KCT Waste Heat Applications

March 2, 2005

Presentation Outline

- ☑ K-Cycle Technology Summary and its History
- ☑ Process Description and its Advantages
- ☑ Canoga Park Demonstration Project
- ☑ Sumitomo Project
- ☑ Waste Heat Applications for the K-Cycle

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K-Cycle Technology Summary

- Commercially available
- Underlying principles are simple & understood
- Effective, Efficient and Safe
- Utilized in Refrigeration for over 100 years
- Breakthroughs in:
  - Understanding of ammonia/water properties
  - Applying principles to power plant operations
  - Developing proprietary super efficient cycle designs

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Process Technology, No New Components

- PROCESS, no technological or component improvements required for implementation
  - Improved heat transfer process
  - Improved recuperation
  - Use of, and Reliance on, Proven Plant Components

A proven technology, composition changes in the power cycle similar to refrigeration plants

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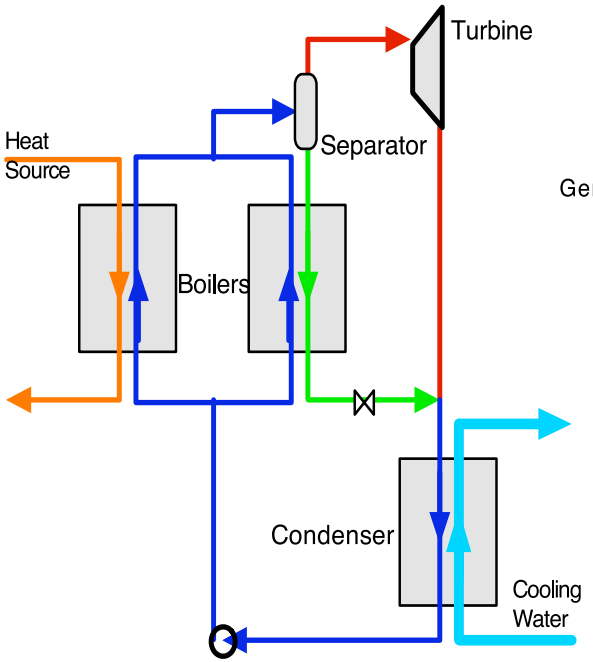
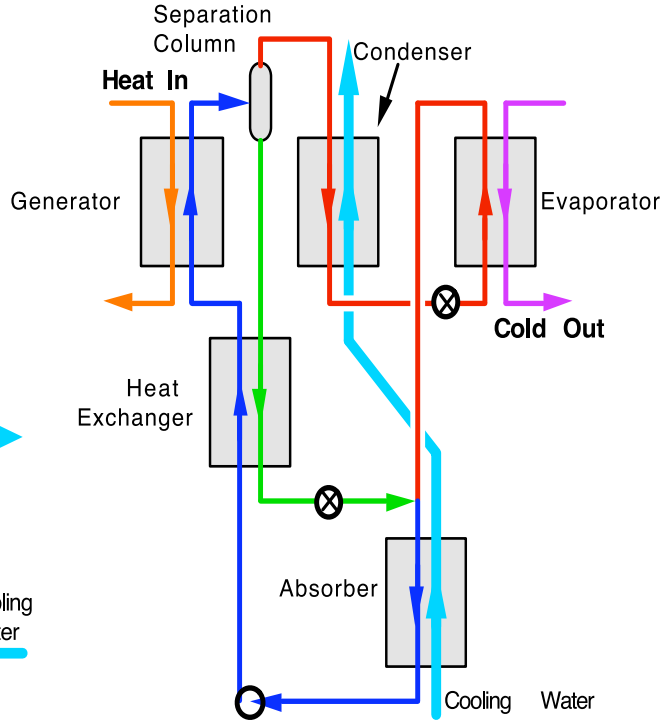
Components are Well Known



Kalina Cycle® System 34g
Conceptual Flow Diagram
KCS34g



York Ammonia Absorption Chiller

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History of the Kalina Cycle

1988	Invention of technology, formation of Exergy
1990	Start of construction of 6.5MW Canoga Park demonstration
1991	Startup of Canoga Park
1992-97	Canoga Park Testing
1999	First commercial Kalina Cycle Plant operational, Sumitomo Metals
2000	First geothermal power station, Húsavík
2002	Recurrent Engineering acquires KCT and staff
2003	Waste Heat Plant in Hydrocarbon Facility Started
2003-04	Amp Resources purchases Cove Fort and Stillwater (large scale geothermal projects)

