



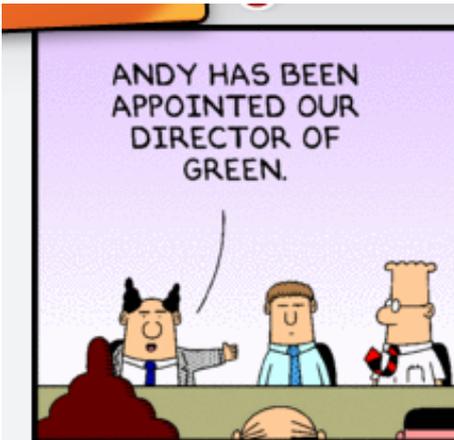
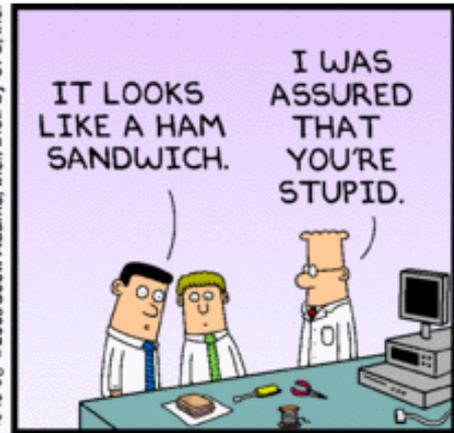
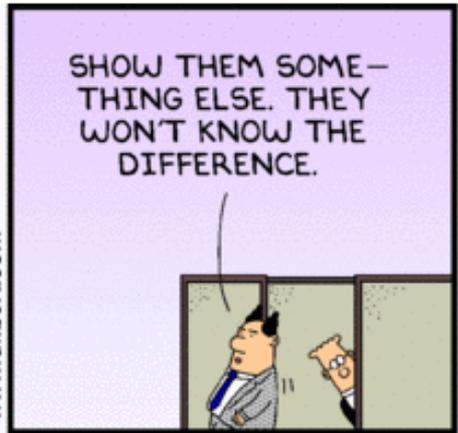
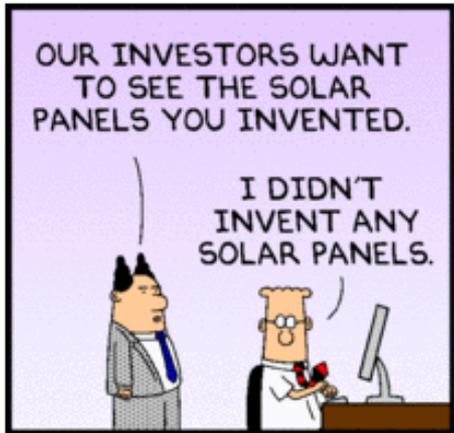
• August 15-18, 2010 • Dallas, Texas •  
• Dallas Convention Center •



Presenter: Paul L. McCarty  
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# Combining Ground-source Community Loop Systems with Variable Flow Equipment

