SMU Geothermal & WHP Conference
Waste Heat to Power in the U.S.
&
State/Federal Policy Implications

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An American Opportunity

Hidden within American manufacturing and oil and gas processing is a largely unknown and un-captured form of energy

redefining renewable…

Thousands of megawatts of untapped

emission free electricity

*from **heat** currently wasting into thin air…*

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Waste Heat to Power

Energy intensive industries require high temperatures to process their product. While industries recover a good amount for useful thermal needs onsite, there is often still heat energy left that is frequently vented through smokestacks. With the evolution of lower temperature WHP systems, more opportunity exists.

- Industrial Manufacturing
  - Steel, Chemicals, Paper, Cement, Glass, Food Processing
- Oil and Gas Processing
  - Gas Compressor Stations
  - Refineries

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U.S. Market Potential

Industry	Potential MWs
Gas Compression	2,636
Refining	2,211
Chemical	1,650
Paper	924
Marcellus Shale	300
Boilers	371.5
Landfill Gas	365
Steel	330
Lime	271
Cement	240
Metal Casting	166
Glass	154
Aluminum	47.5
Total	**9,666**

- Enough emissions free power for approximately 10 million American homes
- Easy to find: Smokestacks, gas flares, heavy energy consumers

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Locations and Applications

Waste heat is most prevalent in the Southeast and Midwest regions of the United States

- Oil and Gas Processing
  - Gas Compressor Stations
  - Refineries
- Industrial Manufacturing
  - Steel, Chemicals, Paper, Cement, Glass, Food Processing

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Modular Technology

Exportable World Wide

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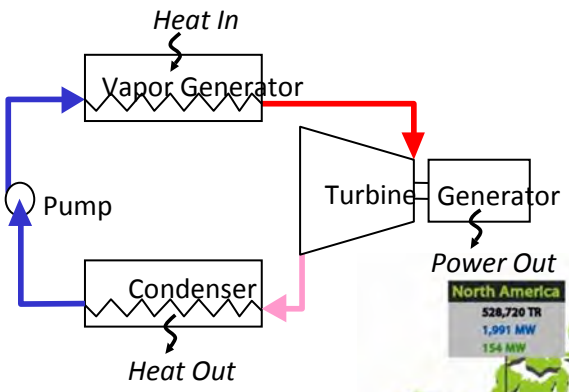
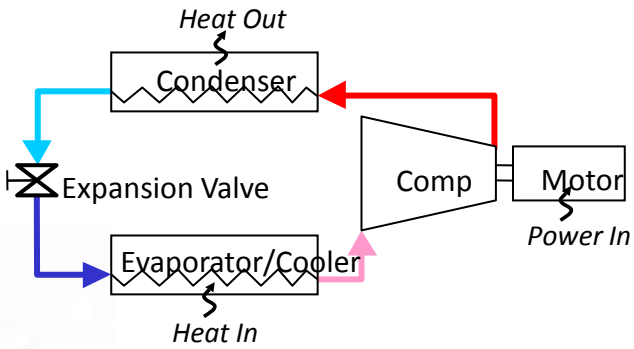
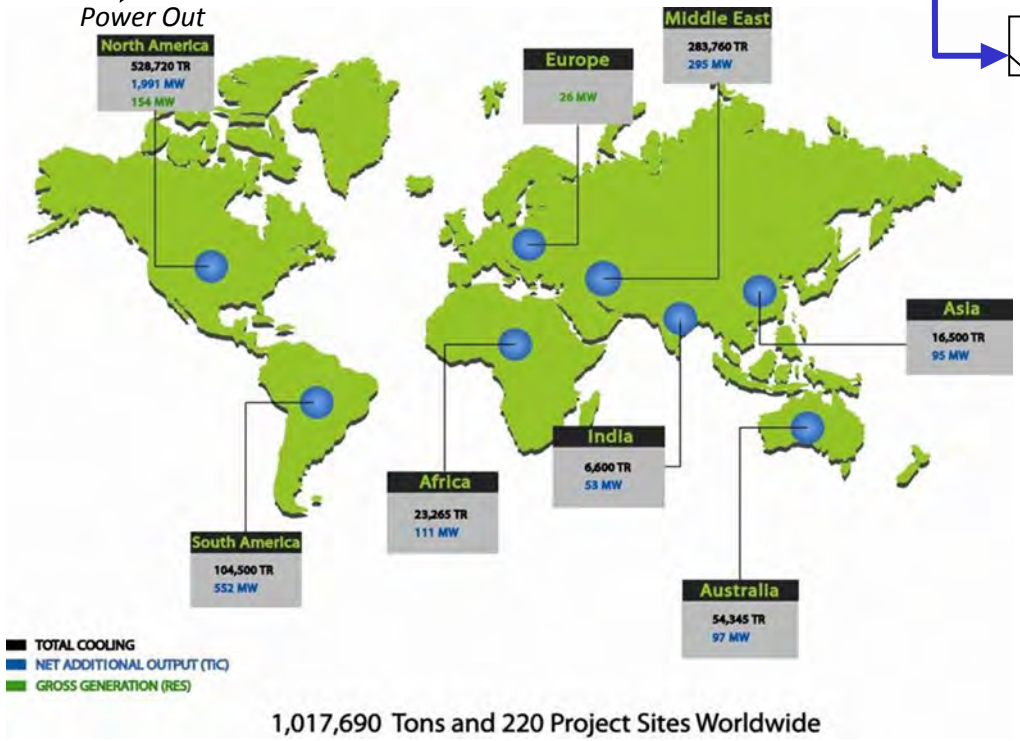
Organic Rankine Cycle



