

U.S. DOE



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# Trailblazer Pipeline

## 3.5-MW Waste Heat to Power System

### Site Description

The 436-mile Trailblazer natural gas pipeline winds through parts of Wyoming, Colorado, and Nebraska. The pipeline is dotted with compressor stations that maintain the pressure of the gas as it travels along. These compressor stations are often run by turbines, which exhaust waste heat during the compression process.

One such compressor station is located in the service territory of Highline Electric Association, a member-owned rural electric co-op serving farming and ranching communities in the northeastern corner of Colorado (northeast of Sterling).

Rather than let the exhaust heat be vented to the atmosphere, Highline decided to recycle that waste heat and turn it into clean, renewable power for Highline's electric grid.

### Reasons for Installing Waste Heat Recovery

Highline Electric Association's main reason for pursuing this renewable energy project was to provide cost savings to its members. Highline expects to save over \$10 million over the 20-year agreement. In addition, the project has virtually no emissions or environmental impact, qualifies as a renewable energy source for Colorado's Renewable Portfolio Standard (RPS), and is a baseload, non-intermittent source of clean energy.

### Quick Facts

**LOCATION:** Peetz, Colorado

**MARKET SECTOR:** Pipelines

**FUEL:** None (waste heat only)

**POLLUTION:** None

**MAX CAPACITY:** 4.5 MW

**AVERAGE CAPACITY FACTOR:** ~ 70%

**ENERGY OUTPUT:** 27,600 MWh per year

**IN OPERATION SINCE:** March 2009

**EQUIPMENT:** Ormat organic rankine cycle

**USE OF ELECTRICAL ENERGY:** Renewable energy for Highline Electric Association members

**ESTIMATED 20-YEAR SAVINGS:** Over \$10 million

**ESTIMATED YEARLY SAVINGS:** Over \$600,000

**JOINT PROJECT BY:** Highline Electric Association, Tri-State Generation & Transmission, Kinder Morgan, and Ormat

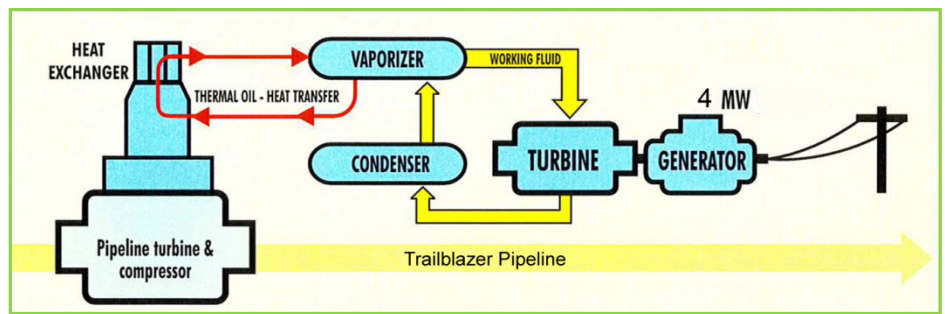
**ENVIRONMENTAL BENEFITS:** 27,600 tons of CO<sub>2</sub>, 34,500 kg of NO<sub>x</sub>, and 124,200 kg of SO<sub>2</sub> saved each year



Trailblazer Waste Heat to Power Project in Northeastern Colorado

## Equipment and Configuration

The Trailblazer compressor station has two 14,500-horsepower Solar Mars 100 gas turbines, with exhaust temperatures of 900°F. An Ormat organic rankine cycle technology was installed at the site to capture and turn the heat into electricity.



Heat Recovery Generator Schematic

The heat from the turbines is recovered using a heat exchanger in new exhaust stacks, and then transferred to a working fluid of pentane in a second heat exchanger, or “vaporizer.” Heating the working fluid causes it to vaporize and expand in volume, and this increase in volume drives another turbine generator. After the vaporized working fluid has passed through the turbine, it is air-cooled and condensed back to a liquid. There is no water used in the heat recovery process, no emissions, and no additional fuel.

The 12.47-kV electrical output is transformed and interconnected to a new 69 kV transmission line. Although the generator could have been interconnected to an existing 12.47 kV 3-phase distribution line, the area’s occasional summer lightning storms made a 69-kV line a higher-reliability choice.

## Collaborative Business Arrangement

This project was a result of a successful collaboration between several organizations:

- The system is built, owned, and operated by Ormat, a major technology supplier and owner of recovered energy and geothermal energy projects.
- Highline Electric Association buys the electric output of the system through a 20-year Power Purchase Agreement (PPA), and uses it towards meeting its Renewable Portfolio Standard required by the state of Colorado.
- Tri-State, the generation and transmission provider for Highline and 43 other rural electric co-ops, supported the project through its Member Local Renewable Project program that provides financial assistance for local clean energy projects (policies 115, 117, and 118).
- Kinder Morgan owns the Trailblazer natural gas pipeline and compressor station, and receives a payment from Ormat for use of its waste heat.

## Lessons to Share

All of the organizations involved in this project consider it successful and recommend this application to other cooperatives and pipelines. Two lessons to share include:

- Tri-State’s distributed and renewable energy policies make it easier and more economical for its member co-ops to pursue waste heat to power. Each co-op can self-supply up to 5% of its own load with locally-produced clean energy.
- The plant’s electrical output partly depends on the amount of natural gas going through the pipeline, which depends on natural gas prices. The Trailblazer system has averaged about a 70% capacity factor over the most recent year of operation. It is wise to do an economic analysis using a couple different capacity factors (70% and 90%, for instance). The economics of the project has changed with the advent of the Marcellus gas shale play in the Midwest and eastern United States. The pipeline has run intermittently in 2013 and 2014.

## For More Information

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