Sustainability – Utilization of FAA VALE Grants for Geothermal Projects

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sbn south bend INTERNATIONAL

Mead & Hunt

Presentation Overview

- South Bend International Airport Overview
- HVAC Project Need
- Geothermal Heat Pump Systems
- FAA VALE Program (Voluntary Airport Low Emissions)
- Funding for VALE Projects

South Bend International Airport Overview

South Bend International Airport Overview

- Airport governed by the St. Joseph County Airport Authority
- Indiana third busiest airport for commercial traffic
- Economic Impact of SBN estimated at more than $410 million per year
- Approximately 300,000 passenger boardings per year

South Bend International Airport Overview

- Air Service
  - Allegiant Air – Fort Myers/Myers/Punta Gorda, Las Vegas, Orlando/Sanford, Phoenix/Mesa, St. Petersburg/Clearwater
  - Delta Connection: Atlanta, Detroit, Minneapolis/St. Paul
  - United Express: Chicago-O'Hare, Newark
- Cargo: FedEx Express, UPS
- FBO: Atlantic Aviation

Why is this project important to our community?

- Griffen Plumbing and Heating – Michiana-based company (Elkhart)
- $6,600,000 used in Michiana area for a construction project in community
  - Supports jobs
  - Economic impact to the region
- Reduces the carbon footprint of the airport
  - Increasing focus for the airport

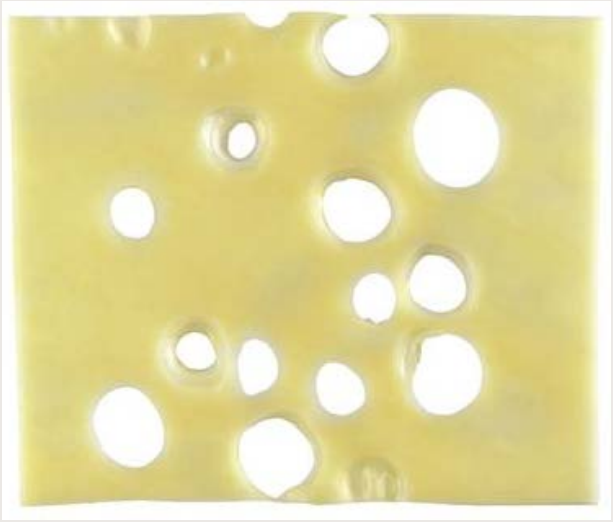
Project Need

- Existing HVAC needed to be replaced
- Cooling towers and other equipment were at the end of their useful life
- Wanted a Geothermal system regardless of VALE incentives

Project Location and Need

Project Need

Project Need



Geothermal Heat Pump Systems

What is a Geothermal Heat Pump System?

- A method of providing heating and cooling energy for a facility using the earth as an energy source or “battery”
  - Systems are not limited to just ground-source may also utilize ground water and surface water bodies for energy transfer.
- In winter, energy is extracted from the earth for heat
- In summer, energy is rejected to the earth for cooling
- Geothermal energy can be utilized to heat air and water for space conditioning or it can heat water for domestic water needs.

Geothermal Heat Pump Systems

Types of Geothermal “Fields”

- Vertical Bore
- Horizontal Loop
- Surface Water Coil
- Open-Loop Surface Water
- Open-Loop Ground Water

