

Combined Heat & Power (CHP) Opportunities in Nevada

U.S. DOE Pacific CHP Technical Assistance Partnership

Nevada Legislative Committee on Energy
6/17/2016

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CHP Technical Assistance Partnerships
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Agenda Item IX A-1 (ENERGY)
Meeting Date: 06-17-16

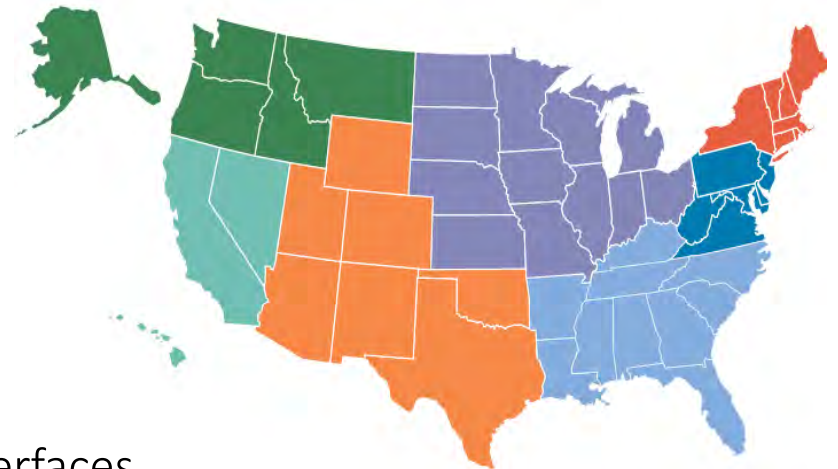
Presentation Overview

- DOE CHP TAP Technical Assistance
- Overview of Combined Heat & Power (CHP)
 - Concept
 - Benefits
 - Market
 - Energy Policies Favorable for CHP
- Nevada CHP Technical Potential
- Why is CHP a good fit for the State of Nevada?
- Example CHP Projects
- Working with the Pacific CHP TAP
- Questions



President's Executive Order 13624: 40GW of new CHP by 2020

- CHP TAPs are critical components of achieving the goal:
 - Regional CHP experts
 - Provide fact-based, un-biased information on CHP
 - Technologies
 - Project Development
 - Project Financing
 - Local electric and natural gas interfaces
 - State best practice policies
 - Vendor, fuel, and technology neutral



<http://eere.energy.gov/manufacturing/distributedenergy/chptaps.html>



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Pacific CHP TAP: Key Activities

- **Market Opportunity Analysis.**

Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors

- **Education and Outreach.**

Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

- **Technical Assistance.**

Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy with CHP in their facility and to help them through the development process from initial CHP screening to installation.



