An Industrial Waste Heat Win-Win!

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Managing Director
Integral Power, LLC
An Industrial Waste Heat Win-Win!
Re-development of Dynegy Cogen plant (1983 vintage)

3 x Heat Recovery Boilers

2.5 mile steam pipeline

400,000 lb/hr steam export

5 MW power production

~55 MW equivalent output
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Commercial Structure

- Great Lakes Carbon (GLC)
  - Flue Gas Heat
  - Power, Revenue

- Integral Power
  - Development, Mgmt
  - Capital

- American Industrial Partners

- Port Arthur Steam Energy LP (PASEL)
  - 600 psig Steam

- North American Energy Services
  - O&M Services

- Entergy
  - Clarified Water
  - Steam payments

- Valero Energy Corporation
Monthly Average MMBTU/hr Delivered to Valero

- Start-up: August 05
- Hurricane Rita: October 2005
- Planned Kiln Outages: July 2007, July 2008

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Key Commercial Points

- Great Lakes receives value for waste heat via share of revenue
- PASE provides all of GLC power requirement at discount
- Great Lakes retains air emissions
- Valero provides clarified water, receives HP steam
- Steam priced on net BTUs metered tied to nat gas market index
- Long term agreements on both sides
General Project Drivers

- Waste heat = **NO FUEL BILL**
- Natural hedge against rising energy prices
- Waste heat = **NO** incremental **EMISSIONS**
- “Green” project = sustainable development, great P.R.
- State provides expediting permitting via “Standard Permit”
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Natural Gas Pricing - Industrial Sector National Avg
EIA Monthly Energy Report

$USD per 1000 SCF


- Dynegy project shutdown October '00
- IP begins redevelopment June '02
- PASE Start-up August '05
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GREAT LAKES
- Revenue for waste heat
- Reduced electricity cost
- Increased electricity reliability
- Reduced raw water cost

NAES (3rd party O&M)
- Revenue from O&M Mgmt Fees
- 23 full time jobs created

PASE OWNERS
- Revenue from Operations
- Expand asset base

VALERO
- Savings vs gas firing in boilers
- Reduced boiler fan HP
- Water treatment savings
- Capital and O&M avoidance
- Reduced Emissions
Steam Savings – Example Fuel Component

Based on: 100,000 lbs/hr steam @ 600 psig/750 ºF (1378.6 BTU/lb) 95% availability:

<table>
<thead>
<tr>
<th>Natural Gas HHV</th>
<th>Refinery Boiler @ 81% eff</th>
<th>Project Price @ 1.0 factor</th>
<th>Fuel Savings</th>
<th>Yearly Fuel Savings</th>
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<tr>
<td></td>
<td>$/steam MMBTU</td>
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Project Challenges

- Discretionary project for both Great Lakes & Valero
- Steam & power generation outside of GLC core business
- Plot constraints (original project)
- High installed capital cost (original project)
- Boiler isolation … *do not want the tail wagging the dog!*
- Greed – difficult to conclude negotiations
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Key Project Issues

- Heat flow …*economy of scale is huge*
- Reliability / availability of heat source
- Ability to isolate is a must
- Length of tie-in pipe (2-3 miles max) or wires
- Permit constraints drive configuration and operation
- Plot constraints can drive capital up sharply
- Other commercial issues:
  - credit worthiness of counterparties
  - history and future longevity of the facility
Conclusion

- PASE is a huge WIN for all parties and the community
- Nearly 5,000,000 MMBTU per year recovered
- Displaces ~200 tons/yr NOx & ~280,000 tons/yr CO2
- PASE is a model for industrial efficiency and cooperation!