

U.S. DOE Regional Clean Energy Application Centers

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Heat is Power Annual Meeting

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Purpose / Overview

- Introduce Attendees to the CEACs
 - US DOE CHP Issues and Goals
 - CEAC Origins
 - Who we are
 - What we do
- Present CEAC efforts on WHP
 - Highlighting Intermountain CEAC efforts
- Introduce Attendees to the SEE Action Network
 - Industrial EE/CHP Working Group



Defining CHP

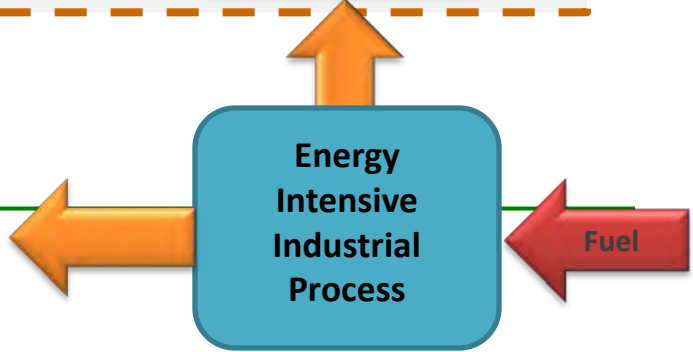
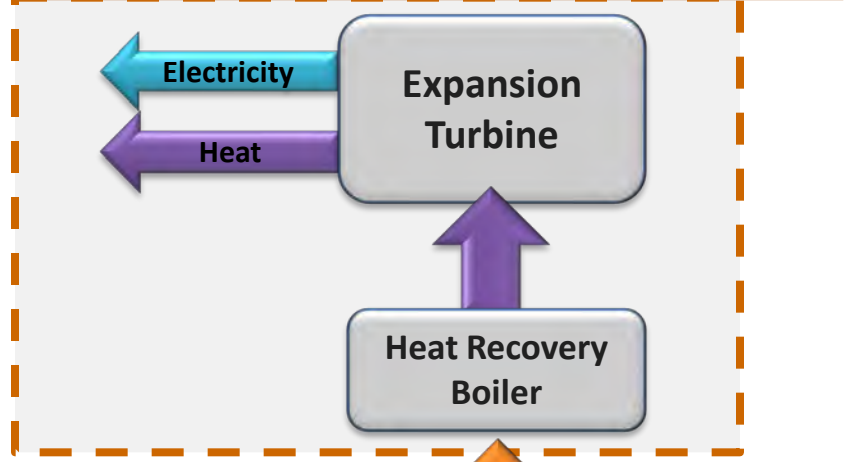
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Two (2) Forms of CHP

Topping Cycle CHP *(also referred to as Conventional CHP)*



Bottoming Cycle CHP *(also referred to as Waste Heat to Power or WHP)*



Why CHP Matters

- CHP is an important energy resource that provides
 - Benefits for U.S. Industry
 - Reduces energy costs for the user
 - Reduces risk of electric grid disruptions
 - Provides stability in the face of uncertain electricity prices
 - Benefits for the Nation
 - Improves U.S. manufacturing competitiveness
 - Offers a low-cost approach to new electricity generation capacity
 - Provides immediate path to lower GHG emissions through increased energy efficiency
 - Lessens need for new T&D infrastructure and enhances power grid security
 - Uses abundant, domestic energy sources
 - Uses highly skilled American labor and American technology



Why CHP Now

- **State and federal policymakers recognizing CHP benefits**
 - Increasing activity at the state level – policy makers, Governors, regulators
 - DOE refining CHP deployment efforts
 - CHP receives credits in proposed national Clean Energy Standard
- **Coal and oil power plant retirements announced / planned in a number of states**
 - CHP can help replace generation capacity – highly efficient, distributed
- **Near-term market opportunities**
 - Forthcoming Industrial/Commercial/Institutional Major Source Boiler MACT
 - Universities and some companies have set reducing carbon footprint as a priority
- **Shale gas has changed the outlook for natural gas in North America**
 - Moderate gas prices and less volatility