<http://eere.energy.gov/manufacturing/distributedenergy/chptaps.html>

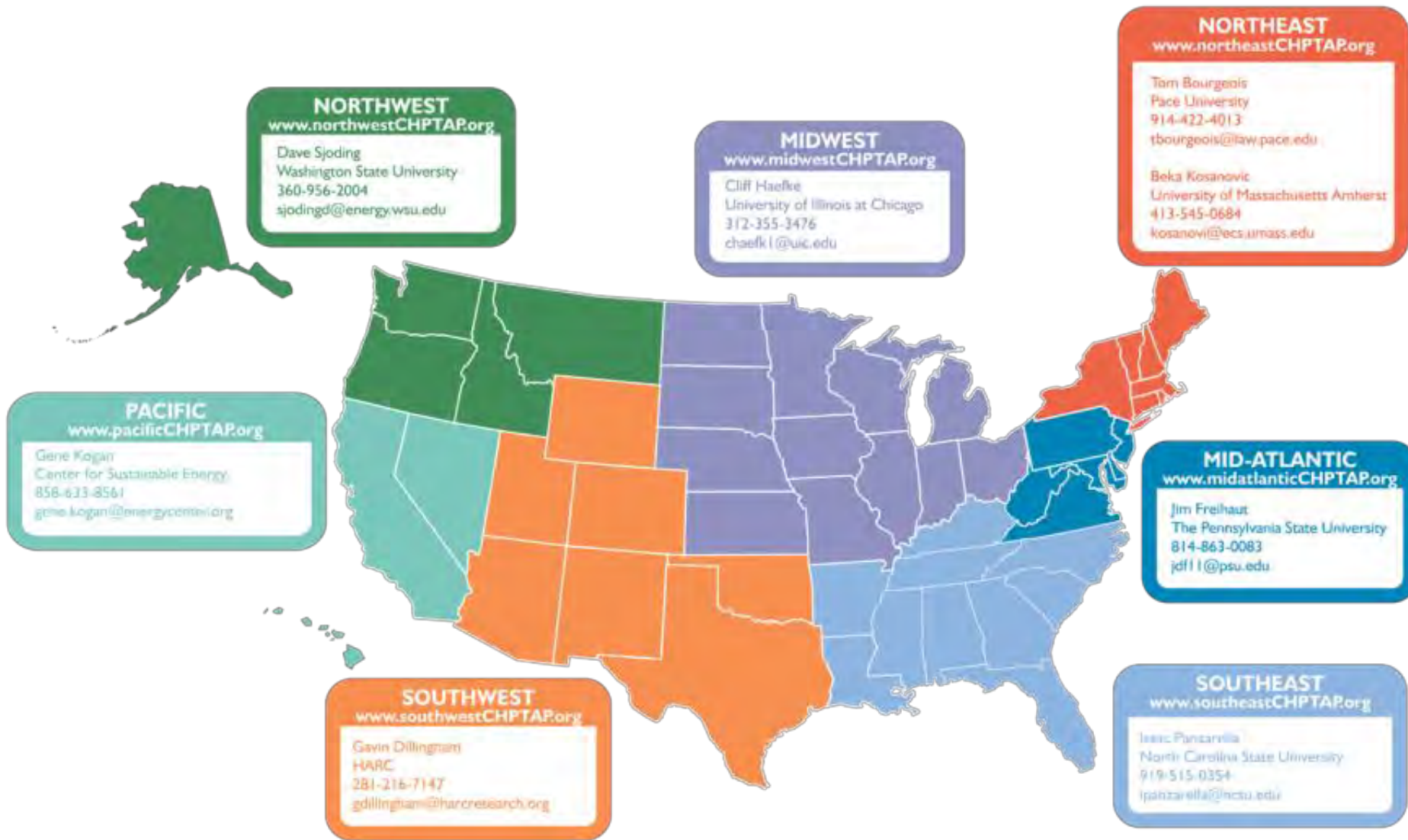


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DOE CHP Technical Assistance Partnerships (CHP TAPs)



DOE CHP Technical Assistance Partnerships (CHP TAPs): Program Contacts

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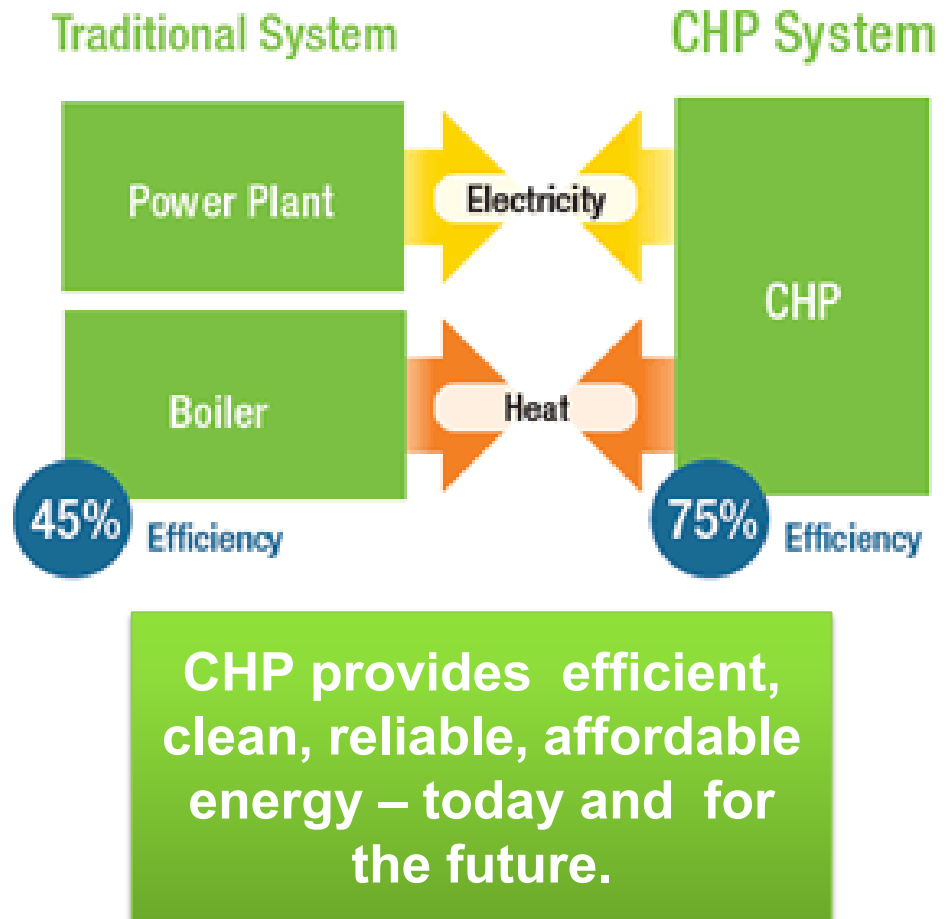
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CHP: A Key Part of Our Energy Future

