How Combined Heat and Power Can Support State Climate and Energy Planning

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

About this Presentation

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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 climate and energy plans.

Combined Heat and Power as an Emission Reduction Approach

Possible Leads

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

E-Savings

- kWh / MWh generated on site

Potential Program Components

- District energy / microgrids

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 buildings	Recent resources provide guidance, including: – *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) - Interconnection standards	
Low Income Opportunities	
• CHP projects in low income neighborhoods (e.g., multifamily housing, schools, community centers, hospitals, facilities)	

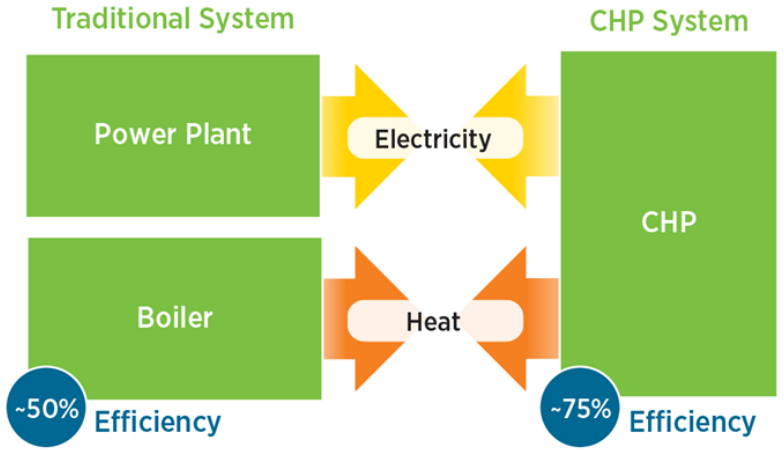
Potential Savings in 2030
75-115 million MWh
43-66 million short tons CO_2

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
  - dehumidification
- Can utilize a variety of technologies and fuels