DOE CHP Deployment Goal

- 40 gigawatts (GW) of new, cost-effective CHP by 2020
 - Approx 50% more than current US CHP capacity
 - Goal same as SEE Action IEE/CHP Working Group (WG)
- Context:
 - 81.7 GW CHP today at over 3700 facilities
 - Technical potential: 132 GW (64 Industrial, 68 Commercial)
- Energy savings from achieving goal
 - Nearly 1 quad savings. Equivalent to:
 - 1% of total annual energy consumption in the U.S.
 - 7% of the total 13.4 quads estimated potential energy savings in the industrial sector by 2020
- CO₂ savings from achieving goal
 - Over 150 million metric tons (equivalent to displacing the CO₂ emissions from over 25 millions cars)



Clean Energy Application Center (CEAC) Mission and Focus

CEAC Mission: Develop technology application knowledge and the educational infrastructure necessary to promote “clean energy” technologies as viable energy options and reduce any perceived risks associated with their implementation.

CEAC Focus: Assist in transforming the market for CHP, WHP, and DE technologies and concepts throughout the United States by providing:

Market Analysis
& Evaluation

Education &
Outreach

Technical Assistance

Evolution of the CEACs

- Originally Established as “Regional CHP Application Centers” by US DOE to support DOE CHP Challenge
 - ORNL/Industry Recommendation: Regional presence to build awareness and address project and policy barriers
- Pilot Center Started in 2001 in the Midwest
 - Partnership between UIC ERC and ORNL
- Expanded from pilot to 8 regional centers in 2003/2004
- Energy Independence & Security Act (EISA) - 2007
 - Re-designated the 8 Regional “CHP Application Centers” as “Clean Energy Application Centers”
- Established the International District Energy Association as the 9th CEAC - 2009

DOE Clean Energy Application Centers: Locations, Contacts, and Web Sites



NORTHWEST

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CEAC Services

Market Assessments

Supporting analyses of CHP market potential in diverse sectors, such as health care, industrial sites, hotels, and new commercial and institutional buildings.

Education and Outreach

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

Technical Assistance

Providing technical information to energy end-users and others to help them consider if CHP, waste heat to power or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.



Key State CHP Challenges

- Host of market and non-market barriers impacting increased CHP investment:
 - As states look to emerge from economic downturn, job creation is a high priority. Link between CHP and job creation has not been fully recognized.
 - Establishing and maintaining favorable policies for CHP requires continual education as policy leaders change.
 - Inclusion of CHP in state energy portfolio standards is growing, but many states still do not include it as an eligible resource.
 - Increasing amounts of distributed supply (renewables and CHP) may pose integration challenges for power pools and RTOs.
 - CHP often recognized as an effective GHG reduction measure but how to balance it with other priority measures and issues may be challenging.

WHP Lay of the Land

- Market Potential: >5.7 GWs
- Existing: 557 GWs
 - Industrial waste heat, compressor station GT exhaust, and landfill prime movers exhaust
 - Largest Market Applications
 - Primary Metals
 - Nonmetallic Mineral Production
 - Petroleum refining
 - Chemical Industry
 - Fabricated Metals
 - Natural Gas Compressor Stations
 - Landfill Gas Energy Systems
 - Oil and Gas Production
- Incentives
 - 14 states WHP RPS / EERS or Goals :
 - AZ, CO, DE, IN, LA, MN, NV, NC, ND, OH, OK, SD, UT, WV
 - No current fed tax incentives

Source: ICF International

CEAC WHP Efforts - Policy

- Waste Heat to Power under RPS / EERS / Goals
 - Recent CEAC actively supported WHP under RPS in:
 - North Carolina REPS – WHP eligible
 - Ohio RPS – WHP eligible
 - Leading to initial project activities
 - Efforts coordinated with Ohio Coalition for CHP
 - Louisiana Pilot RPS – 350 MWs RE by 2013 (WHP Eligible)
- Other State Incentives
 - California SGIP: \$1250/kW installed (internal loads only)
 - Texas: No air permits required for WHP