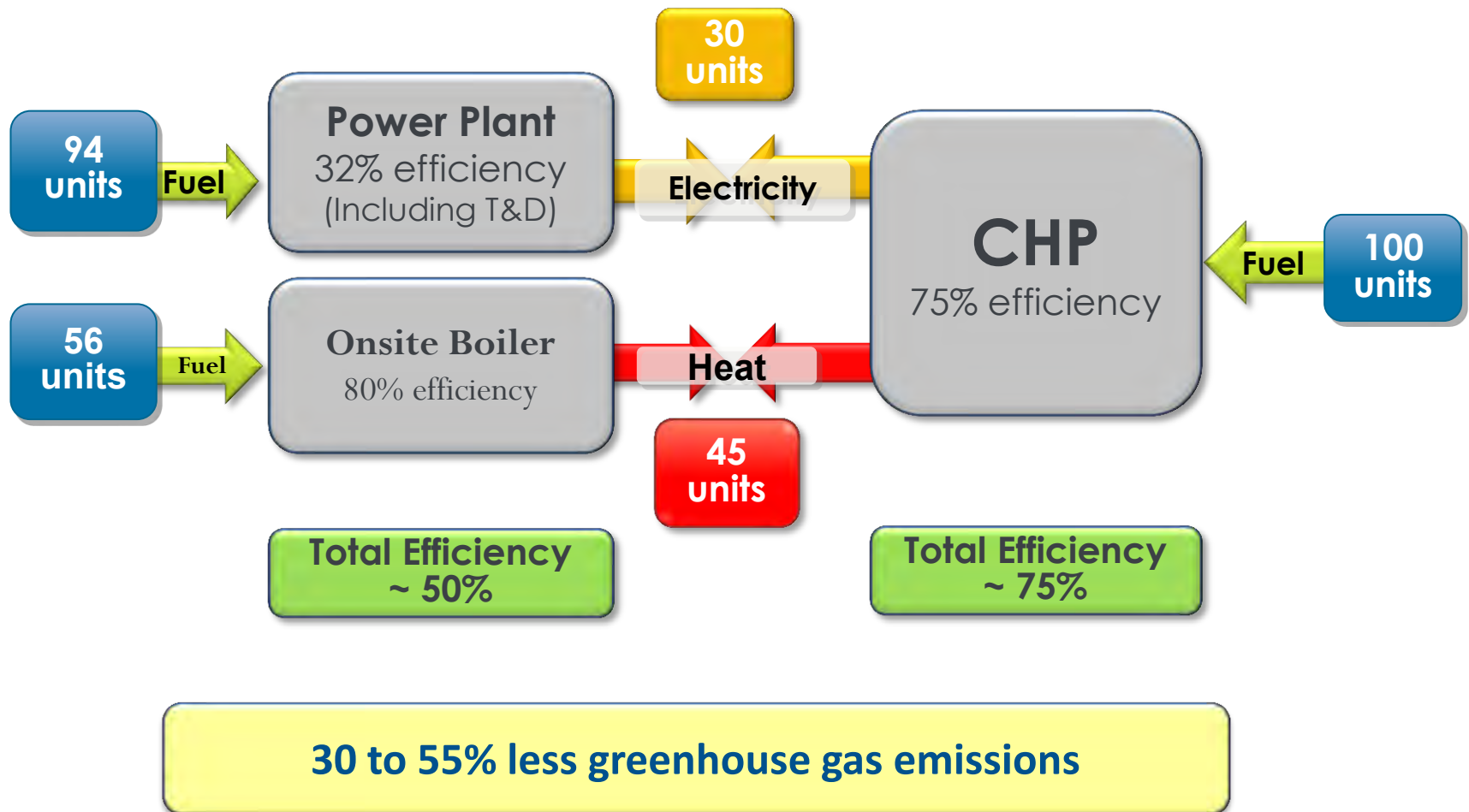
- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
 - Space Heating / Cooling
 - Process Heating / Cooling
 - Dehumidification



Source:
http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf



CHP Recaptures Heat of Generation, Increasing Energy Efficiency, and Reducing GHGs



CHP can use a Variety of Technologies and Fuels

Natural Gas – Biogas - Propane

Microturbines



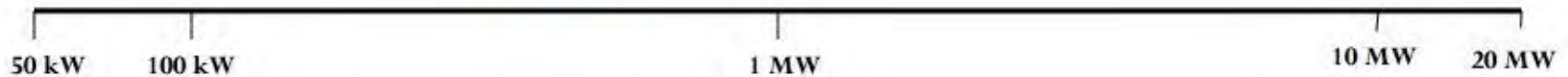
Gas Turbines



Reciprocating Engines



Fuel Cells



What Are the Benefits of CHP?

