Waste Heat to Power
Applications in the Utilities Market

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Agenda

- CHP TAPs and WHP Overview
- WHP Markets
- WHP Projects Snapshots
- Veyo Heat Recovery Project
- Recycled Energy: Policies, Incentives, Financing Options
- Working with the CHP TAPs
- Q&A
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)

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

- Fuel: 100 units
- CHP: 75% efficiency
  - Electricity: 30 units
  - Heat: 45 units
- Power Plant: 32% efficiency (Including T&D)
- Onsite Boiler: 80% efficiency
- Total Efficiency: ~ 50%
- Total Efficiency: ~ 75%

30 to 55% less greenhouse gas emissions
Defining Combined Heat & Power (CHP)

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

Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)

- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion (no incremental emissions)
- Normally produces larger amounts electric generation (often exports electricity to the grid; base load electric power)
Main Sources of Waste Heat

- Waste Heat from a Thermal Process
- Waste Heat from a Mechanical Drive
- Waste heat from other systems

Port Arthur Steam Energy/Oxbow Corp, Texas

Northern Boarder Pipeline, North Dakota
WHP Power Generation Technology

- Back Pressure Steam Turbine
- Rankine Cycle
  - Steam Rankine Cycle (SRC)
  - Organic Rankine Cycle (ORC)
- Emerging Technologies
  - Kalina Cycle
  - Thermoelectric Generation
  - Piezoelectric Power Generation
  - Thermionic Generation
  - Stirling Engine
  - Steam Engine


Source: ORNL Waste Heat to Power Market Assessment 2015
Benefits of WHP

- Utilize heat from existing thermal processes, which would otherwise be wasted to produce electricity.
- Important resource for vastly increasing industrial energy efficiency.
- Improving the competitiveness of the U.S. industrial sector.
- Providing a source of pollution-free power.

Port Arthur Steam Energy/Oxbow Corp.
Technical Factors to Consider

- Is the waste heat source a gas or a liquid stream?
- What is the availability of the waste heat—is it continuous, cyclic, or intermittent?
- What is the load factor of the waste heat source—are the annual operating hours sufficient to amortize the capital costs of the WHP system?
- Does the temperature of the waste stream vary over time?
- What is the flow rate of the waste stream, and does it vary?
- Is the waste stream at a positive or negative pressure, and does this vary?
- What is the composition of the waste stream?
- Are there contaminants that may corrode or erode the heat recovery equipment?

Economic Factors to Consider

- **Waste heat recovery options**
  - Uses with other thermal processes or power generation?

- **Cost of Grid Electricity**

- **Integration of WHP**
  - Site Factors to Consider

- **Availability of Financial Incentives**
WHP Markets
Waste Heat to Power CHP Technical Potential

- According to CHP Installation Database, there is currently 939.7 MW of WHP capacity at 107 sites across the U.S.
- Estimated 7.6 GW of remaining WHP technical potential in the U.S. (2016)
  - Process to determine WHP technical potential:
    - Identified target markets based on electric consumption and waste heat data
    - Quantified the number of target facilities
    - Estimated WHP potential MW electric capacity, based on waste heat quality and electric load
- The top sectors are those with large waste heat streams available for capture at temperatures conducive to generating electric power
  - 98% of all WHP potential is found in four sectors:
    - Petroleum refining
    - Primary metals
    - Stone/Clay/Glass
    - Oil/gas extraction
- WHP potential found in 48 states
- Most potential for new WHP in Texas, Louisiana, and California

WHP CHP Technical Potential by State

WHP CHP Technical Potential by State

# WHP CHP Technical Potential by State

<table>
<thead>
<tr>
<th>State</th>
<th># of Sites</th>
<th>Potential (MW)</th>
<th>State</th>
<th># of Sites</th>
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<td><strong>7,624</strong></td>
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<td><strong>7,624</strong></td>
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WHP Technical Potential by Application

- Petroleum Refining: 3,593 MW
- Primary Metals: 2,186 MW
- Stone/Clay/Glass: 1,173 MW
- Oil/Gas Extraction: 538 MW
- Chemicals: 92 MW
- Mining: 23 MW
- Other: 21 MW