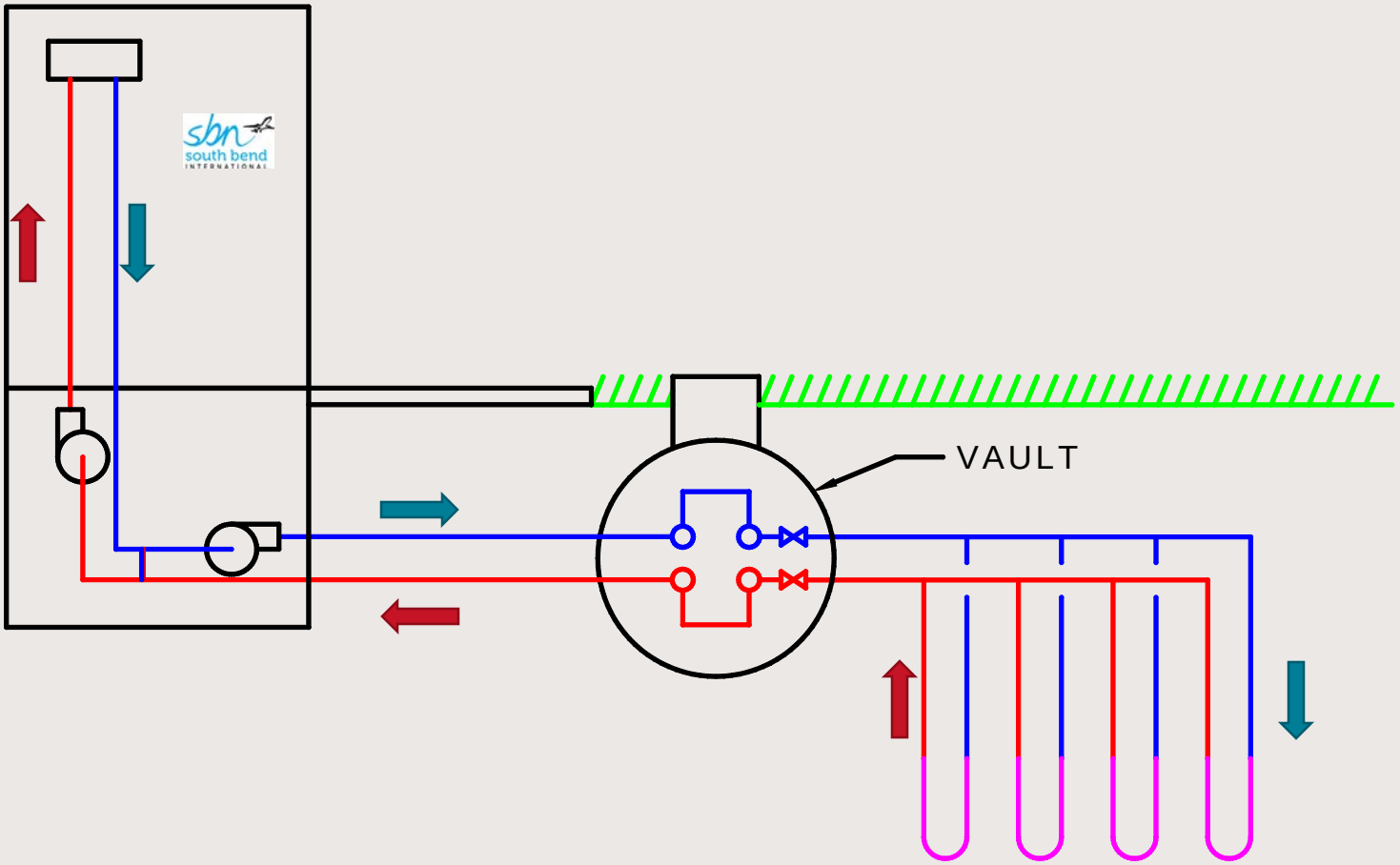
Source: Application Guide (AG 31-008). N.p.: McQuay International, 2002.

Geothermal Heat Pump Systems

How Does a Geothermal Heat Pump System Work?

