Utah State Geothermal Workshop

April 29-30

Salt Lake City Library

Salt Lake City, Utah

Major George Downey Mansion

Offices Lear & Lear, L.L.P • 808 East South Temple

Downey Mansion Characteristics

- 8,000 sq. ft. National Historic Register Building Seaside Victorian Mansion built in 1893
- Previously a private dwelling, apartment building corporate/legal office
- Redesigned to house up to 14 lawyers and staff
- Design effort to restore building to traditional 19th century configuration and integrate 21st century energy system
- Utilizes unique sewage/municipal water based ground source heat pumps (a.k.a. Poop Pumps)

Three Key Components of Energy System

1. Heat Exchange System

A heat exchange system captures heat or cool from an established source (ground, air or water) and is the source for heat in winter or cool in the summer. There are three heat exchange systems working together at the Downey Mansion

- Sewage Based Heat Exchange System
- Traditional Ground Source Coil Heat Exchange System
- Indoor Water Based Heat Exchange system (Used to water the lawn in the summer).

Heat Exchanger Installation

QuickTime™ and a
H.264 decompressor
are needed to see this picture.

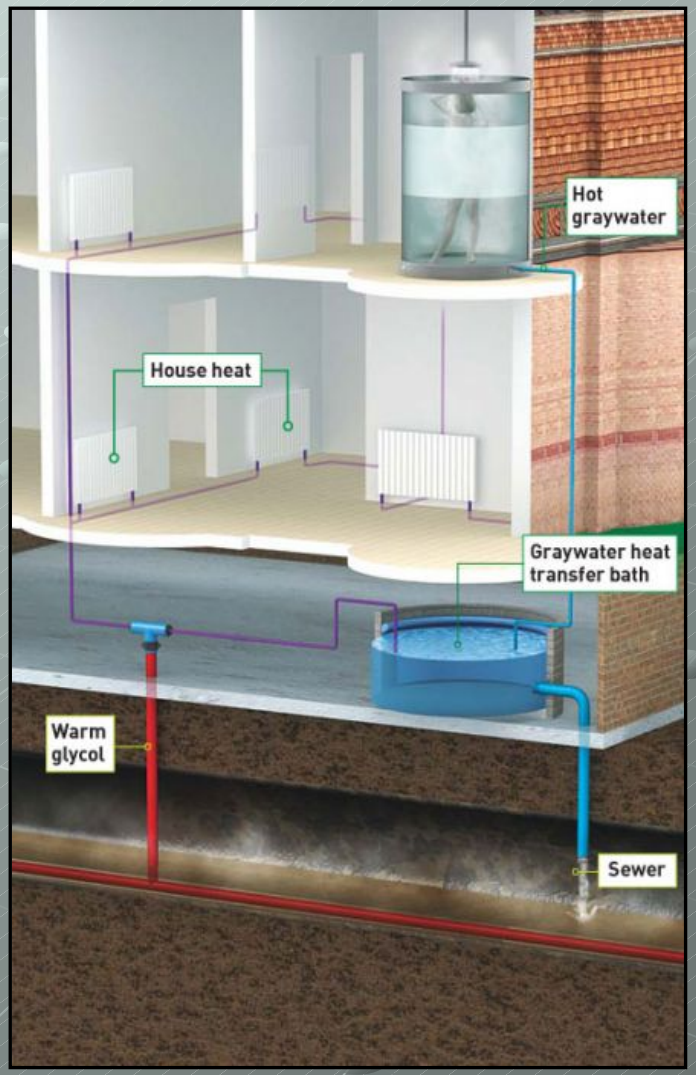
Featured in *Popular Science*

Case Study: Heating Buildings From Waste

When Salt Lake City attorneys Jon and Phillip Lear decided to set up offices in the Major George Downey mansion downtown in 2005, gas prices had spiked after Hurricane Katrina, and they started brainstorming alternative heating and cooling systems.

"Alternative" is the word for what the brothers came up with. The system they designed, with help from engineers at Utah's Sound Geothermal Corporation, pulls heat from warm sewage water. A secondary network of pipes surrounding a sewage pipe carries a water-based glycol that enables a heat exchange - since it is cool relative to the sewage water, it rapidly absorbs heat. The pipes carry the warmed glycol back into the house, where the accumulated heat energy radiates from vents. On hot summer days, the glycol absorbs heat from inside the house and releases it underground.

The entire setup uses about 40 percent less energy than a conventional heating and cooling system would, reducing carbon dioxide emissions by eight tons a year.



Source: *Popular Science*, March 2008

2. Heat Pumps*

A Heat Pump utilizes traditional refrigeration coils and an air compressor to extract heat or cool from heat exchange systems and transfers heat and cool throughout the mansion by way of a liquid circulation system.

- The Downey Mansion has 13 heat pumps each heating/cooling approximately 500 Square Feet
- All 13 heat pumps are connected on a closed loop circulation system. A mixture of 70% water and 30% food grade glycol circulates between the heat pumps and the heat exchangers
- The heat pumps are controlled by individual smart thermostats that keep temperatures in each area between a prescribed range and starts and stops the units depending on time of day.
- A window air conditioner or your refrigerator is a heat pump

*your refrigerator or window air conditioner is a heat pump

Downey Mansion Heat Pump System

3. Additional Downey Mansion Energy Saving Systems

The mansion compliments the heat exchangers and heat pumps with additional air handling systems.