## WHP Technical Potential by Application

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<tr>
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<td>Chemicals</td>
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<td>Petroleum Refining</td>
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<td><strong>Total</strong></td>
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</tbody>
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WHP Projects Snapshots
Project Snapshot 1:
Waste heat to power and process heat, Port Arthur, TX

Application/Industry: Petroleum Coke, Crude Oil Processing
Capacity: 5 MW
Equipment: Waste heat recovery boilers; back pressure steam turbine
Fuel Type: Waste heat
Thermal Use: Steam and electricity generation
Installation Year: 2005
Environmental Benefits: CO2 emissions reduced by 159,000 tons/year

Testimonial: “Through the recovery of otherwise-wasted heat to produce high pressure steam for crude oil processing, Port Arthur Steam Energy LLP has demonstrated exceptional leadership in energy use and management.”
- U.S. Environmental Protection Agency, in giving the 2010 Energy Star Award
Project Snapshot 2:  
Flare Gas to Electricity Bakken, ND

Application/Industry: Oil and Gas Upstream  
Capacity (MW): 65 kW  
Equipment: ElectraTherm Organic Rankine Cycle  
Power + hot water boiler  
Fuel Type: Flare Gas  
Thermal Use: Electricity generation  
Installation Year: 2015  
Environmental Benefits:  
CO avg % reduction: 89.1  
NOx avg % reduction: 48.1  
VOC avg % reduction: 92.8

Testimonial: “It proves that using 100-year-old boiler technology and some newer technology married together is a good simple offering to produce electricity – Hess”
Project Snapshot 3:

Trailblazer Pipeline Peetz, CO
Application/Industry: Pipeline
Capacity (MW): 3.5 MW
Prime Mover: Ormat Organic Rankine Cycle
Fuel Type: WHP
Electrical Use: Renewable Energy for Highline Electric Association Members
Installation Year: 2009
Emissions Savings: Reduces CO₂ emissions by 27,600 tons/year

Testimonial: “Highline Electric Association’s main reason for pursuing this renewable energy project was to provide cost savings to its members. Highline expects to save over $10 million over the 20-year agreement. In addition, the project has virtually no emissions or environmental impact, qualifies as a renewable energy source for Colorado’s Renewable Portfolio Standard (RPS), and is a baseload, non-intermittent source of clean energy.”
Project Snapshot 4:

Williams Ignacio Gas Plant
Durango, CO

Application/Industry: Gas Processing
Capacity (MW): 6.2 MW
Power Output: 43,800 MWh per year
Prime Mover: Steam turbine
Fuel Type: WHP
Electrical Use: Waste heat from turbines drives centrifugal compressors
Installation Year: 1984, upgraded 2014
Emissions Savings: 2,480 tons per year
  • Nitrogen oxides (NOx) reduced 88%
  • Carbon oxides (CO) reduced 48%
  • Volatile Organic Compounds (VOC) reduced 82%
  • Particular matter (PM) reduced 59%

Steam Turbine Waste Heat Recovery
Facility provides compression, dehydration and natural gas liquids recovery and produces liquefied natural gas (LNG) as part of the company’s San Juan Gathering System. A recycled energy system captures waste heat from the compression process and uses it to generate electricity.
Project Snapshot 5:
Northern Border Pipeline
St. Anthony, ND

Application/Industry: Midstream
Capacity (MW): 5.5 MW
Equipment: Organic Rankine Cycle Ormat
Fuel Type: Waste Heat
Thermal Use: Electricity generation
Installation Year: 2006
Annual Emissions Reductions:
27,600 tons of CO$_2$
34,500 kg of NO$_x$
124,200 kg of SO$_2$
Estimated Savings: $600,000 per year

Testimonial: This project was a result of a successful collaboration among several organizations. Northern Border Pipeline supplies the land and waste heat to ORMAT in exchange for a royalty on electric sales. ORMAT built, owns and operates the ORC plant, using its Power Purchase Agreement (PPA) with Basin Electric to finance the project. Basin Electric executes a 25-year PPA with ORMAT for all electricity.

