Recovering and Using Waste Heat in Oil and Gas Operations

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The Heat is Power Association

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The Heat is Power Association

The industry-led advocacy organization focused exclusively on advancing waste heat to power.

Active with federal, state and regional stakeholders including

- Congress
- Federal agencies including EPA and DOE
- Regional industry and environmental organizations

Through education and advocacy, HiP is seeking inclusion of WHP in federal and state legislation, regulations, and programs as an energy efficient power resource that generates electricity with no additional fuel, combustion or emissions.

For more information: www.heatispower.org
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WHP Waste Heat to Power

HEAT IS POWER LET'S CAPTURE IT

What is WHP?

- Waste heat to power (WHP) is the process of capturing heat discarded by an existing process and using that heat to generate electricity. The process requires no additional fuel and produces no incremental emissions.

Table 1. Types of Waste Heat Streams

Source of Waste Heat Stream	Example (illustrations only, examples are not intended to be all inclusive)
Thermal Process	Energy recovered from a furnace, oven, or kiln, and subsequently used in a combined heat and power (CHP) bottoming cycle.
Mechanical Drive	Energy recovered from a natural gas pipeline compressor station.
Other	Waste heat recovered from industrial or other processes that generate heat as a byproduct, such as exothermic reactions, incineration, and pressure reduction.

Source: Waste Heat to Power Market Assessment, DOE ORNL, March 2015

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Where to Install WHP and Why

WHERE

- Industrial operations with high temperature processes such as refineries, glass furnaces, steel mills, cement kilns
- Oil and gas production, transportation, refining
- Other processes that exhaust heat greater than ~250°F

WHY

- Generate electricity on-site where the power is needed, including in remote locations
- No additional combustion = no additional emissions
- Using waste heat eliminates costs associated with fuel and purchased electricity
- Sell back excess power to grid
- Improve electric service reliability on-site
- Reduce carbon footprint
- Produce renewable energy credits (RECs)

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Waste Heat to Power (WHP) Opportunity

30% of all energy consumed in the US is consumed by industry.
20% to 30% of this energy is lost as waste heat,
~ 5-13 quadrillion BTU/yr at a cost of $20B-$60B/year[1]

Energy companies flare about 30% of the gas they produce, ~10.65 billion cubic meters of natural gas[2]

Total WHP opportunity = 15 GW

Gas compressor stations located every 40-70 miles along over a million miles of U.S. pipelines produce waste heat that can be captured for power generation

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sources
[1]Waste Heat Recovery: Technology and Opportunity in US Industry, Report for US DOE, BCS, 2008.
[2]https://www.scientificamerican.com/article/u-s-has-more-gas-flares-than-any-country/

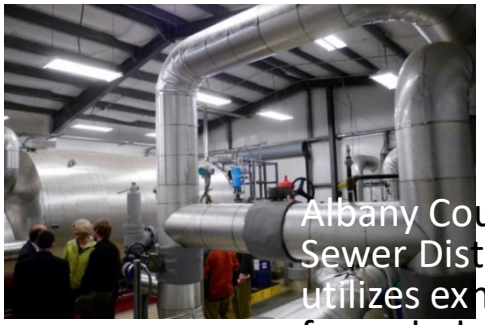
A Few Examples of WHP in the U.S.

3.5 MW is generated from waste heat off a Trailblazer pipeline compressor station (CO)

The 40 MW (equivalent) Port Arthur Steam Energy system produces both process steam and 5 MW power from kiln exhaust energy (TX)

Primary Energy generates 50 MW, 90 MW and 95 MW at its WHP plants in steel mills (IN)

JR Simplot uses excess heat from exothermic chemical reactions to drive a steam turbine that generates 16 MW (ID)



Albany County Sewer District utilizes exhaust gas from sludge incinerators to generate 925 kW (NY)