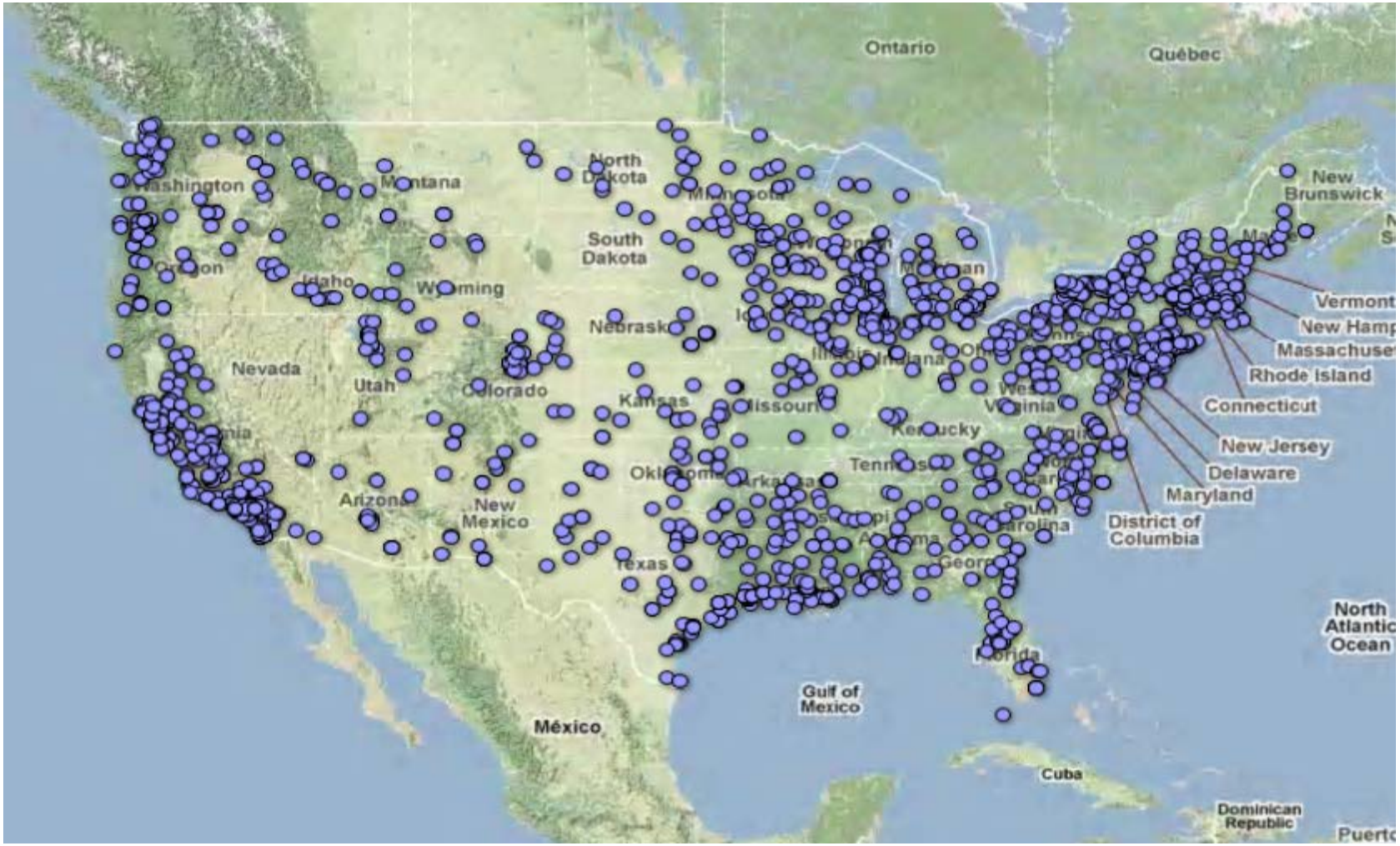


Benefits of Combined Heat and Power

- 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 can *keep critical infrastructure operating and support the grid* in times of emergency

Current Status of Combined Heat and Power Adoption

CHP Is Used Nationwide – Map of Installations

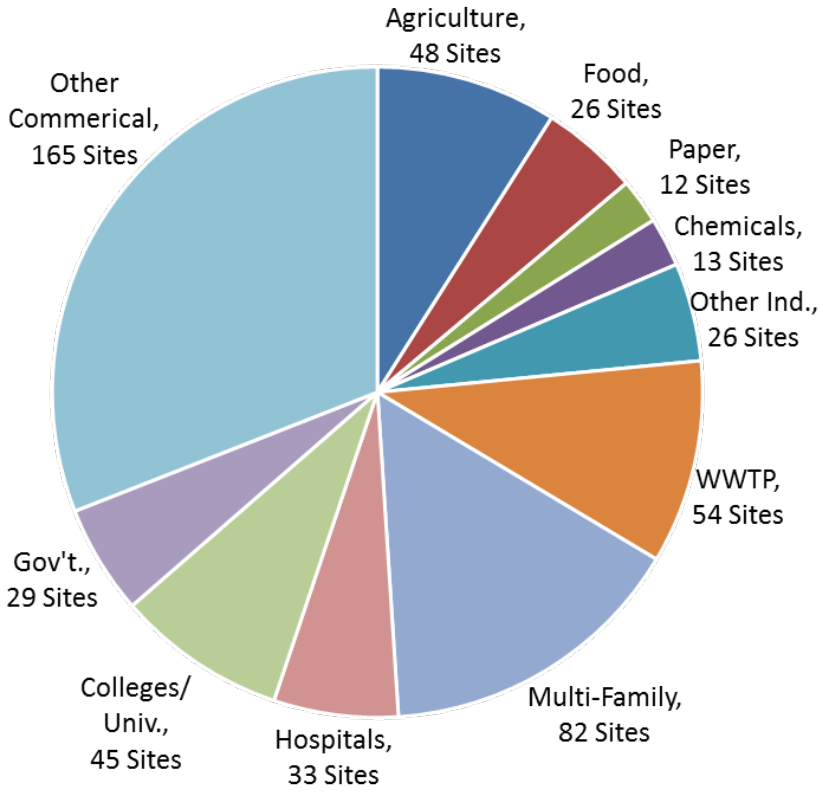


Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2014)