Source: [http://www.midwestchptap.org/profiles/ProjectProfiles/NorthernBorderPipeline.pdf](http://www.midwestchptap.org/profiles/ProjectProfiles/NorthernBorderPipeline.pdf)
Veyo Heat Recovery Project
ABOUT UAMPS

- A non-profit Joint Action Agency (JAA) and a political subdivision of the State of Utah
- Project-Based
- 46 Members in 7 States
UAMPS Projects

- **Thermal**
  - Hunter – Coal
  - San Juan – Coal
  - IPP – Coal
  - Payson – NGCC

- **Renewable /Carbon Free**
  - Horse Butte – Wind
  - Pleasant Valley – Wind
  - **Veyo – Heat Recovery**

- **Transmission**
  - Craig – Mona
  - Central – St. George

- **Energy Services**
  - Power Purchases
  - Pool
  - Member Services
  - Energy Efficiency
  - Government Affairs

- **Resource (Development)**
  - Carbon-Free Project (SMR)
  - Solar
  - **Heat Recovery**
  - Small Hydro
  - Other
ABOUT THE VEYO HEAT RECOVERY PROJECT (VHRP)

- A 7.8 MW Recovered Energy Generation (REG) Facility
- Utilizing wasted heat from Kern River’s Veyo gas compressor station
  - Royalty structure based on MWh
- COD May 2016
  - Ahead of Schedule and Under Budget
- 100% Debt Financed
  - ~$21 Million revenue Bonds; Series 2014 (Green Bonds)
- Take or Pay Power Sales Contracts (PSCs) with Project Members
  - Bondholders have direct exposures to participating Project Members
VEYO HEAT RECOVERY PROJECT PARTNERS

- Owner – UAMPS
- Host – Kern River Gas Transmission
- Recovered Energy Generation (REG) Vendor – Ormat Nevada
- Land – BLM
- Interconnection – Rocky Mountain Power (RMP)
- Operator/Operations – UAMPS / City of Santa Clara (UT)
HOST

- Kern River Gas Transmission
- Location – Veyo, Utah
  - 3 – 15,000 Hp Solar Mars
    100 Combustion Turbines

- A good host partner is key to a successful project
WASTED HEAT
**Main Sub-systems**

- Thermal Oil System
- Pentane (Motive Fluid) System
- Turbine/Generator/Lube oil skid
- Air Compressor (for Damper control on WHOH)
- Air Cooled Condensers
- Mechanical Control Center (Electrical, Instrumentation and Controls)
- Emergency Generator
- Interconnection Substation
HOST FACILITY – HEAT RECOVERY PROCESS

- Original Stack, Now the Bypass Stack
- New Exhaust Stack
- Heat Recovery Unit or Waste Heat Oil Heater
- Compressor Building
- O&M Building
- Diverter
To see a video of the Veyo Heat Recovery Project, go to: https://www.youtube.com/watch?v=AK4ikrErsIU
**Key Take-Aways**

- Veyo is a Carbon Free Resource.
- Relatively easy to develop and operate
- Committed Partners are very important to the Success of this project
- Operating at approximately $50/MWh in last fiscal year.
- Operations
  - Walkdowns twice a week to monitor equipment, read gauges, check lubricants, etc, with equipment serviced as needed, monthly, quarterly, etc.
  - 2 Maintenance outages a year to check hot equipment and do bi-annual and annual services to sub-systems as required. Turbine Overhaul expected every 5 years.
  - 24 hour call-out as needed or required under Host Agreement
Recycled Energy & CHP Policies, Incentives, Financing Options

Susan Brodie
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SusanDBrodie@gmail.com
The **Heat is Power Association** is working in partnership with the **Colorado Energy Office** to provide education and information on CHP and recycled energy in Colorado to companies that have waste heat producing facilities and thermal energy needs, with the goal of expanding the use of these technologies in the state.

**Heat is Power Association (HiP)**
- National association for waste heat to power (WHP) industry
- Outreach and educate regarding WHP opportunities, policies, technologies
- Advocate for parity for WHP with other clean energy sources
- Susan Brodie | 630.292.1304 | susandbrodie@gmail.com

**Colorado Energy Office (CEO)**
- Mission: To deliver cost-effective energy services and advance innovative energy solutions for the benefit of all Coloradans
- Expanding deployment of recycled energy and CHP in Colorado
- Lindsey Stegall | 303.866.2594 | lindsey.stegall@state.co.us
Recycled energy is an eligible energy resource

- “Energy produced by a generation unit with a nameplate capacity of not more than 15 megawatts (MW) that converts the otherwise lost energy from the heat from exhaust stacks or pipes to electricity and that does not combust additional fossil fuel.”