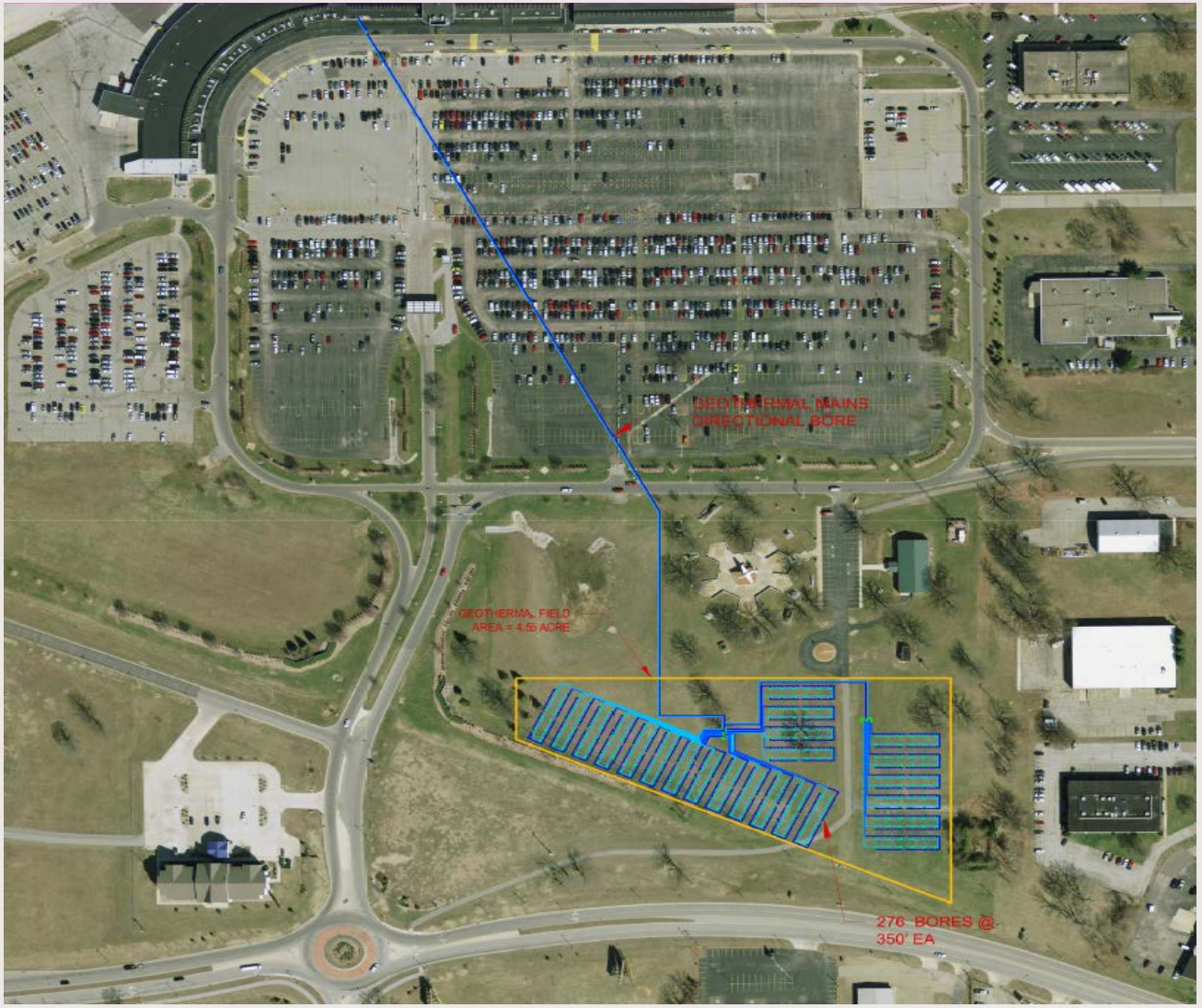
- System pumps circulate a heat transfer medium through distribution piping to heat pump units.
- In summer, heat pumps reject energy to the heat transfer medium via the refrigeration cycle
- In winter, heat pumps extract energy from the heat transfer medium via a reversed refrigeration cycle
- The heat transfer medium is pumped to the geothermal field where it is sent to individual bores via the distribution vault.
- Energy is transferred to/from the earth and the heat transfer medium is returned to the facility

Geothermal Heat Pump Systems



Constant Ground Temperature = Energy Transfer

Geothermal Project at SBN



Geothermal Bore Field Location

Geothermal Project at SBN – Fun Facts

- 276 geothermal bore holes were used
- Each geothermal bore extends 350 ft below grade
- System consists of 2 distribution vaults and 23 circuits with 12 bores per circuit
- Approx. 33,000 gallons of 50% water/propylene glycol was used
- 1,928 total feet of directional bore between terminal and field
- Approx. 202,000 feet of underground piping
- All underground piping is High Density Polyethylene (HDPE)
- Top of wells 6 to 8 feet below surface
- The fluid will travel a 1 mile loop to the field and back

Geothermal Project at SBN

Construction Phasing

- One of main constraints placed on the project was the requirement for the airport to remain 100% functional during construction
- Contractors began boring in the fall to have field prepared for spring
- Existing cooling towers and boilers are left in place and tied to new pumps until geothermal field tie-in is complete
- Heat pumps are being changed one at a time with changes to heat pumps in sensitive customer or operations areas occurring during off hours
- Timing of cut over important to keep existing building at proper temperatures

Geothermal Bore Field Location

Sustainability: Triple Bottom Line

Sustainable Actions

- Reduce environmental impacts.
- Help maintain high, stable levels of economic growth.
- Help achieve "social progress", a broad set of actions that ensure organizational goals are achieved in a way that's consistent with the needs and values of the local community.