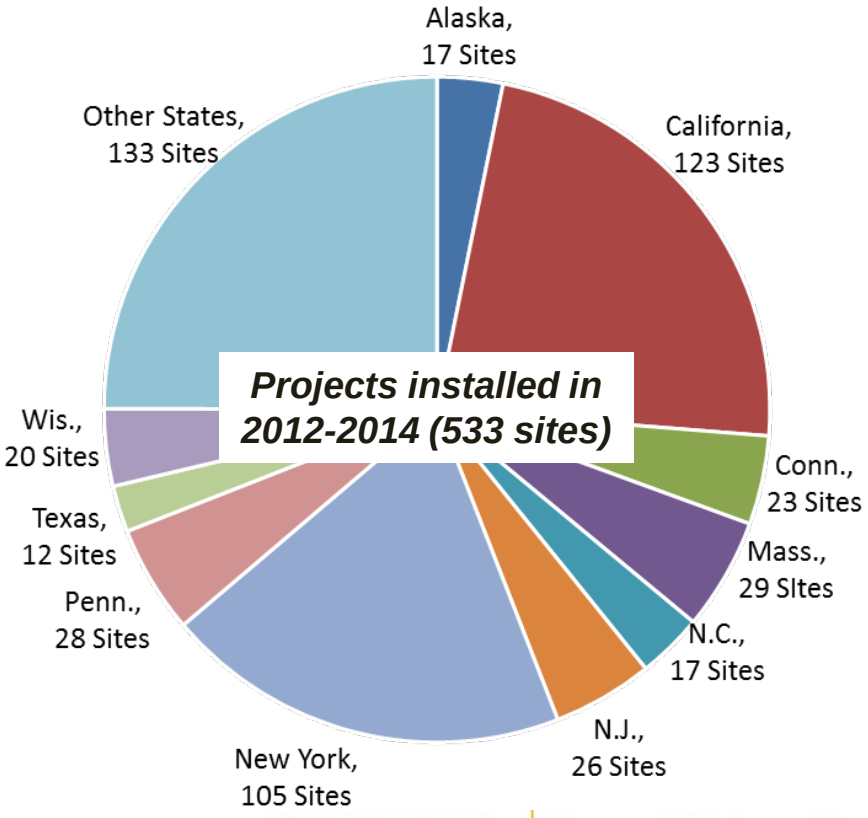
Current Status of Combined Heat and Power Adoption

- **82.7 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

By Application (Sites)



By State (Sites)



Source: DOE CHP Installation Database (installations as of 12/31/14)

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 reasonable standby rates
  - Pursuing models of utility ownership of CHP
  - 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 with no electricity export
  - 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 [~200 projects in process].
  - 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 and utilities to provide data, information, and financial incentives
- 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

National Electricity Savings Estimates

Current: In 2014, CHP installations resulted in approx. 5.5 million MWh of savings from:

- 847 MW of new CHP capacity in 2014 operating at an average rate of 6,500 hours per year

Future: In 2030, CHP installations could result in 75 to 115 million MWh and 43-66 million short tons CO_2 of savings if:

- States installed 30 to 45% of estimated economical (less than 10 year payback) CHP projects smaller than 100 MW.