- Excludes energy produced by any system whose primary purpose is the generation of electricity.

CHP may qualify if it is fueled by a resource listed in the RES: biomass, landfill gas, anaerobic digestion, recycled energy, fuel cells using renewable fuels, coal mine methane, pyrolysis of MSW
Xcel Recycled Energy Tariff

- Uses recycled energy definition from Colorado RES
- Incentive of $500/kW of recycled energy system capacity installed, paid monthly over ten years at a rate of approximately 12 cents per kWh actually produced.
- Incentive applies to total recycled energy system output (up to 10 MW capacity), whether used on-site or sold to a utility or other wholesale electricity provider
- Systems that generate up to 120% of the customer’s annual on-site consumption: excess energy will be purchased by Xcel at a rate of 4.3 cents per kWh
- Systems that generate more than 120% of the customer’s annual on-site consumption: excess energy can be sold to Xcel through a negotiated PPA or a third-party wholesale provider
Select Terms
• Pre-approval by Xcel Energy required
• Customers must enter into a 20-year contract
• Program capped at 20 MW per year, individual projects limited to 10 MW
• Standby service optional under 500 kW, required 500 kW to 10 MW
• 4 weeks planned maintenance, 2 weeks “grace energy” allowed annually before daily demand charges apply

Links
• [Xcel Recycled Energy Incentive Program](#)
• [Recycled Energy Info Sheet (PDF)](#)
• [Recycled Energy tariff (see sheet 117)](#)
• [Xcel Energy Distributed Generation Guidelines (PDF)](#)
Tax Incentives

**Colorado Enterprise Zone (EZ) Investment Tax Credit**
- Up to 3% state tax credit for eligible energy resources, including recycled energy and renewables
- [https://choosecolorado.com/doing-business/incentives-financing/ez/](https://choosecolorado.com/doing-business/incentives-financing/ez/) Find out if your site is in an EZ

**Federal investment tax credit (ITC) for CHP** (expires end 2021, does not apply to WHP)
- 10% of expenditures for the first 15 MW of CHP property for systems less than 50 MW
- Energy efficiency must exceed 60% and system must produce at least 20% in the form of useful energy and 20% in electrical or mechanical power (or a combination)

**Modified Accelerated Cost Recovery System (MACRS)** - provides accelerated depreciation of CHP investments (does not apply to WHP)
Financing for Direct Ownership

**Commercial Loan**
Customer borrows money directly from banks or lenders

**OBF/OBR On-Bill Financing or Repayment**
Utility or private lender supplies capital, borrower repays via utility bill

**Energy Performance Contract (EPC) or Energy Savings Performance Contract (ESPC)**
- Energy Service Company (ESCO) installs equipment and provides a savings guarantee that pays back the financing
- Improvements usually owned by the customer and may be installed with little or no upfront cost
- Best suited for larger ($1 million+) more complex projects with high upfront costs
Financing for Direct Ownership (cont’d)

PACE (Property Assessed Clean Energy)
State-sponsored program that facilitates 10+ year financing for energy and water improvements with low rates paid back via property tax assessment
• 100% financing (soft and hard costs)
• Well designed projects are cash flow positive
• No personal guarantees
• Long term - repayment up to 25 years
• Open market financing
• Lower utility bills
• Can be combined with utility incentives
• Owner retains all tax incentives
• Payments are a line item on property tax bill and can be transferred to new owner if property sold

Map showing participation of counties in PACE program
**Financing for Third Party Ownership**

**Lease Financing:** Lower financial risk than direct ownership

**Capital Lease**
- Customer is considered equipment owner
- Extended equipment rental
- Equipment is considered an asset and lease payments a liability
- Owner can use tax credits and other incentives

**Operating Lease**
- Lessor owns equipment, customer is equipment renter
- Extended equipment rental
- Equipment rental is treated as an operating expense rather than an asset
Financing for Third Party Ownership (cont’d)