Source: FAA and UNF Center for Sustainable Business Practice

Voluntary Airport Low Emissions (VALE) Program

- The Voluntary Airport Low Emission Program (VALE) is designed to reduce all sources of airport ground emissions.
- Created in 2004, VALE helps airport sponsors meet their state-related air quality responsibilities under the Clean Air Act.
- Through VALE, airport sponsors can use Airport Improvement Program (AIP) funds and Passenger Facility Charges (PFCs) to finance low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements.

- Source: http?://www.faa.gov/airports/environmental/vale/ accessed March 2015

VALE Eligibility Requirements

- Only applicable for commercial service airports in non-attainment or maintenance areas for National Ambient Air Quality Standards (NAAQS) criteria pollutants
  - **Ground Level Ozone (O_3)**
  - Carbon monoxide (CO)
  - Particulate matter (PM_{10} and $PM_{2.5}$)
  - Nitrogen dioxide (NO_2)
  - Sulfur Dioxide (SO_2)
  - Lead (Pb)

Source: FAA Voluntary Airport Low Emission Program Technical Report, Version 7

VALE Eligibility Requirements

- Only applicable for commercial service airports in non-attainment or maintenance areas for National Ambient Air Quality Standards (NAAQS) criteria pollutants (ozone, etc)
- Must reduce on-site emissions

Gas Usage – Existing and Proposed HVAC system

Gas Usage	No Action (MCF/Year)	Proposed Project (MCF/Year)
east and west heat pump systems	4.3	0.5
ancillary (not connected to heat pump system and include baggage handling, mechanicals, board room and other misc. areas)	1.7	1.7
Total Annual Usage	6.0	2.2

-reduction of 3,800,000 cubic feet of natural gas per year

-According to the U.S. Energy Information Administration website (www.eia.gov) the average WI household uses an average of 103 million Btu of natural gas per year which is approximately 103,000 cf

-total reduction equates to approximately 38 households per year

SBN Estimated Reduction Emissions

Pollutant	Baseline (Tons)	With Geothermal (Tons)	20 Year Life Cycle (Tons)
CO	173.48	63.82	-109.656
VOC	11.488	4.226	-7.262
NO_2	213.513	78.552	-134.962
O_3 Ozone (NO_2 + VOC)	**225.001**	**82.78**	**-142.224**
SO_2	1.334	0.491	-0.844
PM-10	16.013	5.891	-10.122
PM-2.5	16.013	5.891	-10.122

VALE Eligibility Requirements

- Only applicable for commercial service airports in non-attainment or maintenance areas for National Ambient Air Quality Standards (NAAQS) criteria pollutants (ozone, etc)
- Must reduce on-site emissions
- Cost Effectiveness

Cost Effectiveness

Pollutant	Projected Emission Reductions over Useful Life of Project (20 years) (tons)	Cost Effectiveness over Useful Life of Project Vehicles and Equipment ($/ton)	Projected Emission Reductions over Useful Life of Project (25 years) (tons)	Cost Effectiveness over Useful Life of Project Vehicles and Equipment ($/ton)
NOx	135	34,746.31	169	27,796.63
VOC	7	645,819.03	9.	516,612.54
O3 Ozone (NOx + VOC)	**142**	**32,972.33**	**169**	**26,377.38**
CO	110	42,764.44	178	34,203.44
PM_{10}	10	463,277.22	13	370,607.13
$PM_{2.5}$	10	463,277.22	163	370,607.13
SO_2	1	5,562,623.96	1	4,465,992.38