Sources: DOE CHP Installation Database.
American Gas Association, 2013, The Opportunity for CHP in the United States

Expansion Potential: Examples from States

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

State	Total Onsite Potential (MW)	State	Total Onsite Potential (MW)
Alabama	2,777	Montana	377
Alaska	408	Nebraska	984
Arizona	2,320	Nevada	1,254
Arkansas	1,795	New Hampshire	447
California	11,542	New Jersey	3,761
Colorado	1,665	New Mexico	1,140
Connecticut	1,214	New York	6,908
District of Columbia	747	North Carolina	4,352
Delaware	762	North Dakota	445
Florida	6,917	Ohio	7,005
Georgia	5,110	Oklahoma	1,805
Hawaii	563	Oregon	1,337
Idaho	659	Pennsylvania	7,025
Illinois	7,161	Rhode Island	616
Indiana	4,145	South Carolina	3,063
Iowa	1,993	South Dakota	378
Kansas	1,909	Tennessee	3,981
Kentucky	2,721	Texas	13,675
Louisiana	4,903	Utah	1,119
Maine	494	Vermont	228
Maryland	2,282	Virginia	4,308
Massachusetts	3,028	Washington	2,387
Michigan	4,291	West Virginia	929
Minnesota	3,260	Wisconsin	3,187
Mississippi	1,833	Wyoming	847
Missouri	2,882	**Total**	**148,936**

Source: DOE. 2016. Assessment of Technical Potential for CHP in the United States

Combined Heat and Power is a Cost-Effective Resource

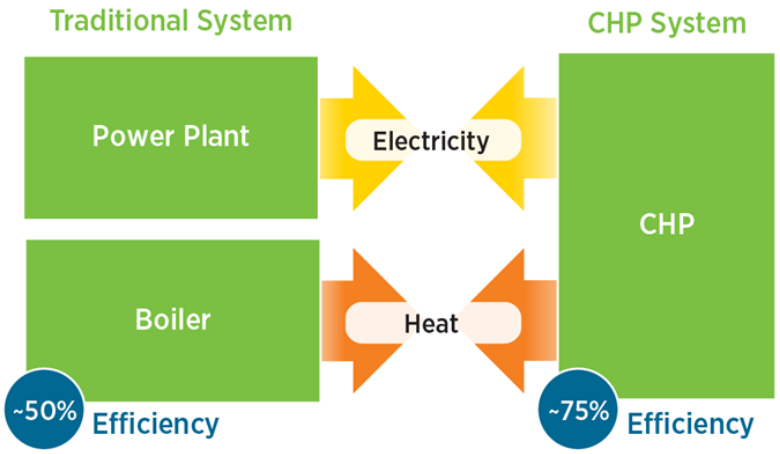
- Bloomberg Energy's *2015 Factbook: Sustainable Energy in America* notes that CHP has one of the lowest levelized costs of electricity across power generation technologies at an unsubsidized rate of around $45/MWh in 2014.

- 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 CO_2e in commercial applications; -$15/ton CO_2e 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:

- U.S. Environmental Protection Agency, *Methods for Calculating Efficiency & CHP Emissions Calculator*
- 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
- *Combined Heat and Power, The Uniform Methods for Determining Energy Efficiency Savings for Specific Measures*. Publication expected summer 2016.

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)

See also: EPA Combined Heat and Power Partnership

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On the Horizon (2016)

Technical Assistance Partnerships:

- *New Better Buildings Combined Heat and Power (CHP) for Resiliency Accelerator*

  Partners (states, localities, utilities) include CHP and other distributed generation into resiliency planning considerations to keep critical infrastructure operational.

- *New Packaged CHP System Challenge*

  Partners (states, localities, and utilities) increase CHP deployment in underdeveloped markets with standardized, pre-approved, and warranted CHP systems.

Publications:

– *Combined Heat and Power, The Uniform Methods for Determining Energy Efficiency Savings for Specific Measures*

Get More Information on This Pathway and Others

Visit: energy.gov/eere/slsc/EEopportunities

How Energy Efficiency Programs Can Support State Climate and Energy Planning

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

- National electricity 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