



# Oregon Institute of Technology Organic Rankine Cycle CHP Project

## 2,030-kW CHP/ORC System



Oregon Institute of Technology, Klamath Falls, Oregon

### Quick Facts

**LOCATION:** Klamath Falls, Oregon

**MARKET SECTOR:** Educational Facility

**FACILITY SIZE:** 5,490 students

**EQUIPMENT:** 280 kW PureCycle ORC CHP Module plus 1.75 MW ORC Expansion

**FUEL:** Geothermal Hot Water

**USE OF THERMAL ENERGY:** Space Heating

**CHP TOTAL EFFICIENCY:** N/A

**ENVIRONMENTAL BENEFITS:** Offset fossil fuel combustion for electricity and space heating

**TOTAL PROJECT COST:** \$14.7 million (expansion only)

**YEARLY ENERGY SAVINGS:** About \$1.5 million annually

**PAYBACK:** >20 years w/o incentives for expansion

**CHP IN OPERATION SINCE:** 2010, expanded in 2018

### Site Description

The city of Klamath Falls lies above an abundant supply of geothermal energy. In 1964, the Oregon Institute of Technology (OIT) moved its Klamath Falls campus to tap hot water from the relatively shallow geothermal reservoir for heating campus buildings (16 buildings with about 1-million square feet of floor space). The geothermal district heating system uses three production wells to supply 192°F to 197°F hot water. Spent water is returned to the reservoir through two injection wells. In 2010, the geothermal heating system was modified to include a 280 kW (gross) Pratt & Whitney PureCycle modular Organic Rankine Cycle (ORC) power plant with a water cooling tower. The ORC cycle is used to convert low temperature heat to electricity. This was the first geothermal CHP project at a college campus in the world.

### Reasons for CHP

The success of the initial CHP system led to the design and installation of a 1.75 MW project expansion---consisting of a new deep geothermal well, an injection well, connecting pipelines; and the installation of a 1.75 MW ORC project. The new installation consists of both 1,000 kW and 750 kW air-cooled binary series-counterflow ORC generating units, built by Johnson Controls. The combined ORC and CHP projects are sized to deliver 8.3 million kWh annually to campus after offsetting well pumping requirements; reducing campus electrical energy costs by about one-half million dollars per year. Geothermal heating saves the university an additional \$1 million dollars annually. The CHP and ORC projects can run automatically while requiring little maintenance. The result is reduced energy and operating costs while lowering the campus' carbon footprint.

## ORC Equipment Costs

Funding for the \$14.7 million ORC project expansion was provided by a federal appropriation, Energy Trust of Oregon incentives, grants from the U.S. Department of Energy and the Oregon Department of Energy; Pacific Power Blue Sky grants, OIT, and state-supported bonds.

## CHP and Renewable Project Operation

Following the success of its CHP project, the Oregon Institute of Technology partnered with SolarCity to install 7,800 ground mounted solar modules. The 2 MW photovoltaic solar array was completed in 2014 on 9 acres of the OIT campus. While the integrated renewable and CHP projects enable OIT to generate all of the electrical and thermal energy needed for the campus using clean energy sources, the project was not intended to operate in grid independent or island mode operation. The combined output from the renewable and CHP energy projects is expected to exceed the campus electrical energy requirements by about 700,000 kWh per year. Excess electrical energy is donated to Pacific Power's low-income subsidy program while excess geothermal hot water is made available to adjacent businesses.



**280 kW binary Pratt & Whitney PureCycle ORC powerplant at OIT (Geo-Heat Center)**

## Projects Offer Educational Opportunities

The 280 kW ORC unit has operated reliably since its installation. The new ORC powerplants are undergoing commissioning and performance testing. Both the renewable and CHP projects serve as an onsite laboratory for green jobs industry training for students enrolled in the campus's Oregon Renewable Energy Center and the Geo Heat Center. When the new ORC units are placed into full operation, OIT will be the first university in North America to generate most---if not all---of its electrical power from renewable sources.



**1,000 kW and 750 kW binary ORC projects at OIT**

## For More Information

### U.S. DOE Northwest CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)

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More CHP Project Profiles:  
<http://northwestchptap.org/>

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***"They (the renewables and CHP projects) support the education of our students in the growing green jobs industry, and they put us closer to our goal of becoming a climate neutral campus..."***

***-Christopher Maples, President of OIT***