Electrical Power Generation Using Geothermal Fluid Co-produced from Oil & Gas

May 19, 2010

Principal Investigator
Bernie Karl

Tracks:
Engineered Geothermal Systems
Low Temp

Project Objectives

- To validate and realize the potential for the production of low temperature resource geothermal production on oil & gas sites
  - Both producing and abandoned wells
  - Show that lower cost geothermal projects are possible, as most geothermal costs are associated with drilling
  - Prove to oil & gas companies that our unit operates safely and efficiently
- Test and document the reliability of this new technology
- Gain a better understanding of operational costs associated with this equipment
- Help realize that a more distributed power generation network is attainable and an effective solution to energy problems

Project Overview (Timeline)

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Construction Phase

July 1, 2008

Aurora Energy validation of ORC using a waste heat stream for urban municipal energy generation in Fairbanks, AK

Planning for future deployments to Oil & Gas sites for co-production

Final Report to DOE

May 16, 2012

~92% complete

Unit was producing power from Chena Hot Springs geothermal resource at the Renewable Energy Fair and U.S. Senate Energy and Natural Resources Sub-Committee Field Hearing

Display and Confirmation of the unit's mobility and its effectiveness for power generation for urban applications.

Project Overview (Budget)

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Total Costs
  - $1,699,681
- FY ‘09
- DOE Share
  - $688,000
- Awardees’ Share
  - $1,025,065
- FY ’10
- ~$36,000 Remaining DOE funds for shipping Mobile Power Plant
- ~$300,000 Site installation to be paid for by well owner

Relevance/Impact of Research

The objective of our project

- During the last year our projects were able to be successfully demonstrated on 154° water at Chena Hot Springs, Alaska, on a municipal waste heat stream in Fairbanks, Alaska, and again at the Geothermal Resource Council annual meeting in Reno, Nevada
- There are many cost savings that can be derived from successful coproduction of geothermal power production and oil & gas production
- Our project is uniquely innovative, in that we are hoping to create power from what was previously considered an inadequate heat source. We are hoping to countinue to develop strategies to cut production costs in order to make these units economically viable for private industry to pursue.

