Power Generation from Low to Intermediate Temperature Resources

Generates Electricity From Lower Temperature Geothermal Fluids

GTO's program initiatives enable technology development and deployment for power generation using low-temperature geothermal fluids. These technologies could be used in existing or new production sites and non-productive low fluid temperature injection wells. Similarly, in the oil and gas sector, significant amounts of co-produced hot water and steam are treated as waste but is warm enough to generate electricity. This mode of power generation could potentially generate over 30 GW_e in the U.S. and extend the life of mature oil and gas fields.[1]

The University of North Dakota (UND), with assistance from GTO (as part of the American Reinvestment and Recovery Act), is developing technology to demonstrate the technical and economic feasibility of generating electricity from co-produced and low-temperature geothermal resources in the oil and gas producing areas of the Williston Basin in North Dakota. UND will evaluate binary Organic Rankine Cycle (ORC) technologies over a range of operating parameters including geothermal fluid temperature, flow rate, and cost. UND's analysis has fond that there are few sites in North Dakota with sufficient fluid production because of the well depths (> 3km) which are produced slowly to prevent watering out. There has been a recent horizontal drilling boom in the Williston Basin which has led to infill drilling that produces large volumes of geothermal fluid in the temperature in the range 120 - 130 ^{0}C.[2]

Additional power requirement estimates for producing oil in the Williston Basin are approximately 2,600 MW. Currently, grid power is supplied by six coal-fired power plants and onsite power from gasoline, diesel and propane powered generators. Onsite power costs over five times more than grid power. UND is proposing that a distributed network of ORC engines could offset the costly and lengthy construction of new power generation infrastructure needed for oil production. UND has selected an innovative ORC design by Access Energy - Thermapower®, which uses R245fa as the working fluid that operates at T ≥ 120 °C with 14 % efficiency and produces 125 kW_e. The integrated power module contains a turbine expander and generator which is hermetically sealed and uses magnetic bearings for high-efficiency and reduced parasitic mechanical load. UND and Access anticipate an onsite field demonstration by mid-2015.[3]

Access Energy's Thermapower® ORC

Overview

- Developed by University of North Dakota in collaboration with Calnetix Technologies.
- Currently preparing for field demonstration start at Williston Basin, ND.

Applications

Can be used to generate electric power and/or provide supplemental heating (CHP) from waste streams or other lower temperature heat sources, including co-produced geothermal fluids.

Capabilities

- Achieves power generation using ORC with efficiencies up to 14 % at T ≥ 120 °C. (similar ORC systems operate at 6 – 8% efficiency)
- Produces 125 kWe, 3-phase 380 - 480 $_{VL\_L}$ at 50 Hz.
- Achieves reduced parasitic mechanical load using fewer moving parts (one) and magnetic bearings.

Benefits

Cost Savings

Reduces energy costs by offsetting grid power and other costly onsite power generation methods.

Installation

ORC system can be retrofitted into existing or newly developed well operations.

Environment

Deployment of emission-free ORC power generation systems could offset the need to construct fossil-fueled power plants to meet power demand, eliminating the potential for increased carbon emissions.

Contact Information:
William Gosnold
Email: william.gosnold@UND.edu
Phone: (701) 777-2631
University of North Dakota
81 Cornell St. (MS 8358)
Grand Forks, ND 58202-8358
Website: http://engineering.und.edu/geology-and-geological-engineering/

[1] GTO Clean Domestic Power Factsheet
[2] Final Project Report DE0002731
[3] Geothermal Resources Council, Transactions, v. 39, 2015