Refrigeration Cycle





1,017,690 Tons and 220 Project Sites Worldwide

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Market Barriers

- Interconnection challenges
- Competing for financing with other sources of *emissions free electricity* without access to *renewable* PPAs…
- …Therefore competing against low gas prices
- Education barrier- power production is not the core competency of the industrial
- Zero federal incentives, limited in states

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Financing Barriers

Geothermal ---- Waste Heat

- ❖ Same Technology
- ❖ Same Product

(emissions free electricity)

VERY DIFFERENT FINANCING OPTIONS

*Assuming technology choice organic rankine cycle	GEOTHERMAL $4-5,000/kw	WASTE HEAT TO POWER $2,500-3,000/kw
30% Tax Credit	-$1,200/kw $2,800	--- $2,500
Price	'renewable' price $.09-.12/kwhr	conventional price $.03-.05/kwhr
Financing & Contracting	Offered 20 yr PPA	Expected 2-3 yr payback
Size	10-50 MW	1-10MW

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Industry Barriers- Terminology

Heat Recovery

Waste Heat to Electricity

Recycled Energy

Recovered Heat Generation

Waste Heat Recovery

Bottoming Cycle

Waste Energy Recovery

Waste Heat to Power

Advanced Heat Recovery

Waste Energy

Recovered Energy Generation

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Confusion with CHP

- In addition to industry terminology barriers, there is a lack of clarity among publications and advocacy of "CHP" and "WHP"
- It is common within the industry and the academic community (as well as agencies) to use the term "CHP" to refer to both topping cycle CHP, and WHP, as a general term.
- However, the term "CHP" is also used as a short hand way of discussing specifically topping cycle CHP
  - The design of a system to simultaneously generate heat and power, traditionally through combusting natural gas

Left Out of All Policies

- Because the term “CHP” is used in both contexts, WHP has unintentionally been left out of “CHP” programs and policies. The CHP programs are technically written around topping cycle CHP characteristics (efficiency calculations), although the *intent* is to include WHP as well.
  - Pepco
  - NYSERDA programs
  - Federal investment tax credit
- Furthermore, WHP has been left out of emissions free/renewable programs because its ‘no combustion/no emissions’ power generation characteristics have been lost due to being confused with topping cycle CHP (which combusts natural gas)

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Heat is Power Association

Mission

To serve as the voice of the waste heat to power (WHP) industry to advance the market through education and advocacy

Vision

To see waste heat to power recognized as an emission-free power resource and developed into a robust market

Who we are and what we do

- Members include equipment suppliers, installers, end users, students, other associations, and the academic community
- Conduct analyses to demonstrate the potential for waste heat to power
- Develop consistent messaging and talking points for the industry
- Convene stakeholders to educate the public and decision makers

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ALLIANCE pipeline
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Primary Energy
Efficiency is the Best Alternative Energy
Pratt & Whitney
A United Technologies Company
ener g rotors
NRGreen POWER
integralpower
alphabet energy
GCGE GulfCoast GREEN ENERGY
35 years ALLIANCE TO SAVE ENERGY
Using less. Doing more.
ELECTRA THERM
ECHOGEN power systems
TURBO THERMAL
SMU GEOTHERMAL LABORATORY
GUARDIAN
Glass · Automotive · Building Products
Barber Nichols
Design & Manufacture of Specialty Turbomachinery
SMARDT
RED RecycledEnergy Development
HUDSON Products Corporation
HYUNDAI IDEAL ELECTRIC CO.
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JOIN US!

It takes the industry coming together, to get regulatory and policy results.

Membership categories for all stakeholders at various dues amounts

www.heatispower.org

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“Waste Heat Resource”

The Heat is Power Association includes waste heat from all sources (other than power generation from a fossil fuel), as well as pressure letdown resources in the definition of ‘waste heat’ and in our advocacy efforts.