VALE Eligibility Requirements

- Only applicable for commercial service airports in non-attainment or maintenance areas for National Ambient Air Quality Standards (NAAQS) criteria pollutants (ozone, etc)
- Must reduce on-site emissions
- Cost Effectiveness
- Equipment commitments
  - Replacement of Equipment for Useful life of Project

Environmental- National Environmental Policy Act

- Environmental Assessment
- Wetland delineation
- Cultural resources (archaeology and historic) field survey (Section 106)
- Hazardous Materials Phase I due diligence
- Agency coordination (SHPO,IDNR, USF&WS, USCOE)
- Construction Emissions Inventory
- Voluntary Mitigation for tree removal
  - Restricted season to avoid Indiana Bat roosting
  - Indiana Tree Project -Planting
- Storm Water Permits

Funding for VALE program

- The level of VALE support may be subject to the following limitation:
  - The portion of the project representing non-revenue producing public – use areas that are directly related to the movement of passengers and baggage

Eligible Areas of Terminal

Eligible: Square Foot method vs CFM Method

What is SF method.

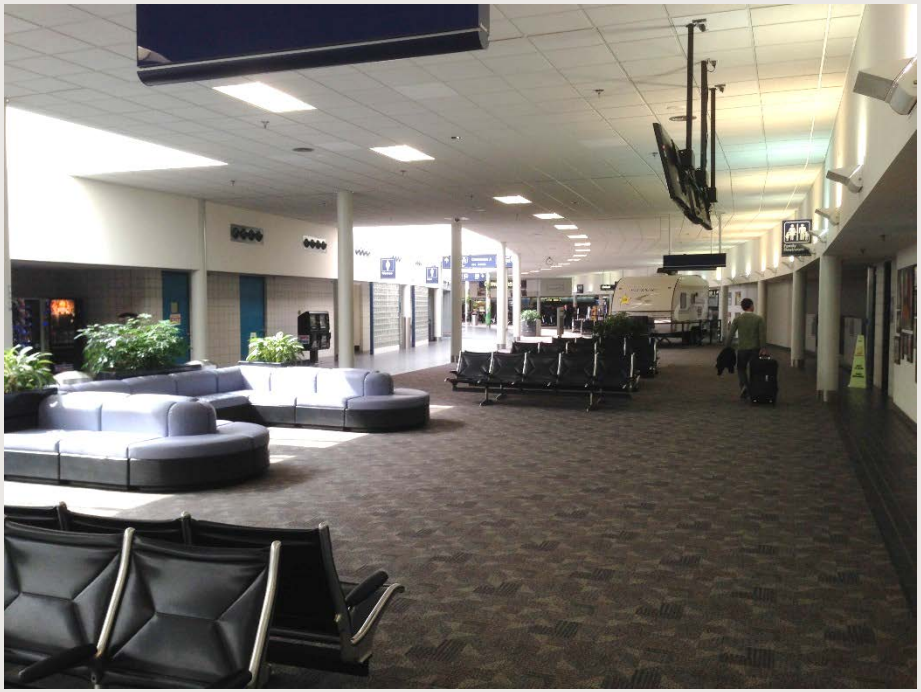
- Based on square footage of rooms eligible for funding: non-revenue producing public use areas that are directly related to the movement of passengers and baggage.

What is CFM method.

- Determines actual air flow delivered to eligible and ineligible space.
- Calculate % of total for eligible areas

- Eligibility Totals
  - SF Method = 71% of project eligible for FAA funding
  - CFM method = 80 % of project eligible for FAA funding

CFM Eligibility vs Traditional SF Eligible Eligibility



Large Volume Spaces

CFM Eligibility vs Traditional SF Eligible Eligibility

Small Volume Spaces

Project Construction Cost and Funding Sources

Funding Source	$	%
Federal – AIP-Entitlement	$2,763,304	42
Federal – AIP -VALE	$2,000,000	30
State	$264,628	4
Local	$1,587,768	24
PFC	0	0
Total	$6,615,700	

Overall Benefits

- Sustainability is about the triple bottom line
  - Economic
    - reduced utility cost ($20,000 per year)
    - Maintenance and labor reduction cost ($100,000 per year)
    - Additional $2,000,000 used in Michiana area for a construction project in community
  - Environment
    - Reduced air emissions
  - Social
    - Managed impact to stakeholders and airport users.

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