

## Juneau Airport Ground Source Heat Pump

<b>Grantees</b>	City and Borough of Juneau (Local Government)
<b>Technology Type</b>	HEAT PUMPS
<b>Region</b>	Southeast
<b>AEDG Project Code</b>	10001

### REF Grants Received

Round	App	Grant Title	Grant #	AEA Project #	Phase	Start Date	End Date	Status
0	-111	Juneau Airport Ground Source Heat Pump	2195359	406008	Construction	10/7/08	6/30/10	Closed

### Grant 2195359: Juneau Airport Ground Source Heat Pump

**Project Scope:** The use of geothermal energy at the Juneau International Airport Terminal is a part of an overall renovation and expansion project. Based on the feasibility study conducted by the Alaska Energy Engineering LLC, a Ground Source Heat Pump (GSHP) scheme offers the financial incentive to move away from traditional fuel oil-based heating systems to a system that extracts heat from the ground and obtains most of its purchased energy from cleaner hydroelectric sources.

The geothermal loop field is located under the pavement of the commuter plane airfield ramp. It consists of 108 vertical borings to a depth of 350 feet each. A mix of 88% water and 12% methanol circulates through a continuous underground loop of more than 16 miles of HDPE piping. The piping enters the building and is distributed to 31 electric heat pumps that provide heating, cooling, and ventilation to interior spaces, as well as heat to the building's front sidewalk that prevents build-up of ice and snow. The heat pumps are digitally controlled to efficiently respond to changing air conditions.

Construction of the loop field was completed in the fall of 2009. Installation of the heat pumps inside the building began in early 2010 and continued alongside other renovation work until May, 2011.

**Project Status:** The completed geothermal heat pump system has not yet been operating under design conditions long enough to draw substantive conclusions. Nearly half of the 96,000 sq. ft. building area is not using the new geothermal system and will continue to be served by diesel boilers until the Airport replaces these older portions of the terminal. Regardless of these obstacles, data gathered to date show promising evidence of a successful conversion from traditional diesel fired boilers to renewable geothermal heat pumps. Preliminary findings are as follows:

The savings in fuel oil between Calendar Year 2008 (pre-construction) and Calendar Year 2011 (post-construction) is 37,082 gallons. The average cost of fuel oil diesel #2 in Juneau during the period of this analysis is \$3.52 per gallon. Therefore, the cost of fuel oil saved between Calendar Year 2008 and Calendar Year 2011 is approximately \$130,529. The airport terminal project added approximately 12,000 sq. ft. of new area to the building.

The difference in electrical usage between Calendar Year 2008 (pre-construction) and Calendar Year 2011 (post-construction that includes 12,000 sq. ft. building expansion) is approximately 168,960 kWh. The electrical local cost, including demand charges, used for purposes of this analysis is \$0.092/kWh. Therefore, the additional cost of electricity for the airport terminal is approximately \$15,544.

Subtracting the additional electrical usage cost from the fuel oil cost savings results in \$114,985 in direct annual fuel cost savings for the Juneau International Airport facility with the installation of the ground source heat pump system.

Another significant benefit that the airport has seen is the decrease in operations costs due to the snowmelt system. This is a new system, and while it demands significant energy to operate, the safety and passenger comfort issues are very positive. The snow melt system is energized by three water-to-water electric heat pumps that are integrally tied to the geothermal loop field. While not analyzed in detail, it is expected that operating this system by an equivalent diesel energy source would have made the installation cost prohibitive for the airports annual operating budget. The geothermal snow melt system savings over traditional snow removal operations is approximately \$10,000 per year in staff labor and \$1,000 in equipment and supplies.

Recognizing the limited scope of analysis to date, the Airport will conduct a full analysis following completion of planned energy efficiency projects and ongoing minor renovation.