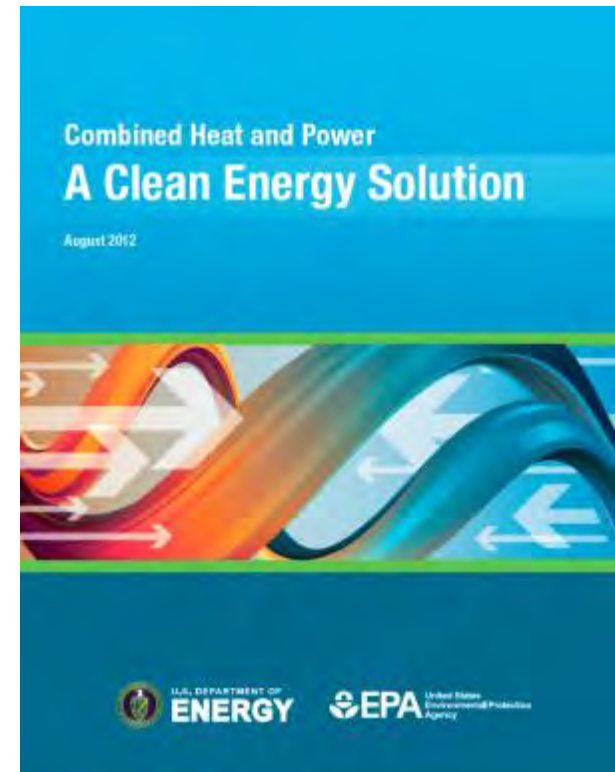
- CHP is **more efficient** than separate generation of electricity and heating/cooling
- Higher efficiency translates to **lower operating costs** (but requires capital investment)
- Higher efficiency **reduces emissions** of all pollutants
- CHP can also increase **energy reliability** and enhance power quality



Emerging National Drivers for CHP

- Benefits of CHP recognized by policymakers
 - President Obama signed an Executive Order to accelerate investments in industrial EE and CHP on 8/30/12 that sets national goal of 40 GW of new CHP installation over the next decade
 - State Portfolio Standards (RPS, EEPS), Tax Incentives, Grants, standby rates, etc.
- Favorable outlook for natural gas supply and price in North America
- Opportunities created by environmental drivers
- Utilities finding economic value
- Energy resiliency and critical infrastructure

DOE / EPA CHP Report (8/2012)



Report:
http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf



Critical Infrastructure and Resiliency

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 (if properly configured):

- Offers the opportunity to improve Critical Infrastructure (CI) resiliency
- Can continue to operate, providing uninterrupted supply of electricity and heating/cooling to the host facility



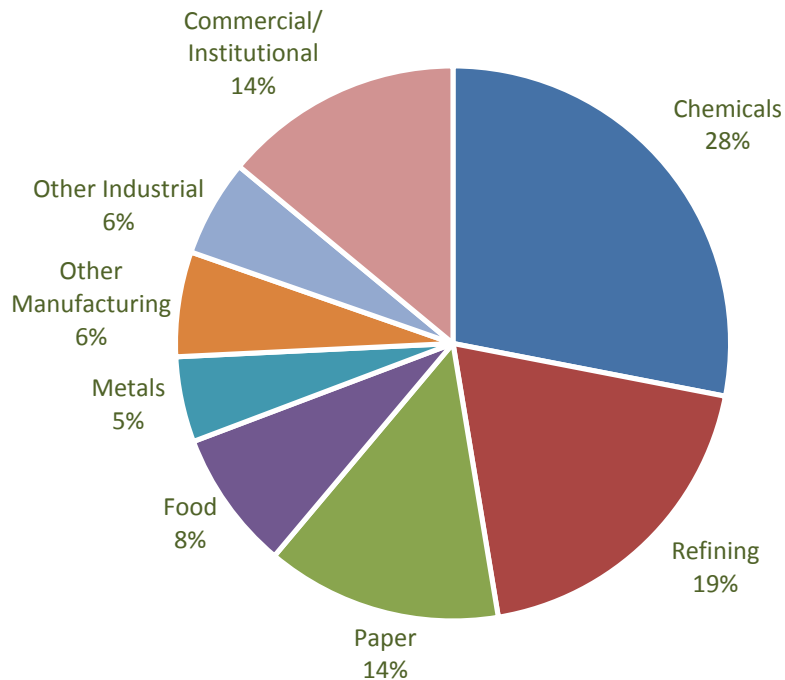
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CHP Today in the United States