# Some Humor



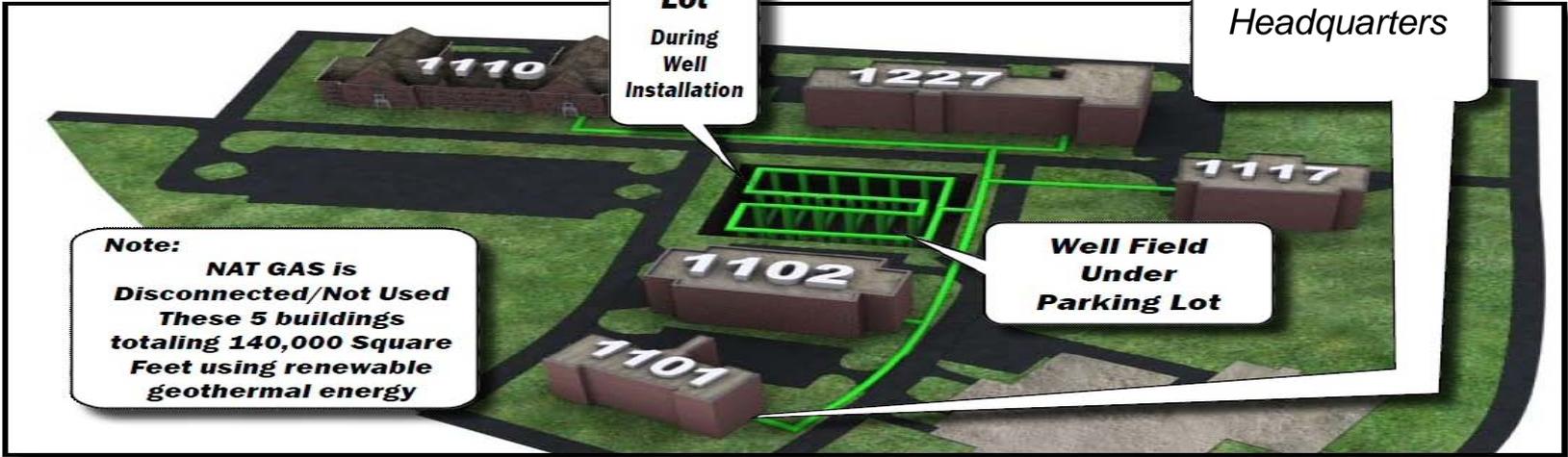
# Overview

- Outlook to Saving Energy
- Ground-source Community Loop Heat Transfer Systems (GCLHTS)
- Variable Flow Everything Chiller/Heaters with GCLHTS
- Variable Refrigerant Flow Systems with GCLHTS
- A Path Forward

# Outlook to Saving Energy

- Cool People Not Spaces
- EISA 2007, E.O. 13423 => Net Zero by 2030
  - First - Save Save Save!
  - Second - Produce Produce Produce!
- LEED => Good, But Can Give False Sense of Energy Security
  - New Buildings = LEED Silver (Bicycle Racks)
  - Energy Savings Best at New Construction
  - HVAC = Big Consumer of Energy

# Ground-source Community Loop Heat Transfer Systems (GCLHTS)



**Note:**  
NAT GAS is  
Disconnected/Not Used  
These 5 buildings  
totaling 140,000 Square  
Feet using renewable  
geothermal energy

**Parking Lot**  
During  
Well  
Installation

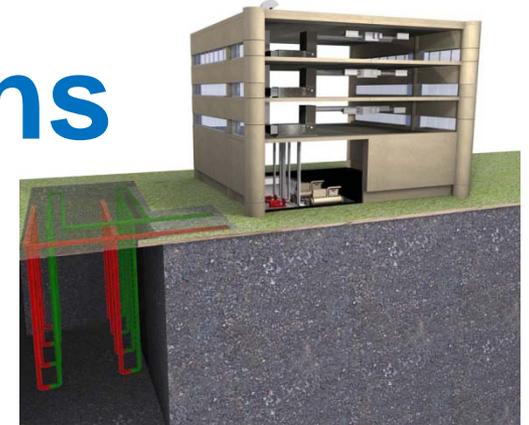
Fort Knox  
Headquarters

**Well Field  
Under  
Parking Lot**

# GCLHTS When?

- Clusters of Bldgs with Varying Load Profiles
  - Administrative Facilities and Barracks
  - Large Barracks with Classrooms & Offices
- Open Real-estate in Close Vicinity
  - Parking Lots
  - Athletic Fields/Running Tracks
- Less than 1500 Tons of Load

# GCLHTS Options



- Vertical Bore-field Wells
  - Less Real-estate & Better Performance
  - Higher First Cost
- Horizontal Wells
  - More Real-estate & Lower Performance
  - Lower First Cost
- Bodies of Water – Natural or Man-made

# GCLHTS Considerations

- No Glycol if Feasible
  - Better Performance
  - More Environmentally Friendly
  - Use Heat Exchangers/Controls = Avoid Freezing
- Use Hybrid Systems to Balance Bore-field
  - Supplemental Cooling Towers in Hot Climates
  - Supplemental Heat in Cold Climates
  - Goal = Balance Bore-field = Avoid Temp Drift



# What About Building Equipment?

- Variable Flow Everything (VFE) = Energy Key
- Must Take Holistic Systems Approach
  - Takes More Design Effort = More Work!
  - GCLHTS & VFE Equipment Must be Compatible
- Option 1 = VFE Chiller/Heaters
- Option 2 = Variable Refrigerant Flow System



