



# Introduction to **HEAT IS POWER**

LET'S CAPTURE IT

**SMU Geothermal Energy & Waste Heat to Power Conference**  
**Successful Heat to Power Development**

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# Agenda

- Introduction to :
  - NRGreen Power, and
  - Alliance Pipeline Canada
- Technology
  - Waste Heat to Power– advantages & process
  - Organic Rankine Cycle
- Development Opportunities and Challenges
  - Waste Heat to Power Opportunities
  - Advancing Waste Heat to Power in the U.S.
- Closing remarks & Questions

# Overview – NRGreen Power

- NRGreen Power is an Alliance Canada related party first established in 2002
- Commercial development of waste heat electrical generation opportunities at Alliance Pipeline compressor stations



**Strong and Stable  
Ownership**  
50% Enbridge  
50% Veresen

# Alliance Pipeline System



# Waste Heat to Power Generation Advantages:

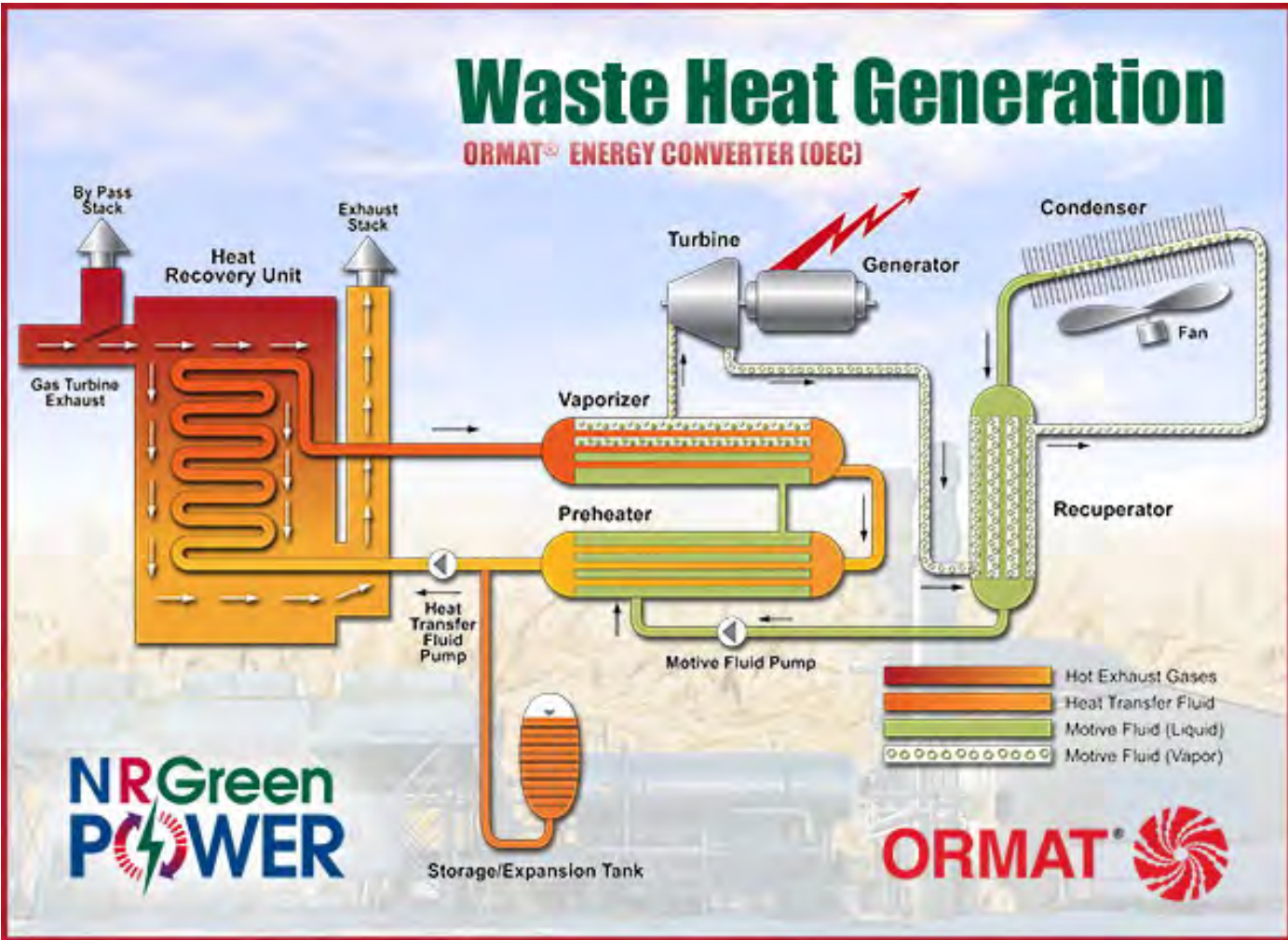
- Electric generation that produces no new greenhouse gas emissions
  - Avoidance of @ 55,000 tonnes of GHG's per year (as compared to traditional fossil fuel generation)
- Technology can be applied to existing industrial facilities and transmission pipelines
- Reliable source of power from pipeline compressors (98+%) = **baseload power**
- Can be interconnected at distribution or transmission voltages