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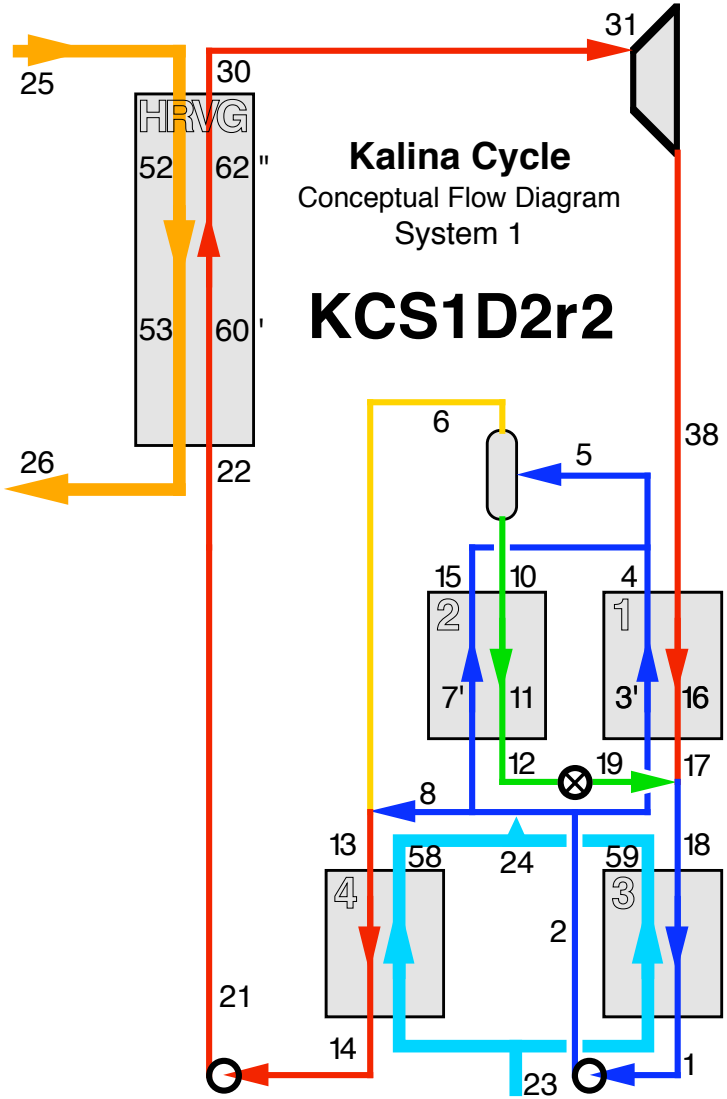
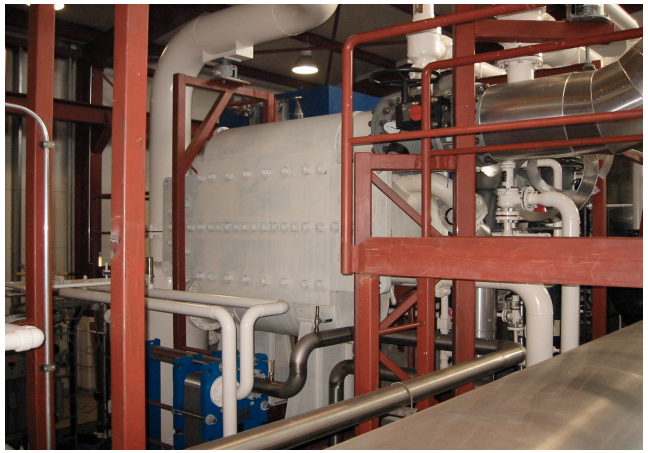
Kalina Cycle Gaseous Waste Heat Process



Four Key Technology Advantages

- Performance
- Environmental & Safety
- Specific Price
- Reliability



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Performance and Heat Source Management

- 10% to 40% more power with the same amount of heat input
- Better off-design performance - greater net electricity on hot and cold days by changes in Ammonia-water composition
- Lower power plant auxiliary loads vs. ORC
- Lower boiling point fluid, less sensitivity to decreases in heat source inlet temperature