CEAC WHP Efforts: Education and Outreach

- Four multi-CEAC workshops on WHP have taken place
 - First two: Introductory, bringing industry together
 - Irvine 2005 and 2006
 - Second two: Beginning to engage prospective end-users, open conversation on policy issues
 - Houston 2007, Chicago 2010
 - Workshops identified:
 - Growth of interest in WHP technologies
 - Market drivers include rising costs of electricity and companies efforts to green products and improve EE, reduce costs, and competitiveness
 - Lack of end-user awareness for largest market segments
 - The need for more project profiles / case studies / lessons learned
 - The need for increased policy discussions - inconsistent policy, incentives, and RPS treatment exist
- Webinars on ORC Technology (March 2011 with Ormat) and Introduction to WHP (May 2011 with TAS)



Project Profiles of Successful WHP Projects

- Purpose - to educate prospective end users on benefits of real projects.
- Plans to increase WHP project profiles - Work with your regional CEAC
- Searchable database at <http://www1.eere.energy.gov/manufacturing/distributedenergy/chp/database/>

PROJECT PROFILE

Trailblazer Pipeline
4-MW Waste Heat Recovery System

U.S. DOE
INTERMOUNTAIN
CLEAN ENERGY APPLICATION CENTER

Site Description

PROJECT PROFILE

Kennecott Utah Copper Smelter
32-MW Waste Heat Recovery System

U.S. DOE
INTERMOUNTAIN
CLEAN ENERGY APPLICATION CENTER

Quick Facts

LOCATION: Salt Lake County, Utah
MARKET SECTOR: Primary metals
SMELTER SIZE: 300,000 tons of copper anodes produced annually
EQUIPMENT: Waste heat boiler, heat recovery system, steam turbine generator
ELECTRIC CAPACITY: 32 MW nameplate, 20-25 MW average
PERCENT OF FACILITY LOAD: ~50%
WASTE HEAT SOURCE: Smelter exhaust, acid plant
IN OPERATION SINCE: 1995
ENVIRONMENTAL BENEFITS: Pollution-free electricity from waste heat, improved energy efficiency

Site Description

Kennecott Utah Copper, a subsidiary of Rio Tinto, produces copper, silver, gold, molybdenum and sulfuric acid. It is the second-largest copper producer in the U.S., providing about 25 percent of the country's copper needs.

The copper smelter is the key facility that processes copper concentrate through heat and oxidation in furnaces, into 99.5% copper metal called anodes (which are then transported to the nearby refinery to be processed into copper cathodes and sold to customers). The smelter produces about 300,000 tons of copper anodes per year.

Reasons for Waste Heat Recovery

The smelter was re-designed and modernized in 1995 to be among the lowest-emission smelters in the world, and a pollution-free, waste-heat-to-power generation system was a key component of the modernization. The Kennecott Utah Copper smelter has the highest level of energy recovery of any smelter in the world.

Since the copper production process is energy intensive and energy is a key component of Kennecott's costs, the company strives for continual improvement in how it manages, generates, and uses energy. Based on forecasts of rising energy costs, the company determined that it would be a wise long-term investment to generate power from thermal energy that would otherwise be wasted. The company's on-site engineers continue to improve the system design to optimize the energy output and reliability.

Quick Facts

LOCATION: Park, Colorado
NET SECTION: Pipeline
HOSE (EXHAUST HOSE ONLY)
L/D IN: None
CAPACITY: 4.5 MW
RGE CAPACITY FACTOR: ~70%
GH OUTPUT: 27,000 Mwh per year
OPERATION SINCE: March 2008
FUELS: Ormat organic Rankine cycle
% ELECTRICAL ENERGY: Renewable energy
% HIGHLINE ENERGY: Association members
ESTATED 30-YEAR SAVINGS: Over \$10 million
ESTATED YEARLY SAVINGS: Over \$200,000
PROJECT BY: Highline Electric Association, Tri-State Generation & Transmission, Kinder Morgan, and Ormat
ENVIRONMENTAL BENEFITS: 27,000 tons of CO₂, 14,000 kg of NO_x, and 124,300 kg of SO₂

Photo courtesy of Kennecott Utah Copper

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Intermountain WHP Activities