# Waste Heat to Power Generation Process:

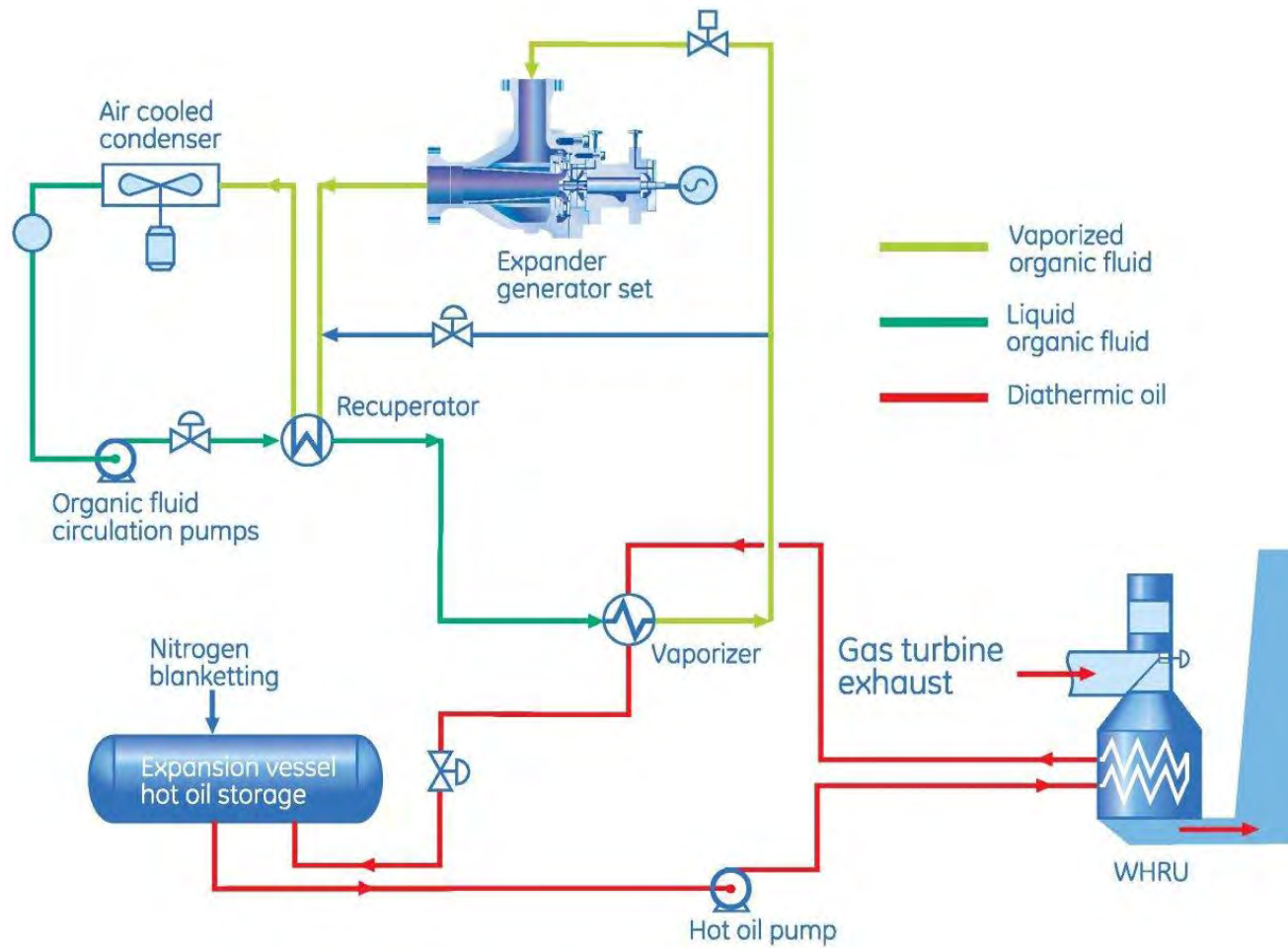
Innovative technology consists of two processes