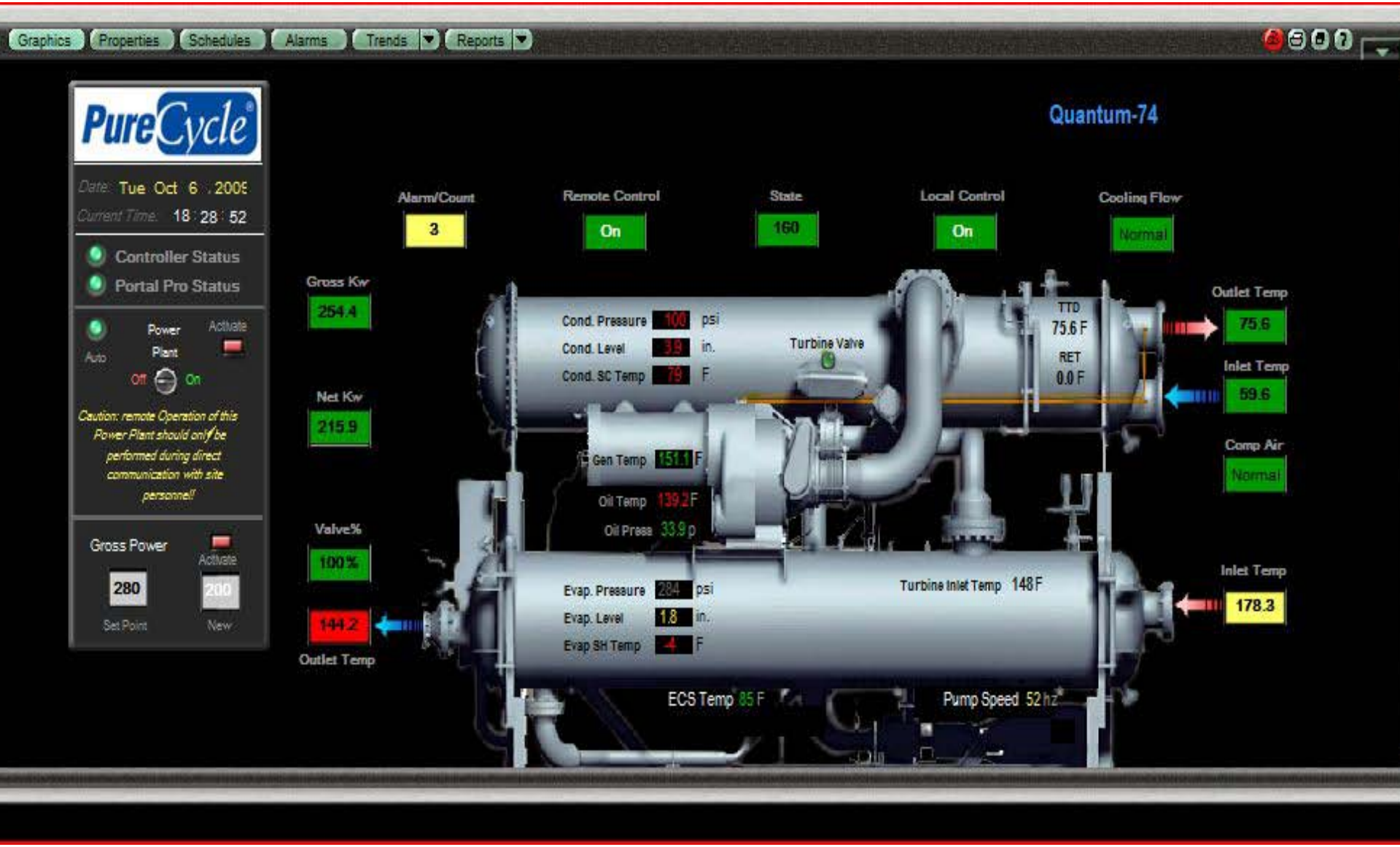
Relevance of Research

- Design research that is directly relevant to solving the alternative energy needs of the United States
- Establish capabilities of energy production from low temperature geothermal resources
- Develop transportable 280 kW geothermal power plant that requires fewer permits and bureaucracy, resulting in reduced cost and expedited project completion
- Exploit the utilization of existing depleted or producing oil & gas wells that have geothermal power
- Lays the foundation for a broadly distributed power network in remote regions

Scientific Basis of This Technology

- Utilizes the thermodynamics of the Organic Rankine Cycle generation process to capture an existing low temperature geothermal heat source to produce electrical energy
- Portable evaporatory coolers
- Dual redundant satellite and cell communications
- Onboard crane for onsite deployment and operation
- Oil-water separator that provides the make-up water for the evaporatory cooling

GRC in Reno, Nevada



Industry Coordination

- This project has required industry coordination between the following entities:
  - U.S. Department of Energy
  - Chena Hot Springs Resort, LLC
  - Pratt & Whitney Power
  - Aurora Energy
  - The Peppermill Resort and Casino
  - The Geothermal Resources Council.
  - Quantum Resources
  - Southern Methodist University (David Blackwell, PhD)

Problems Encountered/Lessons Learned

- Oil fields are sold or shutdown rather than being developed for geothermal power generation, but there is promise in extending the usable life of the fields
- Oil Price fluctuation is a determining factor in oil production
  - Highly volatile markets can negate effective planning
- Diversification is important
  - For example, Quantum Resources underwent a massive restructuring after arrangements were made for oil field testing at their facilities
- Defined and well understood agreements between interested contracting parties are essential
- Technological improvements and discoveries
  - Draining the unit for safe transport requires extra time that must be accounted for, but is essential
  - Dual redundant communications system, required for improved reliability in remote or semi-remote sites, should be maintained
- Air ride suspension trailers are a must

Future Directions

- Our plan is to have our Mobile unit deployed to an oil and/or gas well for coproduction.
  - Our management team has had to be flexible in dealing with partners, as the plans have changed several times since project inception.
  - On or before. May 6, 2010 – Determine Site for field testing of oil & gas coproduction
  - May 6, 2012 – Final report to DOE submitted

Team Qualifications and Awards

- Chena Hot Springs Resort successfully generates electrical power from the lowest temperature geothermal resource in Alaska, and the entire world.
- 2006 Project of the Year Award in renewable energy from *Power Engineering Magazine*
- 2007 R & D 100 Award from R & D magazine
- 2007 Green Power Leadership Award from DOE and EPA
- 2007 Northern Alaska Environmental Center Business of the Year
- 2010 University of Alaska Business Leader of the Year
- Research and Development Team Qualifications
  - Extensive Project Management Experience
  - Design Capability
  - Fabrication
  - Assembly
  - Resource Management
  - Systems Analysis

Summary Slide

- Chena Hot Springs has proven ORC technology can be applied in remote locations without accessible cooling water and local communications
- Chena Hot Springs is one step away from being able to coproduce electricity off oil wells located throughout the country
- This technology can lead to more distributed power generation infrastructure
- The mobile modular construction allows for easy setup and teardown with little effort

Optional Slide

- Geothermal Resource Council Presentation (Oct '09)
- Chena 4th Annual Renewable Energy Fair Demonstration (Aug '09)
- Fairbanks Daily News-Miner (Sep '09)
- CNN.com article
  - 'Imagineer' touts geothermal energy invention

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