Power Purchase Agreement (PPA)
• Contract that allows self-generator or independent power producer to sell electricity
  • Self-generators can use the power on-site or sell it to a utility
  • Third party developer/independent power producer can sell power to utilities, but not directly to retail customers (can sell thermal energy to retail customers)
• Companies that want a third party to develop and operate their project but also want to use the power generated on site can lease the system from the developer
• For projects that use recycled energy or a renewable fuel, the generator can sell renewable energy credits (RECs) to the utility along with the electricity
CEO Recycled Energy & CHP Resources

Recycled Energy — also known as waste heat to power — is a technology that uses waste heat from industrial processes to generate electricity. The electricity is then sold to the electrical grid, providing a valuable source of revenue for facilities that would otherwise be disposing of the heat as a nuisance. Recycled Energy offers an opportunity for companies to generate additional revenue streams and contribute to the grid, reducing their carbon footprint and improving energy efficiency.

Recycled Energy in Colorado

The following data will be used to evaluate site-specific recycled energy potential.

**Recycled Energy Potential Worksheet**

**Date:**

**Company Information**

**Company Name:**

**Financing, Ownership Structure for Recycled Energy & CHP**

Companies and organizations evaluating whether recycled energy and CHP projects make financial sense need to consider a variety of factors, including ownership structures, project economics, and the ability to own and operate their own systems. Here’s a step-by-step overview of how to evaluate these options:

**Financing Mechanisms for Direct Own**

Some facility owners prefer to own and operate their own recycled energy and CHP projects, which can provide them with a more direct control over the project’s financial performance. This approach allows the organization to take advantage of the value of its own waste heat, but it also requires significant capital investment and ongoing maintenance and operational costs.

**Financing Mechanisms for Third-Party O & M**

Rather than owning the energy systems, some companies prefer to lease equipment or services from third-party operators, such as independent power producers (IPPs) or energy service companies (ESCOs). This approach can provide a more flexible and scalable solution, allowing the facility owner to benefit from the expertise and resources of a larger organization.

**Key Benefits**

- Reduces the cost of purchased electricity and fuel costs.
- Reduces overall operating costs.
- Helps businesses meet sustainability goals.
- reduces carbon footprint and emissions.
- Generates revenue from the sale of excess energy.
- Improves energy efficiency and reduces energy costs.

**Energy Savings Performance Contracts (ESPCs)**

Companies can contract with a third-party energy service company, or ESOC, to take on performance risk and provide a savings guarantee. The investment is paid for by a portion of the cost savings that result from the improvements. At the end of the contract term, the customer typically either owns the equipment or buy-backs it from the service provider.

**Combined Heat & Power (CHP): Efficient Generation of Electric Power & Thermal Energy**

Combined heat and power (CHP) systems are highly efficient and can provide significant energy savings by generating both electricity and thermal energy from a single heat source. CHP systems are particularly beneficial for facilities with high energy demands and can reduce the overall carbon footprint of the organization.

**Combined Heat & Power (CHP): Key Benefits**

- **Increased Efficiency:** CHP systems can operate at up to 80% efficiency, significantly higher than traditional systems.
- **Reduced Emissions:** CHP reduces greenhouse gas emissions by capturing and utilizing the waste heat generated during electricity production.
- **Cost Savings:** CHP can provide cost savings through lower fuel costs and reduced maintenance requirements.
- **Flexibility:** CHP systems can operate independently of the electrical grid, providing a reliable source of electricity.

The Williams Ignace V Plant, located northeast of Cheyenne, Wyoming, provides compression, dehydration, and natural gas liquids recovery and produces liquefied natural gas (LNG) as part of the company’s San Juan Gathering System. A hybrid energy system captures waste heat from the compression process and uses it to generate electricity.
Links to Resources

Fact Sheets

- Financing and Incentive for CHP and WHP Systems
- Recycled Energy/WHP Fact Sheet
- Heat is Power - about WHP

Recycled Energy Case Studies

- Flare Elimination
- Gas Processing
- Pipeline Compressor Station
- Coke Calcining

All Colorado recycled energy materials available here: https://www.colorado.gov/energyoffice/recycled-energy
How to Implement a WHP Project with the Help of CHP TAP
CHP TAP Role: Technical Assistance

- Screening and Preliminary Analysis:
  Quick screening questions with spreadsheet payback calculator; Advanced technical assistance to explore equipment or operational scenarios.