Existing CHP Capacity (MW)



- **82.7 GW** of installed CHP at over 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

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"



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Nevada Energy Policies Favorable for CHP

- **NRS 704.7802** (NV Energy Portfolio Standard) includes CHP/Cogeneration as ‘eligible’ energy efficiency resource where CHP can offset consumption (kWh) and demand (kW) and reduce costs
- **NV Senate Bill 123** (2013) requires NV Energy to retire 800 MW from coal-fired plants by 2019 with 900 MW of capacity from cleaner facilities to replace it: 350 MW from renewable energy plants and 550 MW from other electric generating plants, including natural gas
- **NV Senate Bill 358** (2009) directed the Director of the NV GOE to develop and maintain a state energy reduction plan requiring state agencies to reduce grid-based energy purchases for state-owned buildings by 20% by 2015. CHP is included as one of the methods available to the state to meet this goal.

Source: http://puc.nv.gov/Renewable_Energy/Portfolio_Standard/

Source: http://www.leg.state.nv.us/Session/77th2013/Bills/SB/SB123_EN.pdf

Source: https://www.leg.state.nv.us/75th2009/Bills/SB/SB358_EN.pdf



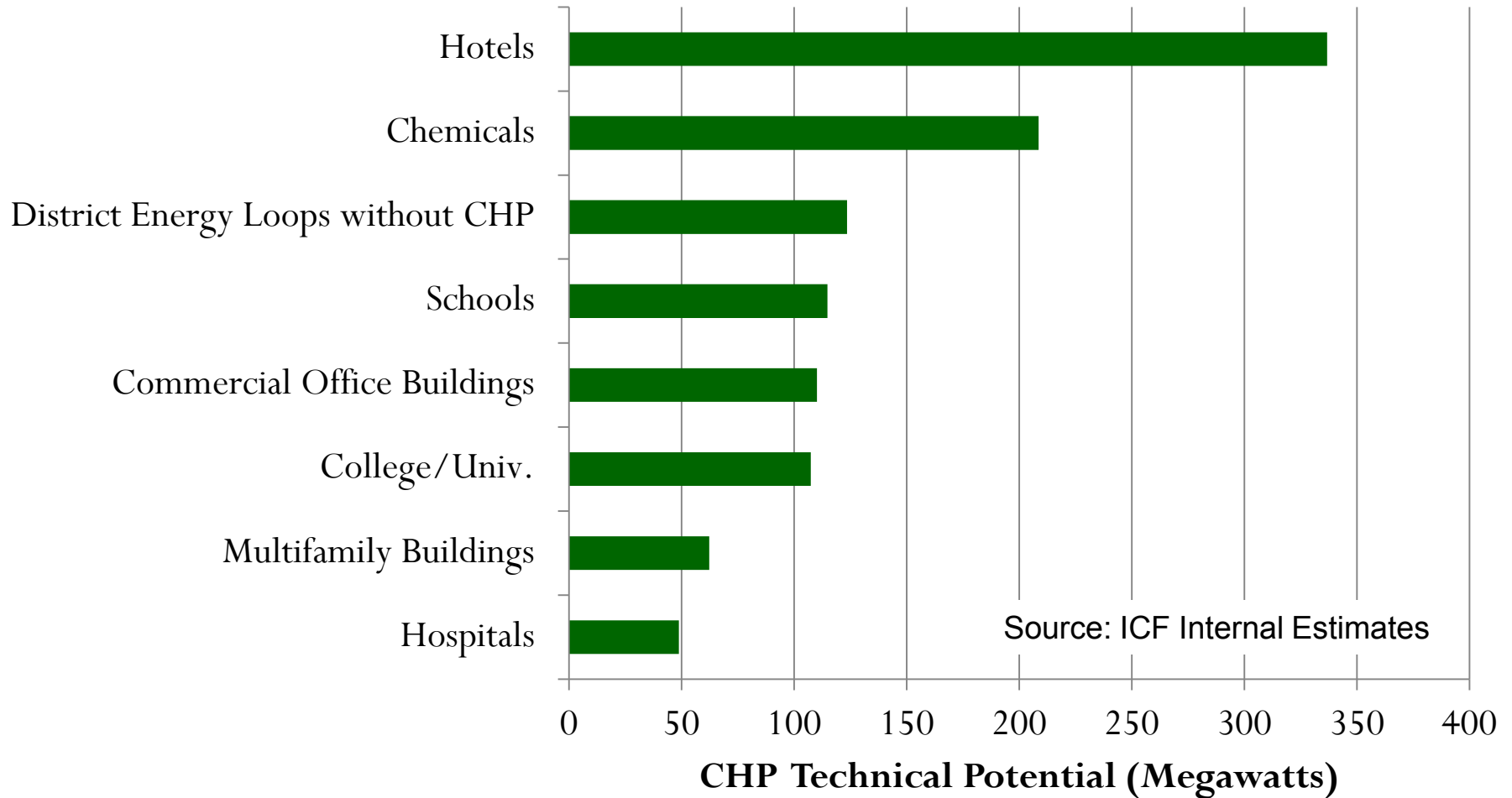
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CHP Opportunities in Nevada