Improved plant efficiency, more efficient use of a fixed heat source

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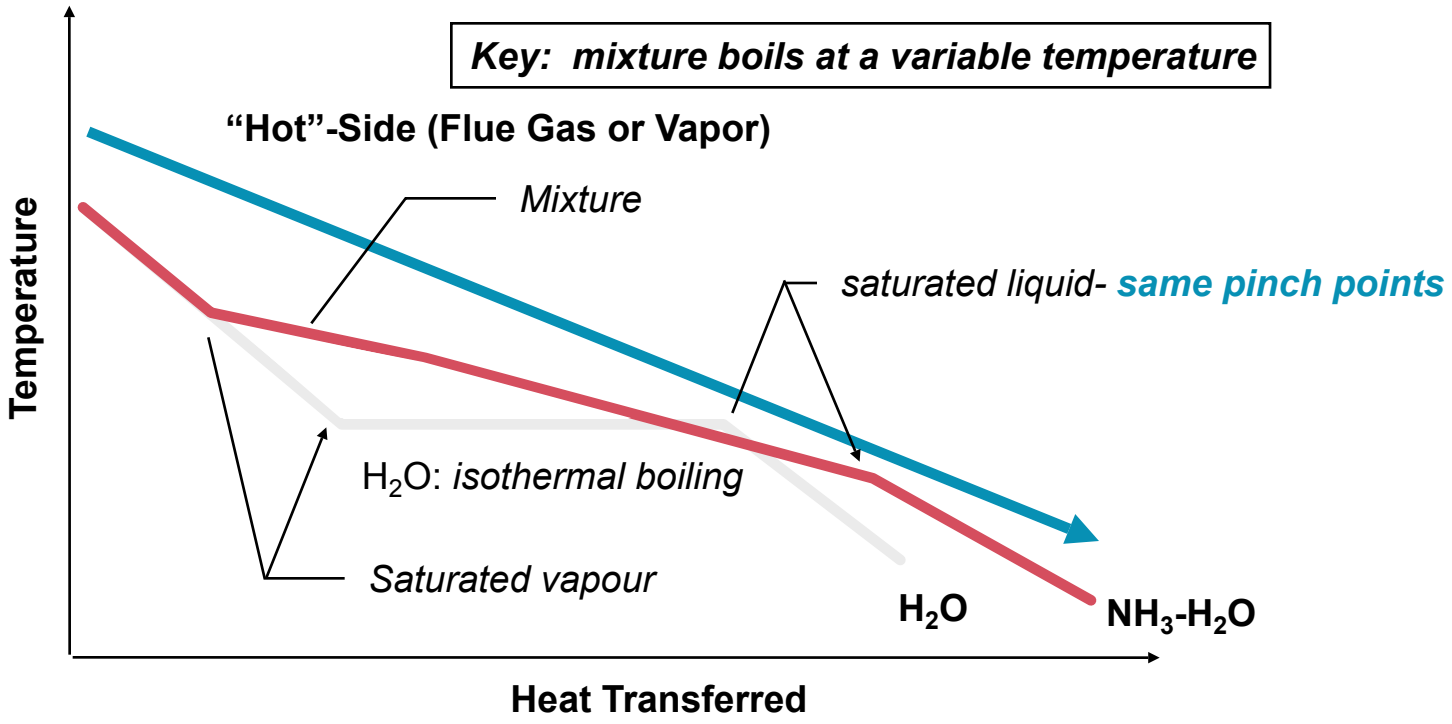
K-Cycle Heat Acquisition Advantage

Improved Heat Transfer From Hot To Cold Streams



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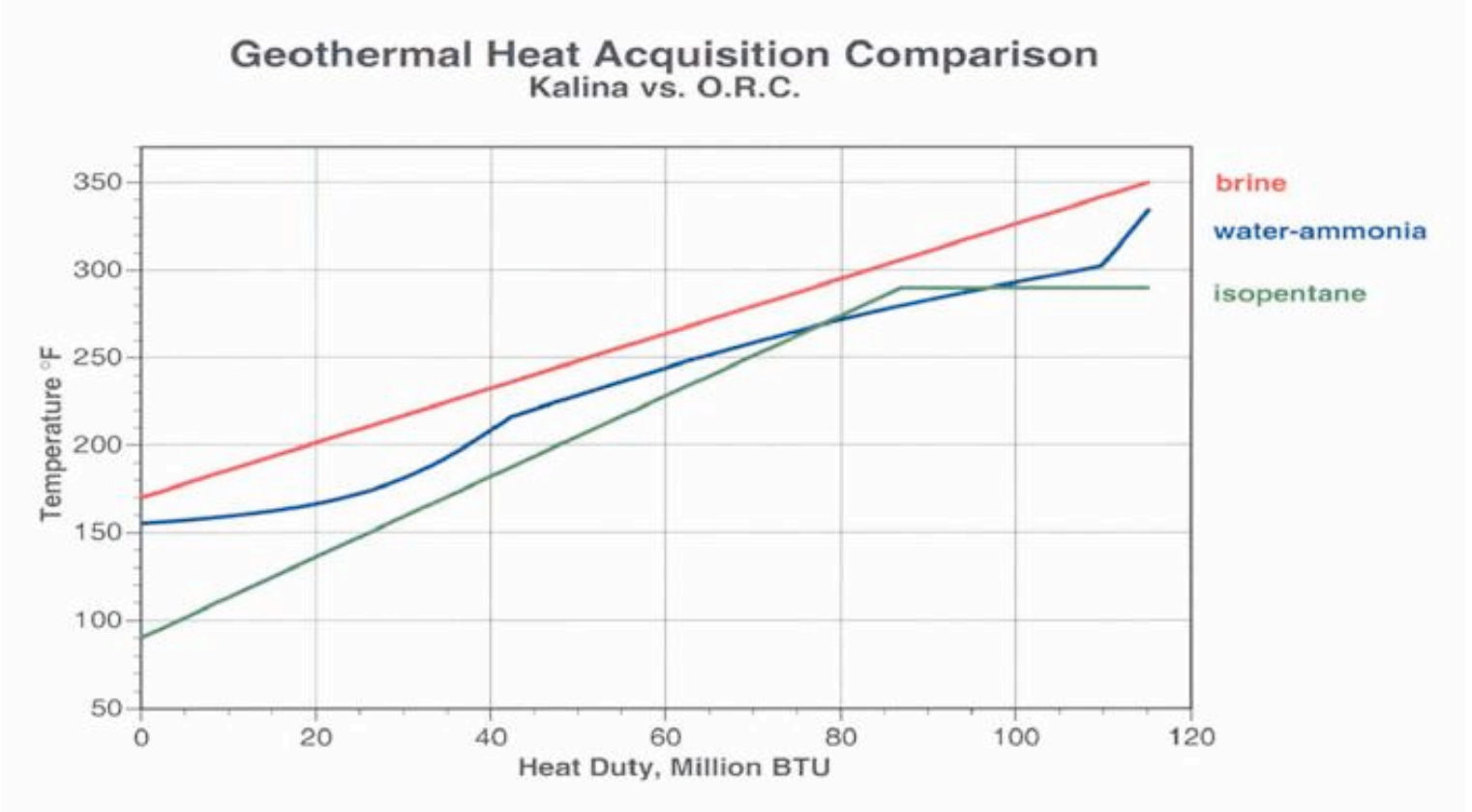
Heat Acquisition Design Data



