

# Juneau International Airport Geothermal Heat Pump Project



*Images throughout courtesy JNU Airport staff, unless noted.*



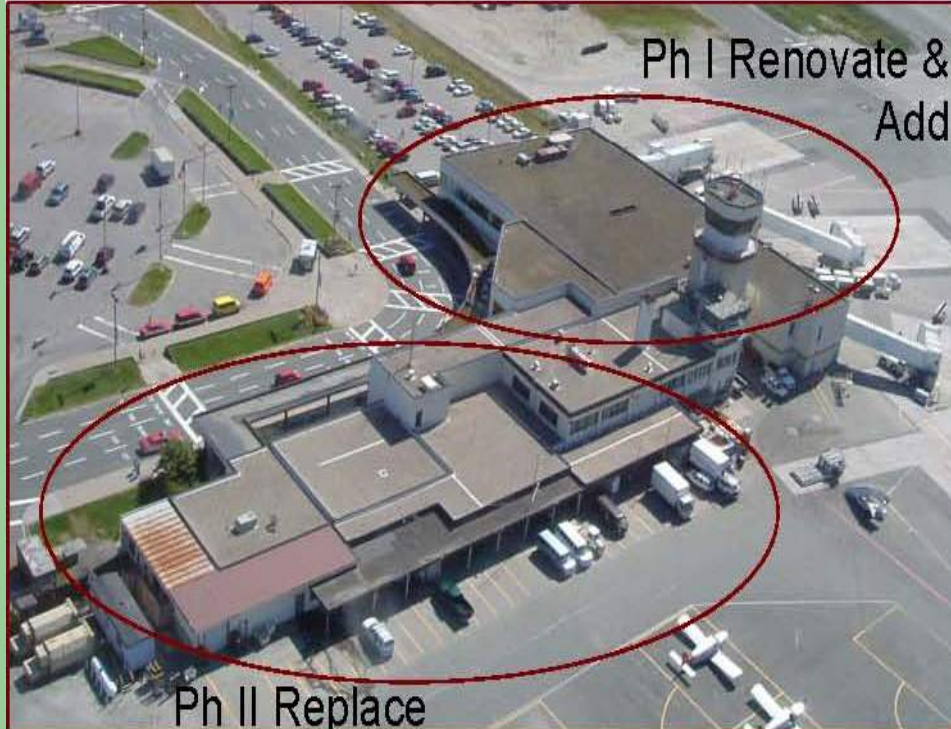
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# Terminal Renovation Project Goals

- **Reduce Operating Costs**
- **Modernize Infrastructure**
- **Improve passenger experiences**

**\$50 million problem, with only \$23 million  
available to address it.**

# Terminal Renovation Project Approach



- Address challenges with **good** design, rather than lots of design. Be efficient.
- Modernize facility & clean up aesthetics.
- Design/construct to high performance standard.

# Geothermal Heat Pump System Basics

- Pipes are placed in the ground, then filled with fluid.
- The earth's constant temperature warms (or cools) the fluid as it passes through the piping.
- Fluid is pumped into the building and “exchanged” by way of electric heat pumps. This provides heating, cooling, and ventilation to the occupied space.



Schematic rendering of closed loop geothermal heat pump system. *Image from [www.mcquay.com](http://www.mcquay.com)*



## Grant Funding

- Alternative Energy Program, Construction Funding Request; February 2008
- Application completed by JNU staff; funding request = \$1,026,000 (50/50 grant)
- Grant award made October 2008



# Loop Field Construction



**108 borings, each  
are 350 ft. deep.**

**Summer 2009**



# Loop Field Construction



**16 miles of HDPE piping in the ground.  
Ground temperature is approximately  
42 degrees F.**





# Pipe Fusion

**Each pipe seam is welded and tested multiple times to ensure bond. The life span of HDPE piping is more than 100 years.**





# Into the Pump Room

**Fluid of 88% water and 12% methanol is pumped throughout the building. A 3-way valve controls when the fluid circulates within the building, and when it returns to the loop field to capture more heat.**



**Fall 2009**

# Into the Ceilings



**28 water-to-air heat pumps are located in ceilings throughout the airport terminal.**





# Ice-Melt System



**3 water-to-water heat pumps serve the ice melt piping system.**





# System Performance to Date\*

## Decrease in Diesel Usage:

- **2008** (prior to heat pump installation) = **89,682 gal**
- **2011** (heat pump installation completed in May 2011) = **52,600 gal**

**Savings = \$130,529**

## Increase in Electrical Usage:

- **2008** (prior to heat pump installation) = **2,093,600 KWHR**
- **2011** (heat pump installation completed in May 2011) = **2,262,560 KWHR**

**Increased Cost = \$15,554**

**Direct Fuel Usage Annual Savings = \$114,985**

\* Data is preliminary. Multiple years of complete system operations under varied demand conditions should be considered for comprehensive analysis.

## Additional Benefits

- Snow/Ice removal operations have been reduced by approximately \$11,000 per year while providing safer public access to the terminal.
- Removing central heat/vent equipment has freed up valuable square footage areas inside the building for other uses.
- Heat pumps provide improved air quality, including air-conditioning.
- The geothermal loop field has been sized to accommodate replacement of pre-1984 areas of the terminal.
- Reduction in diesel usage contributes to carbon emissions reduction.
- The confidence gained through this installation has convinced the airport to use geothermal technology in the new Snow Removal Equipment Facility.

# Geothermal is part of a holistic approach to design and construction





**Thank You** for the grant funding and the opportunity to share our success.



**Jeannie Johnson, Airport Manager**

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