CHP Technical Potential (onsite) = 1,370 Megawatts



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CHP Installations Summary in Nevada

Market Sector	Sites	kW
Chemicals	1	105,000
Pulp and Paper	1	85,000
Stone/Clay/Glass	1	85,000
Agriculture (greenhouse)	1	61,300
Solid Waste Facility	1	11,000
Hotels/Resorts	2	9,209
Petroleum Refining	1	7,500
Printing/Publishing	1	3,000
Hospitals	1	1,000
Amusement/Recreation	1	150
College/University	1	30
Multifamily Buildings	<u>2</u>	<u>25</u>
Total	14	368,214

Fuel Type	Sites	kW
Natural Gas	12	349,714
Biomass	1	11,000
Waste Heat	<u>1</u>	<u>7,500</u>
Total	14	368,214

Source: U.S. DOE CHP Installation Database
(as of December 2015)

<https://doe.icfwebservices.com/chpdb/>



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CHP Project Snapshot:

Sustainability (Hotels/Casinos)

MGM International ([CityCenter](#))

Las Vegas, NV



Application/Industry: Hotels/Casinos

Capacity (MW): 8 MW

Prime Mover: Gas Turbine

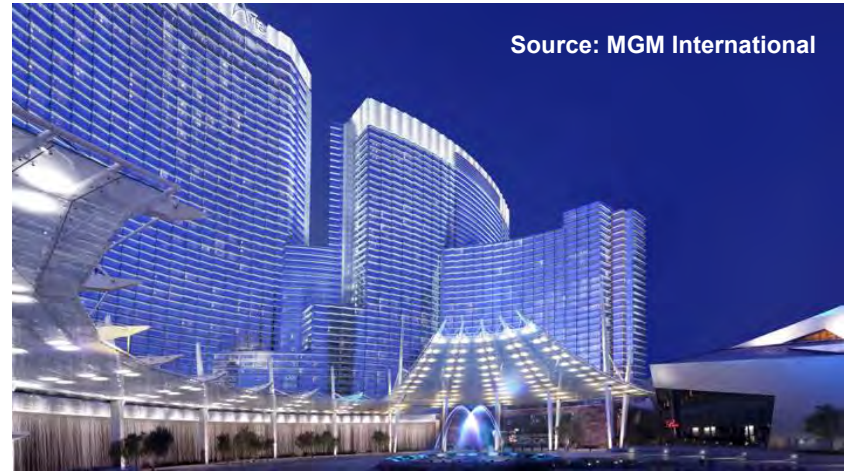
Fuel Type: Natural Gas

Thermal Use: Domestic hot water

Installation Year: 2009

Testimonial: MGM Resorts developed the CityCenter project with an eye on sustainability and functional design. Resort operations require consistent and reliable access to electricity and hot water for guest services and hotel security functions so CHP was an integral component to the campus' development. The installed CHP plant provides more than 25 percent of the annual electricity used at the CityCenter campus and gives MGM Resorts a measure of resiliency from the local electricity grid not available at other resorts. In the event of a grid failure, CityCenter has the ability to maintain operations of critical functions.

In 2009, CityCenter was awarded six Gold LEED certification from the U.S. Green Building Council, in part due to its superior energy performance.