- Feasibility Analysis:
  Perform 3\textsuperscript{rd} Party reviews of site feasibility assessments: Estimates on savings, installation costs, simple paybacks, equipment sizing, and type.

- Investment Grade Analysis:
  Perform 3\textsuperscript{rd} Party reviews of Engineering Analysis. Review equipment sizing and choices.

- Procurement, Operations, Maintenance, Commissioning:
  Review specifications and bids.
High level assessment to determine if site shows potential for a CHP project

- Qualitative Analysis
  - Energy Consumption & Costs
  - Estimated Energy Savings & Payback
  - CHP System Sizing

- Quantitative Analysis
  - Understanding project drivers
  - Understanding site peculiarities

### Annual Energy Consumption

<table>
<thead>
<tr>
<th></th>
<th>Base Case</th>
<th>CHP Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchased Electricity, kWh</td>
<td>88,250,160</td>
<td>5,534,150</td>
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<tr>
<td>Generated Electricity, kWh</td>
<td>0</td>
<td>82,716,010</td>
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<tr>
<td>On-site Thermal, MMBtu</td>
<td>426,000</td>
<td>18,872</td>
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<tr>
<td>CHP Thermal, MMBtu</td>
<td>0</td>
<td>407,128</td>
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<tr>
<td>Boiler Fuel, MMBtu</td>
<td>532,500</td>
<td>23,500</td>
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<tr>
<td>CHP Fuel, MMBtu</td>
<td>0</td>
<td>969,845</td>
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<tr>
<td>Total Fuel, MMBtu</td>
<td>532,500</td>
<td>993,435</td>
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### Annual Operating Costs

<table>
<thead>
<tr>
<th></th>
<th>Base Case</th>
<th>CHP Case</th>
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</thead>
<tbody>
<tr>
<td>Purchased Electricity, $</td>
<td>$7,060,013</td>
<td>$1,104,460</td>
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<tr>
<td>Standby Power, $</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>On-site Thermal Fuel, $</td>
<td>$3,195,000</td>
<td>$141,539</td>
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<tr>
<td>CHP Fuel, $</td>
<td>$0</td>
<td>$5,819,071</td>
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<tr>
<td>Incremental O&amp;M, $</td>
<td>$0</td>
<td>$744,444</td>
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<tr>
<td>Total Operating Costs, $</td>
<td>$10,255,013</td>
<td>$7,809,514</td>
</tr>
</tbody>
</table>

### Simple Payback

- Annual Operating Savings, $ 2,445,499
- Total Installed Costs, $/kW 3,400
- Total Installed Costs, $/k 12,990,000
- Simple Payback, Years 5.3

### Operating Costs to Generate

- Fuel Costs, $/kWh $0.070
- Thermal Credit, $/kWh $(0.037)
- Incremental O&M, $/kWh $0.009
- Total Operating Costs to Generate, $/kWh $0.042
CHP Project Resources

DOE Project Profile Database

EPA dCHPP (CHP Policies and Incentives Database)

energy.gov/chp-projects

https://www.epa.gov/chp/dchpp-chp-policies-and-incentives-database
CHP Project Resources

DOE CHP Technologies Fact Sheet Series

Good Primer Report

www.energy.gov/chp-technologies

www.eere.energy.gov/chp
CHP Project Resources

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

[Image of the DOE CHP Installation Database]

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

[Map of CHP TAP regions with contact information for each region]

- energy.gov/chp-installs
- energy.gov/CHPTAP
Next Steps

Resources are available to assist in developing CHP Projects.

Contact the Upper-West CHP TAP to:

▪ Perform CHP and WHP Qualification Screening for a particular facility
▪ Identify existing CHP sites for Project Profiles
▪ Advanced Technical Assistance
Summary

- **WHP gets the most out of waste heat flows**, enabling
  - Higher overall utilization efficiencies
  - Reduced environmental footprint
  - Reduced operating costs

- **CHP and WHP** can be used in different strategies, including **critical infrastructure resiliency** and emergency planning

- **Proven technologies** are commercially available and cover a full range of sizes and applications
Thank You!

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