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Terminology Clarification

- **Waste Heat to Power:** The generation of emissions free power from waste heat (or pressure).
  - This term should always be used when describing power generation
- **Waste Heat Recovery:** The capture of waste heat for any useful thermal purpose, this includes Waste Heat to Power.
  - This is the 'umbrella term' for waste heat to power, and waste heat captured for thermal use

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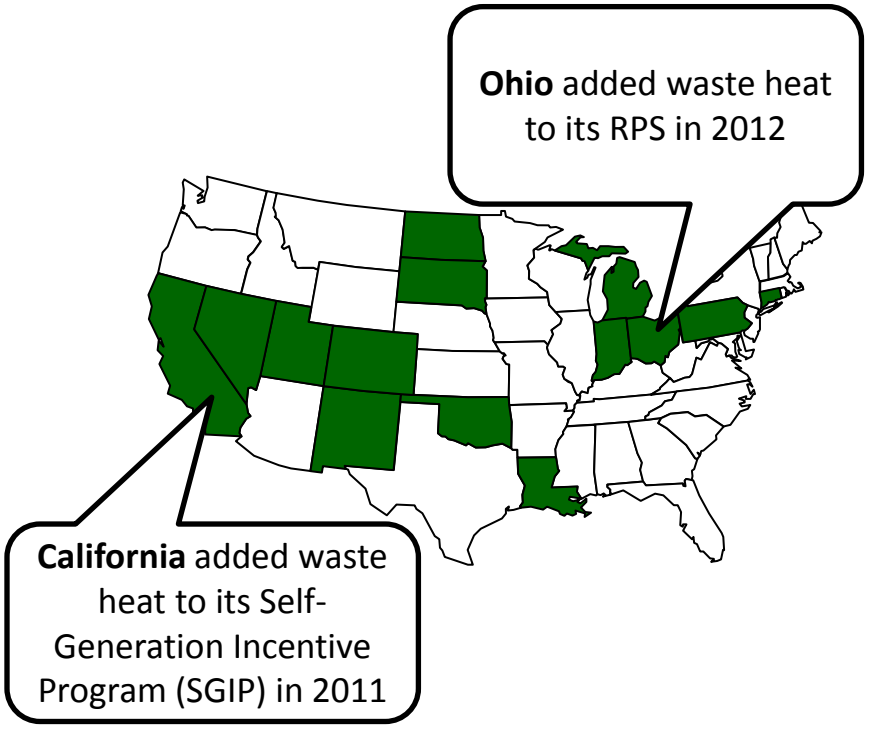
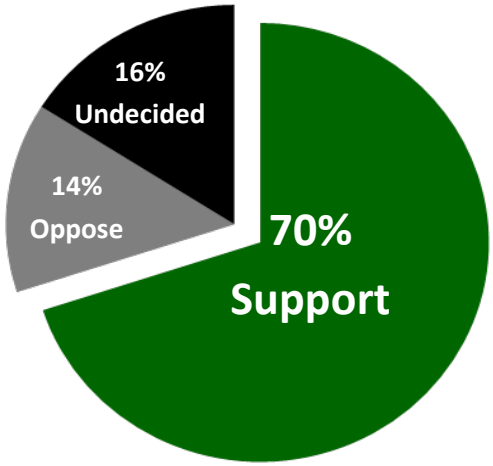
Association & Industry Successes

14 states include waste heat (in some form) in renewable portfolio standards, incentive programs, or other mechanisms



70% of Americans favor tax credits for emission free waste heat to power technology*



* Based on national telephone survey of over 1,000 Americans aged 18 and over. The survey was performed by FD Consultants. December, 2010

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Spotlight: California SGIP

- WHP is offered $1.25/Watt through 2016 – same amount offered to wind projects
- Details:
  - There is no minimum or maximum eligible system size; the incentive payment is capped at 3 MW
  - The first megawatt (MW) in capacity will receive 100% of the calculated incentive, the second MW will receive 50% of the calculated incentive, and the third MW will receive 25% of the calculated amount.

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NEW: From the States

- This February, the National Association of Regulated Utility Commissioners passed a resolution advocating for the adoption of regulatory policies across the states to support the deployment of Waste Heat to Power as an emissions free resource, and energy efficiency measure

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NEW: From the States

- Ohio recently became the 14th State to recognize Waste Heat to Power as a Renewable Energy Source (and included WHP in their EE Standard as well)

- First Energy, Utility of Ohio tried freezing the efficiency standard at 2012 levels for the lame duck session, however their effort failed. Legislation has been introduced in the Ohio Senate to void the efficiency and renewable programs

NEW: From the Feds

- President Obama issued an Executive Order focused on Accelerating Investment in Industrial Energy Efficiency:
  - Goal: 40 gigawatts of new, cost effective *industrial efficiency* projects including combined heat and power (CHP) and waste heat to power (WHP) by 2020
  - FERC Chairman Wellinghoff issued statement in support of this goal, and in support of distributed generation

Pending: With the Feds

- Bi-Partisan Master Limited Partnership bill
  - Would provide access to MLP tax treatment to clean energy technologies, as offered to gas pipelines
  - The Heat is Power Association is working with bill authors to ensure the inclusion of WHP
    - As written, only resources that receive a tax credit are eligible
- The Heat is Power Act
  - Would offer WHP a 30% investment tax credit or 2.1 c/kwhr production tax credit (just like geothermal)
- Proposed bill to clarify WHP's eligibility to qualify for the CHP 10% credit

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