Source: "MGM Resorts Deploys Clean Energy CHP System at CityCenter"

<http://www.pewtrusts.org/en/research-and-analysis/q-and-a/2013/10/31/mgm-resorts-deploys-clean-energy-chp-system-at-citycenter>



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CHP Project Snapshot:

Power Reliability (Chemical Industry)



Evonik Industries

Garyville, LA

Application/Industry: Chemical

Capacity (MW): 5 MW

Prime Mover: Gas Turbine

Fuel Type: Natural Gas

Thermal Use: Process Steam

Installation Year: 2012



Testimonial: Evonik decided to invest in a CHP system to improve both their electric power and steam reliability. The system provides 100% of the facility's electric needs for most of the year and eliminated Evonik's dependency on their previous steam supplier, minimizing disruptions that were out of their control.

Source: Evonik, Garyville, LA
<http://corporate.evonik.com/en/Pages/default.aspx>



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CHP Project Snapshot:

District Energy (Hospitals/Healthcare)

Texas Medical Center (TMC)

Houston, TX

Application/Industry: Hospital

Capacity (MW): 48 MW

Prime Mover: Gas Turbine

Fuel Type: Natural Gas

Thermal Use: Process Steam

Installation Year: 2010



Testimonial: TECO operates the largest chilled water district energy system in the U.S. at the largest medical center in the world, the Texas Medical Center.

The CHP system can operate as a baseload system to serve 100% of the TECO plant peak electrical load and 100% of TECO customers' peak process and space heating loads.



Source: U.S. DOE Southwest CHP TAP Project Profile
http://www.southwestchptap.org/data/sites/1/documents/profiles/Texas_Medical_Center-Project_Profile.pdf



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CHP Project Snapshot:

Microgrid Configuration (University)

University of California at San Diego
San Diego, CA

Application/Industry: College/University

Capacity (MW): 42 MW

Prime Movers: Gas Turbine / Fuel Cell

Fuel Type: Natural Gas / Biogas

Thermal Use: Domestic hot water

Installation Year: 2001

Testimonial: With a daily population of over 45,000 and a number of energy intensive research and medical facilities operating 7/24, UC San Diego is the size and complexity of a small city. In 2001, UCSD decided to pursue CHP as a way to provide reliable, cost effective power to the entire campus.

UCSD self generates over 70% of its electric demand from two sources: a 27MW natural gas CHP power plant and a 2.8MW biogas powered fuel cell. An additional 22% of its electric demand is covered by solar PV and electric batteries. Only 8% of electric demand is purchased from the grid. The microgrid includes a thermal energy storage system that covers 95% of heating and cooling for the campus.



Source: UCSD (<http://sustainability.ucsd.edu/initiatives/energy.html#Clean-Energy-Production>)



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Attractive CHP Markets



Industrial

- **Chemical manufacturing**
- Food processing
- **Natural gas pipelines**
- Petrochemicals
- **Pharmaceuticals**
- Rubber and plastics



Commercial

- **Hotels and Casinos**
- Restaurants
- **Commercial office buildings**
- Data centers
- **Multifamily buildings**
- Supermarkets
- **Government buildings**



Institutional

- **Hospitals**
- Correctional Facilities
- **Colleges & Universities**
- Wastewater treatment
- **Schools (K – 12)**



Agricultural

- **Wood waste (biomass)**
- Concentrated animal feeding operations
- **Dairies**

