Global Opportunity
Focused Opportunity
GHG Opportunities
Genalta – Who are we
Technical Overview
GLOBAL OPPORTUNITY

Useful Energy 37%
Wasted Energy 63%

ENERGY
Coal
Natural Gas
Electricity

CONVERSION
Steam Plant
Turbine
Pump

Useful Energy 37%
Global Opportunity

Energy
- Coal
- Natural Gas
- Electricity

Conversion
- Steam Plant
- Turbine
- Pump

Wasted Energy
- 63%

Useful Energy
- 37%

Actual Work
- 57%
OPPORTUNITY: Generate GREEN, BASELOAD POWER from waste energy
## Green House Gases

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount of CO$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Fired Power Production</td>
<td>1.02 MT/MWh</td>
</tr>
<tr>
<td>Oil Fired Power Production</td>
<td>0.76 MT/MWh</td>
</tr>
<tr>
<td>Gas Fired Power Production</td>
<td>0.52 MT/MWh</td>
</tr>
<tr>
<td>Incineration</td>
<td>1.40 MT/MWh</td>
</tr>
<tr>
<td>SOURCE</td>
<td>ANNUAL SAVINGS/MW</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Coal</strong></td>
<td><strong>$459,000</strong></td>
</tr>
<tr>
<td><strong>Oil</strong></td>
<td><strong>$545,000</strong></td>
</tr>
<tr>
<td><strong>Gas</strong></td>
<td><strong>$372,000</strong></td>
</tr>
<tr>
<td><strong>CO₂ Offsets</strong></td>
<td><strong>$125,000</strong></td>
</tr>
</tbody>
</table>
Extensively invested in Renewable Energy, Power Developer, and Research & Technology. Ability to Deploy necessary Resources. Long Term Relationship.
Engineered Power Solutions

Research & Development

System Optimization

Project Execution
Waste Heat to Power

ORGANIC RANKINE CYCLE

Opportunities:

Hot Exhaust
Steam Condensers
Hot Liquids
Genalta Power

HIGH
GRADE
HEAT

LOWER
GRADE
HEAT

ORC
**EXHAUST HEAT**

Minimum 200°C (400°F)

**RULE OF THUMB**

\[ kW_{\text{net}} = \text{Shaft HP} \times 20\% \]
HOT LIQUIDS

Site Selection

Temp (Min): 80°C  
176°F

Flow (Min): 100 m³/hr  
500GPM

Reduce cooling fan load

RULE OF THUMB

100°C

\[ kW_{\text{net}} = 3.6 \times (m^3/\text{hr}) \]
Heat of Condensation
Reduce cooling fan load

**Site Selection:**
Pressure: > atmospheric

**Rule of Thumb**

\[ kW_{net} = \frac{\text{Flow (kg/hr)}}{15} \]
Waste Pressure to Power

Pressure Differential ➔ Rotational/Mechanical Power
Ethane Pressure Letdown

- STEAM CONDENSER (EXISTING)
- PRE-HEATER
- TURBO EXPANDER GENERATOR PACKAGE
- PRESSURE REDUCTION VALVE
- HIGH PRESSURE ETHANE
- STEAM
- CONDENSATE
- LOW PRESSURE ETHANE

Addition of Preheat
GAS PRESSURE LETDOWN

Turbo Expander Technology
Application Specific
Pre-heat/after heat - Waste heat can be utilized

RULE OF THUMB**

\[ \text{kW}_{\text{net}} = \text{MMscf/d} \times 10 \]

Note: Final Pressure = 4,000 kPa (580 Psi)
Amine Systems

Hydraulic Power Recovery Turbine

Generation vs Pump

Pressure Recovery Comparisons

Min flow: 110m³/hr
500 GPM

RULE OF THUMB

\[ kW_{net} = \frac{GPM}{3.5} \]
Waste Fuel to Power

CONVERT TO BASELOAD POWER

FUEL
- Fuel Composition (H2S, Energy Value)
- Consistency, Pressure, etc
- Odour issues

MECH
- Gas Turbines
- Recip Engines
- Incineration (Heat to Power)

POWER
- Induction
- Synchronous
- Inverter (Power Electronics)

Regulatory
- Conservation
- Offsets

GHG’s
Production vs. Power Generation

- Green line: Installed Power kW
- Blue line: Gas Production (MCF/d)
Site Selection

- 3 Phase Power in area
- Fuel gas analysis required

Turbine Waste Heat:

- Waste heat to power
- Process hot water

**RULE OF THUMB**

\[ kW_{net} = \text{FLOW (mcf/d)} \times 3.8 \]

Or

\[ 1 \text{ MW} = 260 \text{ mcf/d} \]

Min: 70 mcf/d (2 e³m³/d)
Electrical Output:
- 480, 600, 4160 volts, etc
- Inverter, Induction, Synchronous Generation

Interconnection:
- Grid Interconnect & Paralleling
- Off Grid

Control Systems:
- PLC Based
- Remote Monitoring
• Balance of power output and installed equipment
• System optimization
• Focus on system integration (zero interruption to process)
• Designed to site conditions
• Tailored to client’s needs
<table>
<thead>
<tr>
<th>ISSUE</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable Energy</td>
<td>GHG Reductions</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Cost Savings</td>
</tr>
<tr>
<td>Environmental</td>
<td>Carbon Footprint Reductions</td>
</tr>
<tr>
<td>Policy</td>
<td>Going Green</td>
</tr>
</tbody>
</table>