitored performance data for NYSERDA's portfolio of distributed generation projects
- *Combined Heat and Power Design Guide*, ASHRAE, 2015

DOE Support for CHP

www.energy.gov/chp

- DOE Advanced Manufacturing Office, CHP Deployment Program
- CHP Market Analysis and Tracking
  - DOE CHP Installation Searchable Database
  - DOE CHP Project Profile Database
  - DOE CHP Technical Potential Study
- DOE CHP Technical Assistance Partnerships (CHP TAPs)
- Better Buildings Combined Heat and Power (CHP) for Resiliency Accelerator

See also: EPA Combined Heat and Power Partnership

On the Horizon (*coming soon*)

Packaged CHP eCatalog and Market Engagement Partnership

- Will include combination of:
  - Web-based national eCatalog of standardized, DOE-recognized (meeting pre-specified technical standards) packaged CHP systems, with service agreements and approved vendors
  - State, local, and utility (electric and gas) partners willing to implement robust market engagement programs targeted at these markets.
- Designed to increase deployment of CHP in key underdeveloped markets by overcoming barriers that increase the perceived risks to end-users and CHP vendors.
- Expands CHP product offerings, improves quality, lowers costs, and enhances the CHP sales and service infrastructure by promoting CHP system and vendor competition.
- Market engagement partners reduce risk to customers and vendors through access to better information, analytic tools, technical assistance, and access to CHP eCatalog.

Get More Information on This Pathway and Others

Visit: energy.gov/eere/slsc/EEopportunities

How Energy Efficiency Programs Can Support State Energy Planning

Overview and individual presentations on features and benefits associated with including energy efficiency in state energy plans, covering:

- National and state-level energy savings potential estimates for 2030
- Current activity at the national and state levels, best practices, energy savings examples, cost-effectiveness, measurement approaches, and DOE support for:
  - Building energy codes
  - City-led efficiency efforts
  - Combined heat and power
  - Energy savings performance contracting
  - Industrial efficiency, including superior energy performance
  - Ratepayer-funded programs
  - Low income energy efficiency
- Technical assistance available

Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution, and Meet Energy Needs in the Power Sector

State and Local Energy Efficiency Action Network (SEE Action) resource presents pathways thru:

- Case studies of successful regional, state, and local approaches
- Resources to understand the range of expected savings from energy efficiency
- Common protocols for documenting savings
- Sources for more information