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Price

- Same amount of hardware as Rankine with 10% to 40% more power
- Efficiency benefit results in lower specific plant price

Improved project financial returns versus Rankine plants

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Environmental and Safety

- Less hazardous and flammable than organic cycle working fluids
- Environmentally benign, the most common compound found in nature
- Ammonia vents easily, and is self-alarming
- Ammonia is the 6th largest chemical produced in the U.S.
- Proven safety record in ammonia synthesis, power plants and refrigeration plants

Ammonia-Water is safe and environmentally friendly

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Reliability

- Standard power plant design practice
- 100 years of steam turbine experience
- Fewer prime movers (turbines and pumps)
- Standard heat transfer components
- Siemens partnership

Kalina Plants are not limited to modular turbine sizes for low temperature applications

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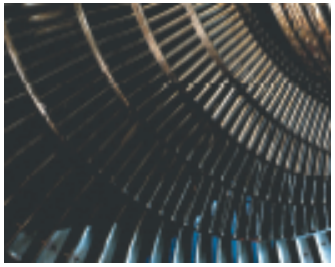
Canoga Park Waste Heat Demo



- Configuration: Combined Cycle
- Operator: Boeing Rocketdyne
- Construction site: California
- Electrical output: 6.5 MW
- Turbine Inlet: 960 F, 1650 psig

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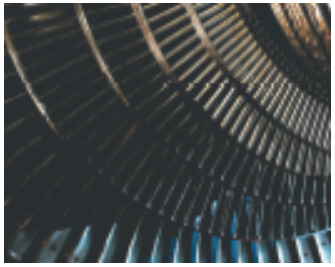
Sumitomo Project



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Sumitomo Power Plant- Plant Electrical Generation Data and Major Milestone Events

August 30 to 31, 1999

MITI witnessed test for Provisional Acceptance (2500 kW) passed.

October 21, 1999

Passed the Guaranteed Output Test @ 3297 kW (corrected guaranteed value was 3234 kW)

June 23, 2000

5100 hours of operation excluding test periods to date beginning August 1, 1999. Approximate availability of 97.5% during this period.

Sumitomo Power Plant- Plant Electrical Generation Data and Major Milestone Events

June 2, 2001

Total running time excluding test run through April, 2001 of approximately 11,000 hours beginning August 1, 1999.

December 17, 2001

Total running hours from November 2000 to October 2001 was 7777 hours generating 20,558 megawatt-hours.

October 1, 2003

Total running hours from November, 2002 to October 2003 was 7884 hours. Planned outages of the steel mill totaled 864 hours during the year, which limited the heat source availability. Plant reliability exceeded 99% during this period.

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K-Cycle Areas of Application

What are the areas of applications?

High Temp.

500°C

Waste Heat Recovery in Industries

- Gas compressor stations
- Iron + Steel Industry
- Cement Industry
- Chemical Industry
- Incineration Plants
- Diesel Plants

Waste Incineration (Japan)

Steel Plant (Japan)

Hot Brine Heat Recuperation

- Geothermal Plants

100°C

Low Temp.

Primary Source

Geothermal Plant (Iceland)

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