Arizona

- Incentives from Southwest Gas
 - Both CHP and WHP are eligible
 - \$400-500/kW
 - See www.swgas.com/efficiency/az/combined.php
 - For further info, contact Kevin Camp, 702-876-7214, kevin.camp@swgas.com



New Mexico

- WHP not included in RPS
- WHP included in Southwestern Public Service 2012 energy efficiency plan (NEW)
 - Custom measure
 - Must pass Total Resource Cost Test
 - www.swenergy.org/news/news/documents/file/SPS_2012_DSM_plan_Oct_2011.pdf
 - www.swenergy.org/news/news/documents/file/SPS_DSM_plan_stipulation_and_White_Testimony_2-22-12.pdf



Colorado

- Already included in RPS
 - 30% by 2020 for IOUs, 10% by 2020 for co-ops
 - Eligible WHP can't use any extra fuel

CO RPS: "Recycled energy" means energy produced by a generation unit with a nameplate capacity of not more than fifteen megawatts that converts the otherwise lost energy from the heat from exhaust stacks or pipes to electricity and that does not combust additional fossil fuel. Recycled energy does not include energy produced by any system that uses energy, lost or otherwise, from a process whose primary purpose is the generation of electricity, including, without limitation, any process involving engine-driven generation or pumped hydroelectricity generation.

www.dora.state.co.us/puc/rules/723-3.pdf



Colorado (cont'd)

- Incentives for WHP for Colorado co-ops served by Tri-State G&T
 - Currently at \$14.97/MWh
 - WHP and renewable CHP are eligible (not regular CHP)
 - www.intermountaincleanenergy.org/states/nm/Tri-State_Policy_Summary.pdf
 - www.intermountaincleanenergy.org/states/nm/Tri-State_Policy_FAQ1.pdf
 - www.intermountaincleanenergy.org/states/nm/Tri-State_Policy_FAQ2.pdf





Example: Trailblazer Pipeline

- Northeastern Colorado
- 4 MW
- Supplies local co-op members
- Estimated 20-year savings of \$10 million

CEAC Future Efforts

- Increasing Technical Assistance
 - Qualification Screenings and Feasibility Studies of potential projects
- Educational Efforts
 - Planning additional efforts to expand WHP applications
 - Developing additional project profiles of WHP sites
 - Developing WHP educational materials
 - Potential end-user focused workshop
 - Oil and Gas Sector target market education and outreach
- State Policy Efforts
 - Continued focus on education of policy makers on benefits of clean energy and policy best practices
 - Continued focus on states with high CHP potential



SEE Action: The State and Local Energy Efficiency Action Network

- State- and local-led effort facilitated by the federal government to bring energy efficiency to scale and achieve all cost-effective energy efficiency by 2020.
- Provides knowledge resources and technical assistance for decision makers
- Network of more than 200 leaders.
- Facilitated by U.S. DOE and U.S. EPA



SEE Action IEE/CHP Working Group

- Co-chairs: Todd Carrier – Washington Energy Office; Joshua Epel, Chairman – Colorado PUC
- 21 Members, including: Saint Gobain, ACEEE, ASE, NRDC, NYSERDA, SoCal Gas, MW CEAC, MA Energy Office
- DOE/EPA staff leads: IEE (Sandy Glatt-DOE, Betsy Dutrow-EPA); CHP (Katrina Pielli-DOE, Neeharika Naik-Dhungel-EPA)
- Four focuses:
 - Drive demand for Industrial Energy Efficiency & CHP
 - Build the workforce
 - Promote efficient operations & investment
 - Move the market

SEE Action IEE/CHP WG: http://www1.eere.energy.gov/seeaction/combined_heat_power.html

SEE Action IEE/CHP Working Group

- Planned CHP activities:
 1. Guide to Implementing Successful State CHP Policies. Fall 2012
 2. CHP Webinar Series based on the Guide
 3. Regional utility-industry workshops on overcoming barriers (IEE and CHP)
 - Midwest: Columbus, Ohio, June 21, 2012
 - Southeast: Fall 2012
 - West, Northeast/Mid-Atlantic: Winter / Spring

For Further Information

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