# VFE Chiller/Heaters When?

- Bldgs Suited for Large Central Equipment
- Ideal for Large AHUs with VFDs feeding VAV boxes (4 pipe chilled water/hot water)
- Allows for Outside Air at AHUs and More Air Filtration Options
- Good for Open Barracks and Office Areas
- Allows for Simultaneous Cooling/Heating



# VFE Chiller/Heater Considerations

- 38 deg F Chilled Water, 140 deg F Hot Water is Possible
- Need Larger/Deeper Cooling/Heating Coils
- All Variable Flow Pumps (Chilled, Hot, Bore-field)
- Use Two Way Control Valves, Except Bypass
- Freeze Protection Options
  - Secondary Circulating Coil Pump
  - Freeze Stat Full Face of Coil by Manufacturer

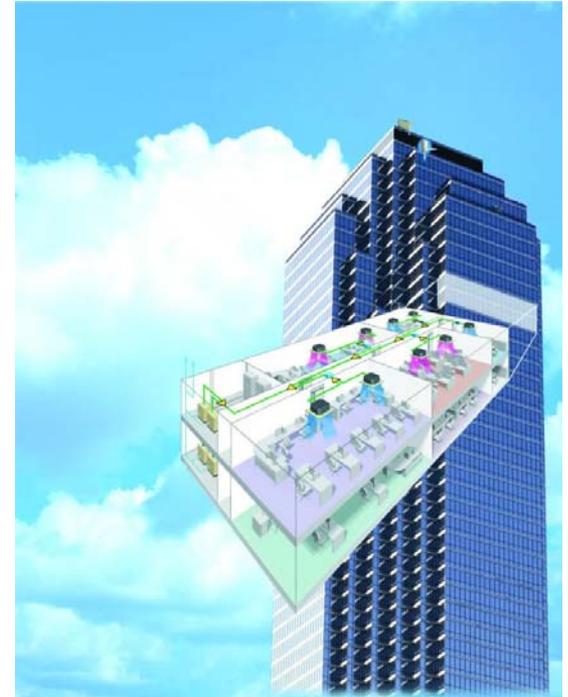
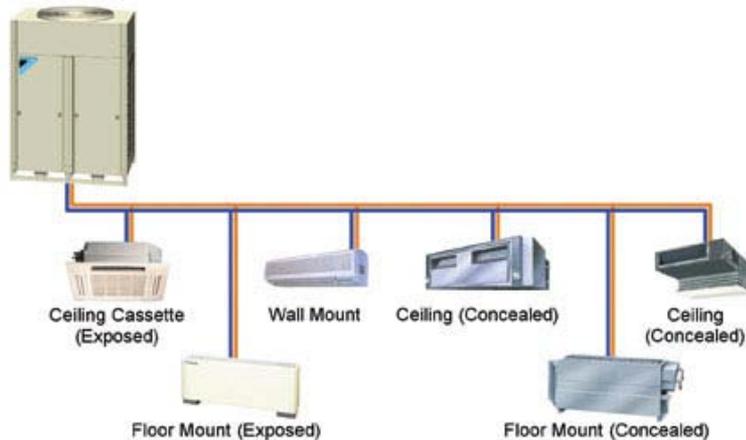
# Variable Refrigerant Flow When?

- Many Individual Rooms – Barracks etc...
- Good for Office Areas With Many Rooms
- Simultaneous Cooling/Heating Required
- Ideal When Individual Control is Needed
- No/Little Mechanical Room Space Available



# Variable Refrigerant Flow Considerations

- Requires Dedicated Outside Air System (DOAS)
- Water Source Condensers Can Fit in Elevator
- Utilize AHRI Standard 1230 - Performance Ratings
- Efficient in Part Load Conditions
- Distributed Equipment is Required
- Many Ductless Options Available



# Life Cycle Considerations of Combining GLUTS with VFE and VRF Equipment

- High First Cost But Very Very Efficient
- Best Payback During New Construction
- Size Bore-field for Smaller of Cooling or Heating Load and Use a Hybrid System
  - Lowers First Cost
  - Prevents Overloading of Bore-field
- Avoid Use of Glycol if Possible => Higher Efficiency and Less Maintenance

# A Path Forward

- Demonstration Projects For Three Barracks
  - One with Standard GSHPs
  - One with Air Cooled VRF
  - One with Ground Loops Combined with VRF
- Current Project being Designed for Fort Benning, Georgia
- Must be Innovative in New DOD Designs & Construction to Meet EISA 2007



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# QUESTIONS?

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