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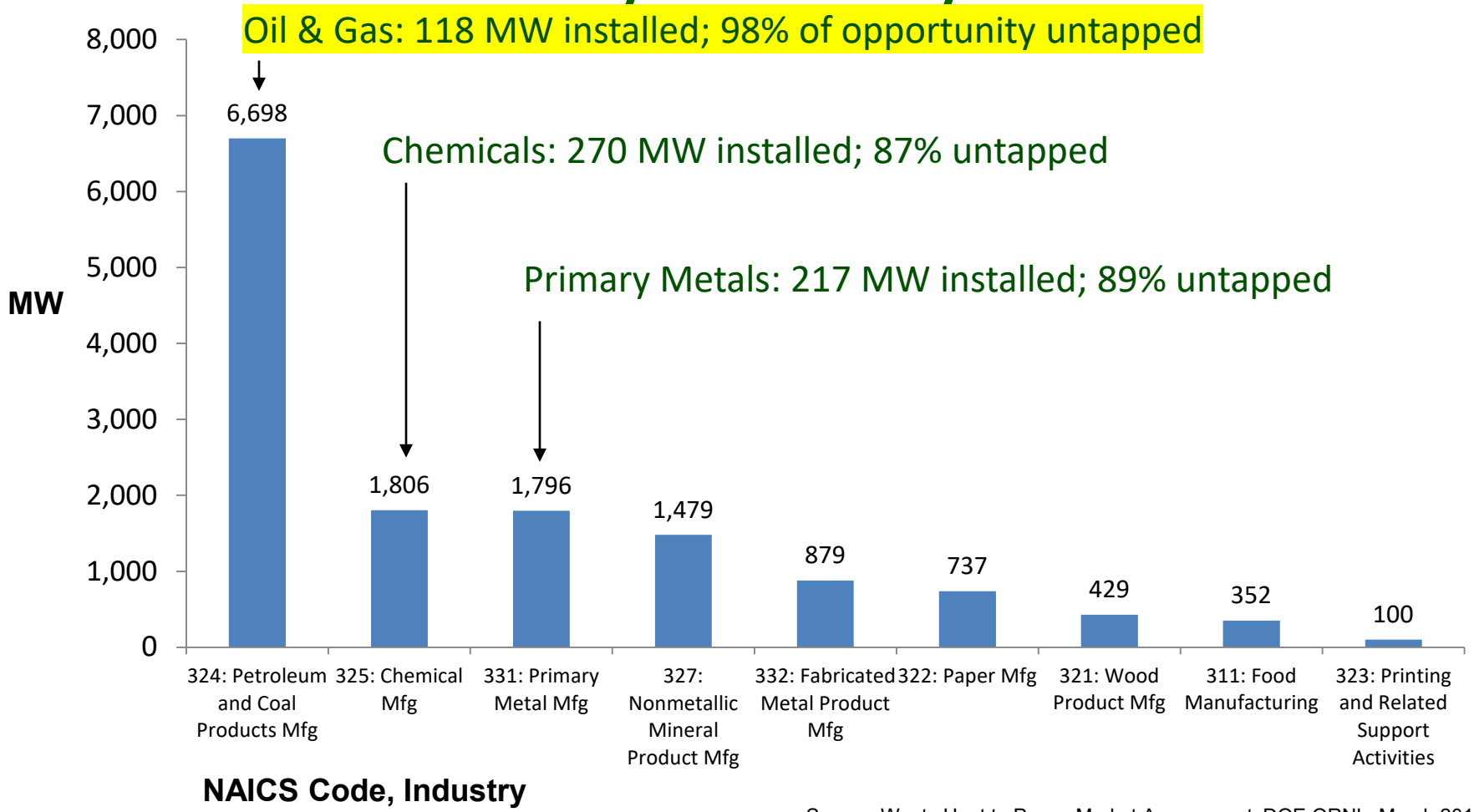
Potential for Additional WHP Projects by Industry



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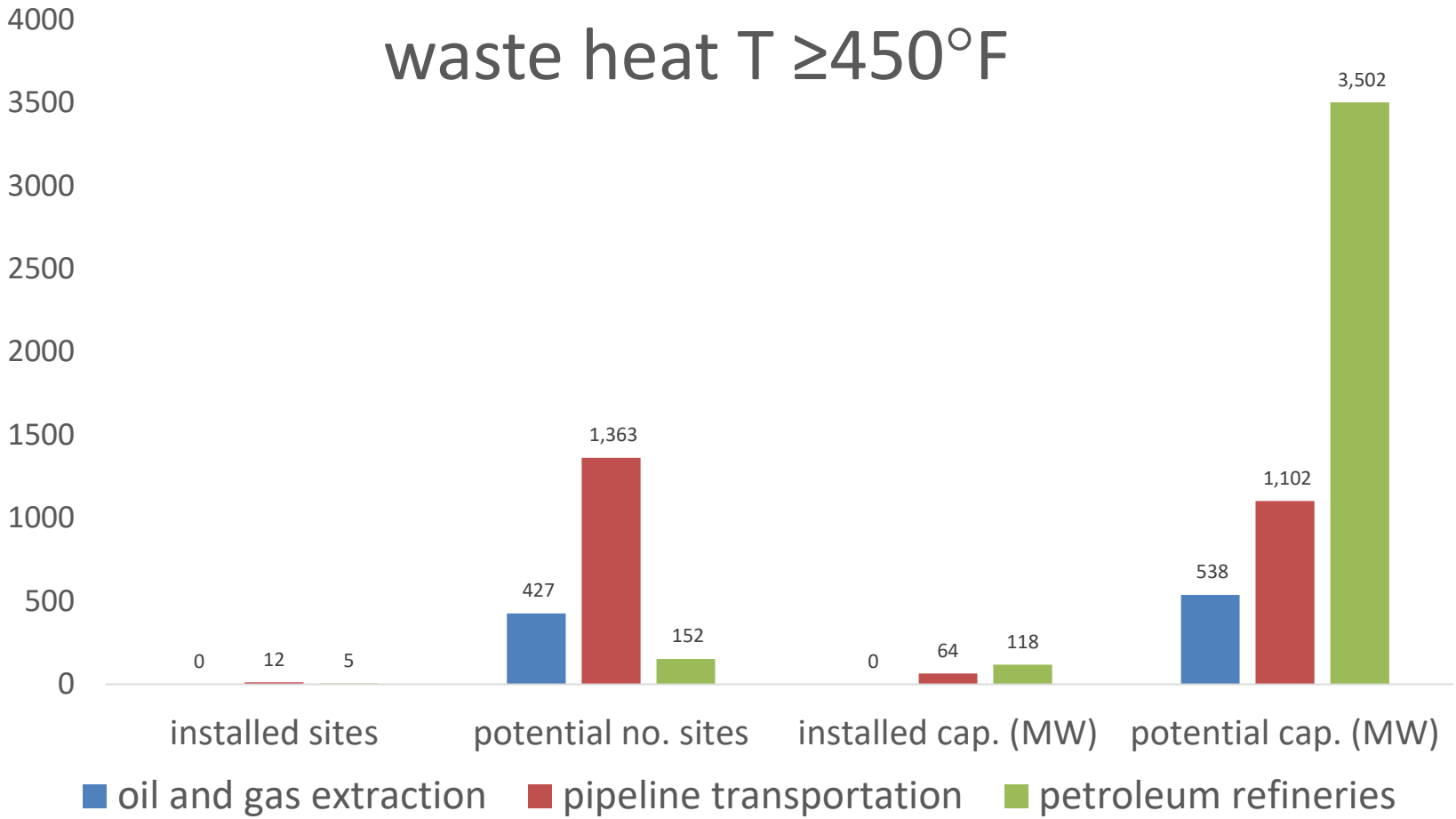
WHP in Oil & Gas