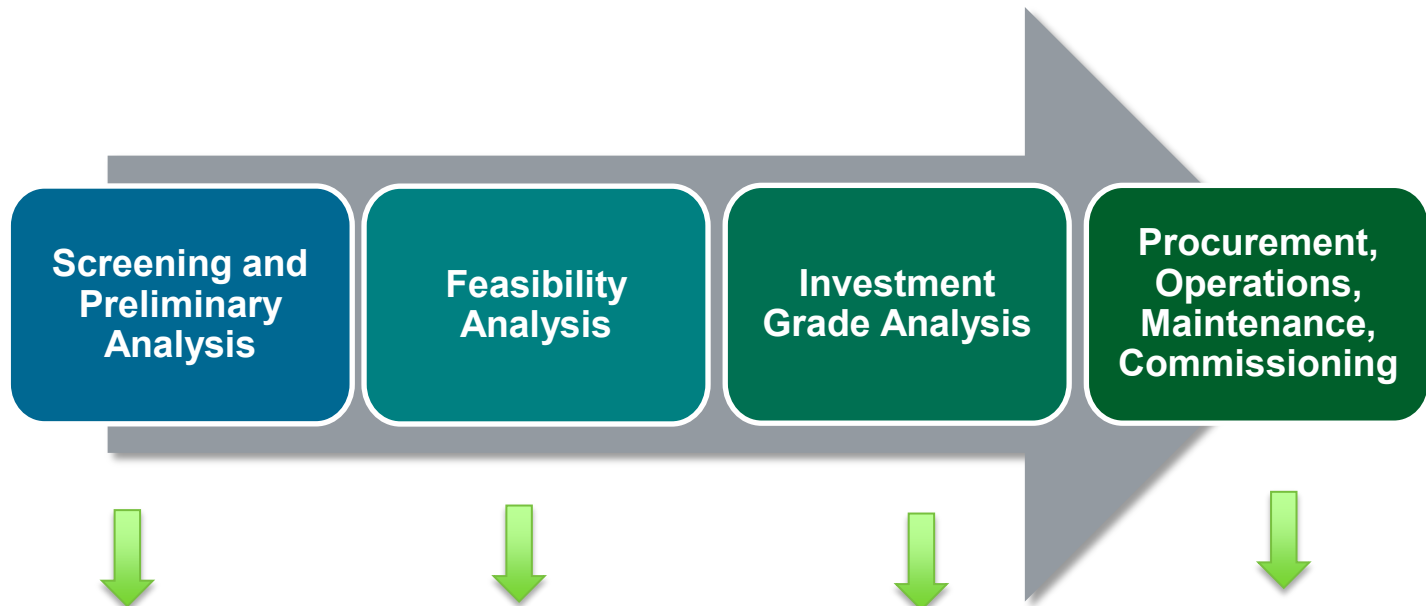


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US DOE CHP TAP Services:

Quick screening questions with spreadsheet payback calculator.

Uses available site information. Estimate: savings, Installation costs, simple paybacks, equipment sizing and type.

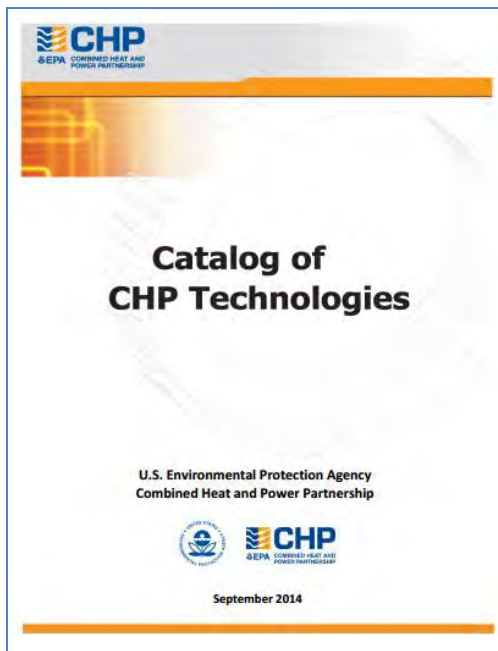
3rd Party review of Engineering Analysis. Review equipment sizing and choices.

Review specifications and bids, Limited operational analysis



CHP Project Resources

DOE/EPA Catalog of CHP Technologies (updated 2014)



www.epa.gov/chp/chp-technologies

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



energy.gov/chp-installs



CHP Project Resources

DOE Project Profile Database
(150+ case studies)

DOE Database of Incentives & Policies (DSIRE)

The screenshot displays two project profiles from the DOE Project Profile Database. The top profile is for North Carolina State University's 11 MW CHP & District Energy System, featuring a 'Project Overview' and 'Quick Facts' section. The bottom profile is for the East Bay Municipal Utility District's 11-MW CHP System, including a 'Site Description' and 'Reasons for Installing Combined Heat & Power' section. Both profiles include images of the respective facilities and detailed technical information.

The screenshot shows the DSIRE (Database of State Incentives for Renewables & Efficiency) website. It features a red header with the DSIRE logo and navigation links for Home, Glossary, Links, FAQs, Contact, and About. Below the header, there are sections for 'DSIRE SOLAR' and 'DSIRE NEWS'. A central search bar is prominent, and a map of the United States is displayed on the right side, with callouts for various states. The website also includes a 'Resources' sidebar with links to RPS Data, Summary Maps, Summary Tables, Library, What's New?, and Search.

energy.gov/chp-projects

www.dsireusa.org



Next Steps

Provide educational and technical assistance by:

- Working with NV GOE and SW GAS to identify end user interest
- Identification of potential new CHP market sectors and projects
- Offering available resources for CHP site screenings, feasibility studies, and other advanced technical assistance
- Educating state lawmakers and affiliated governmental groups on the benefits of CHP in the state and CHP technical potential in commercial & industrial applications



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Thank You

Questions?

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<http://www.pacificchptap.org/>

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