- The 1<sup>st</sup> process loop captures waste heat from hot turbine exhaust using a heat exchanger that contains circulating thermal oil and a waste heat recovery unit
- The 2<sup>nd</sup> process loop is the energy converter system that transfers the heat from the thermal oil to a circulating organic working fluid through a series of heat exchangers using the Organic Rankine Cycle process

# Organic Rankin Cycle – Ormat®



# ORegen™ – General Electric





# Successful Development in Canada

- **Four Waste Heat to Power Generating facilities in Saskatchewan:**
  - Kerrobert, SK – in service 2006
  - Alameda, Estlin & Loreburn, SK – in service 2008
- Safe (no incident) operations at all sites since start-up
- Semi attended operation – ORMAT ORC technology
- Long-term Power Purchase Agreement with SaskPower
- Max generating capacity @ 5.4 MWhr per site

# NRGreen Power / Alliance Pipeline Kerrobotert, SK Facility



# New Facilities: Alberta Initiatives

- **Whitecourt Recovered Energy Generation Project:**
  - 1<sup>st</sup> global application of G.E.'s innovative **ORegen™** system
  - Designed to reliably generate **14 Megawatts** of electricity per hour with no new emissions, water or incremental fuel
  - Project is funded in part from Alberta's Climate Change Emissions Management (CCEMC) Corporation
  - Projected in-service date: **Q2 2013**
- Deregulated market risk offset
  - "Pool Pricing" Agreement & CCEMC funding
- Subject to Alberta regulatory regimes



# Whitecourt Recovered Energy Project

**Project  
Construction  
Underway**



**ELECTRIFYING  
NEWS** Green power is  
coming to town

**NRGreen  
POWER**  
nrgreenpower.com

CCEMC ALLIANCE  
pipeline

Utilizing heat generated from Alliance Pipeline's Windfall Compressor Station operations near Whitecourt, Alberta

# Waste Heat to Power U.S. Opportunities:

## Proposed Projects at Alliance Compressor Stations:

### Seven sites capable of 6 MW

These projects will provide the following benefits:

- Can generate **700,000 MWh per year**
  - Enough to power ~182,000 homes
- No new GHG emissions and does not use water
  - Offset @385,000 tonnes of GHG Emissions per year
- Estimated ~ \$300 million of capital investment

# U.S. Development Challenges

- Waste Heat to Power is **NOT** on a level playing field with other “*emission-free power*”
  - Generation result ‘equivalent’ to other Renewables
  - WHP not defined in PURPA or Energy Independence and Security Act of 2007
- Perceived U.S. Regulatory uncertainties (FERC):
  - Allow for pipeline-related entities to develop projects outside of the current rate-base & rate of return
  - Consider developing a Waste Heat to Power Policy Statement
- Lack of demand for Heat to Power by Utilities
  - Potential Grid Interconnection challenges

# Advancing Waste Heat to Power:

- Create utility demand for waste heat to power generation by including in State renewable energy portfolio requirements
- Minimize “Transmission Interconnection” barriers, including:
  - *Interconnect study queue's*
  - *Costs related to interconnection*
- Add Waste Heat to Power as a **qualified technology** in
  - *Tax Codes – Section 45 (PTC's) & 48 (ITC's)*
  - *Future Master Limited Partnership eligibility*

# Closing remarks:

- NRGreen Power has a solid, safe and efficient history operating WHP facilities
- Advantages of NRGreen Power's Projects include:
  - Electricity generation that produces no new greenhouse gas emissions
    - Reliable source of base-load power from existing pipeline compressors
  - Technology can be applied to other industrial heat sources
- Project Economics require Public Policy Support on a State / Federal level to facilitate future development of Waste Heat to Power Projects in the U.S.



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