existing systems and technical potential



WHP on Compressor Stations

- WHP on 13 U.S. compressor stations
  - 10 on N Border pipeline, one each on Kern River pipeline, Trailblazer pipeline, Cayne compressor station
- Trailblazer Pipeline Compressor Station in Peetz, Colorado
  - Generates 27,600 MWh per year for Highline Electric Association members; Saves est. >$10 million over 20 years, >$600,000 annually; Saves est. 27,600 tons CO_2, 38 tons NOx, 137 tons SO_2 annually
- Over 3,900 compressor stations across N. America (www.mapsearch.com)
- Less than 1% U.S. compressor stations on high pressure transmission and gathering pipelines have WHP

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Flare Opportunity

- Operations in the Bakken Formation flare and vent an estimated 250 million scf natural gas per day
- Oil production in Texas' Eagle Ford formation flares and vents nearly 100 million scf per day
- Flared natural gas can be captured and instead used to generate electricity
- "Zero Routine Flaring by 2030" initiative (led by World Bank) has been signed by 24 countries including U.S. and 31 oil companies including BP, Shell (https://www.acs.org/content/acs/en/pressroom/presspacs/2016/acs-presspac-august-17-2016/reducing-gas-flares-and-pollution-from-oil-production.html)

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Pilot Project in Bakken

- At the oil well, instead of flaring natural gas:
  Flare gas ⟶ industrial boiler ⟶ ORC Power+ generator ⟶ power

The Power+ and Boiler is fueled by gas that would otherwise be flared

- Power can be used for pumpjacks, controls/sensors, wellhead, equipment
- Heat from the boiler ranges from 170 to 252 degrees Fahrenheit
- System is easy to set up, operate, maintain, move
- Pilot demonstration project by Environmentally Friendly Drilling (coalition of major oil producers, research entities and environmental groups), Hess Corp., ElectraTherm, Gulf Coast Green Energy, Houston Advanced Research Center (HARC), DOE's Research Partnership to Secure Energy for America

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Incentives for WHP

- 20 states consider waste heat to be a renewable resource / WHP to be a renewable technology in their renewable portfolio standards and other programs
  - WHP can generate renewable energy credits (RECs) in 18 states

- Federal Initiatives
  - Adding WHP to Sec. 48 ITC
  - A technology neutral tax bill that would encourage clean energy by providing tax incentives on a gradient
  - Comprehensive energy bill – WHP would be added as a renewable resource to the federal definition of renewables
  - Master Limited Partnership Parity Act (MLPPA), which currently provides tax advantages only to investors in fossil fuel-based energy projects

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Find out if your site is a good candidate for WHP

Resources:

- Heat is Power
  - National association for WHP industry; advances WHP in the U.S. through education, outreach and advocacy
  - Heat is Power members provide screening for WHP applicability / evaluations at no or low cost
  - Additional information on WHP policies, data, reports, technology and project development
  - www.HeatisPower.org
- U.S. DOE CHP Technical Assistance Partnerships (TAPs)
  - Help promote and stimulate investment in WHP and CHP
  - Provide technical assistance, education and outreach
  - https://energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps
- Colorado Energy Office (CEO)
  - CO focusing resources on development of WHP, called recycled energy in the state
  - https://www.colorado.gov/pacific/energyoffice/recycled-energy

Questions?

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Appendix

Figure 10. Manufacturing Sector Waste Heat Inventory by Industry and Temperature Range
(reference temperature at 120 °F)