- Air Recirculation System
  - 2 - 1,300 cfm fans circulate cool air up from basement in summer and moves warm air down from the third floor in winter
- Air Exhaust “RenewAire©” System
  - Moderates temperature and humidity by transferring a portion of the humidity from the exhaust air stream to the fresh air stream

Air Handling Systems

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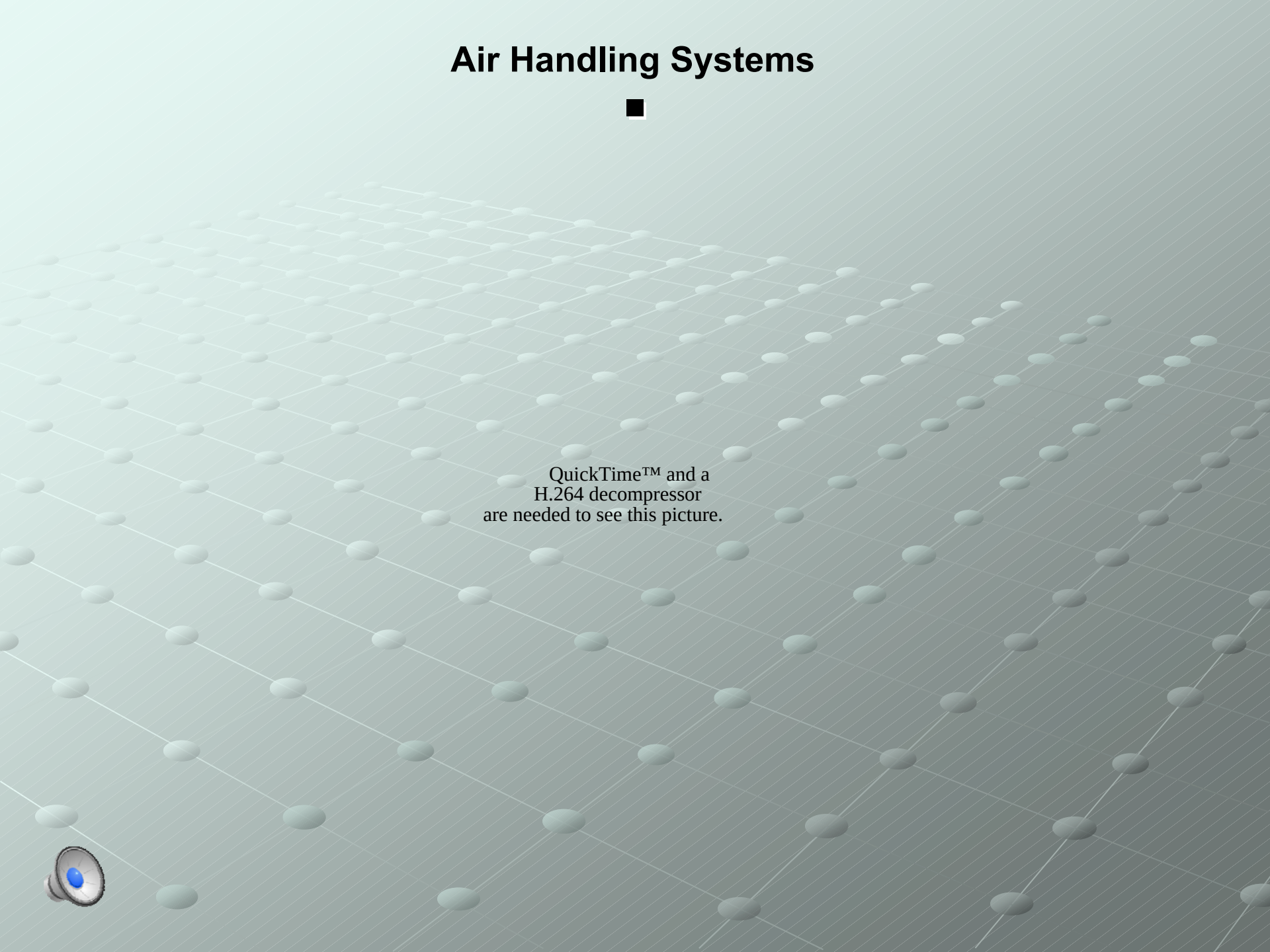

As Part of project, We Also…

- Replaced all existing light bulbs with energy conserving bulbs
- Upgraded insulation during construction.
- Installed “smart” thermostats
- Added double pained windows where possible
- Purchased blinds that keep heat in or reflect sunlight

The Result of the Effort…

Zero Carbon Footprint!

- 40 percent annual energy savings (primarily resulting from savings in natural gas)
- Project increased electrical usage (pumps). Additional electrical emission offset by utilizing Wind-generated electricity purchased from Rocky Mountain Power Blue Skies (renewable energy) Program
- 8 ton+ annual reduction in CO_2 emissions
- Criteria pollutant reductions (PM 2.5; Nox; Ozone) that are harmful to both health
- Ability to reduce consumption of natural and renewable resources
- And Happy Lawyers and Staff!

The finished product - a sustainable building

QuickTime™ and a
H.264 decompressor
are needed to see this picture.

So where do we stand today?

- U.S DOE recognizes geothermal energy as a source that can provide up to one third of our current heating and cooling needs. (Oakridge Lab Study)
- The technology is available and sufficiently robust to meet most needs
  - Work on technology systems and enhancements still required or may have to be assembled to address all situations
  - Installation infrastructure systems need to be improved
- Tax incentives and grants and other incentives are **now** more available than ever and more are coming!!
- Public becoming more aware of GHP
- One of biggest remaining problem - Local and State regulatory agencies and structures
  - Not familiar with technology or systems
  - rules for traditional utilities are not easily adaptable to ground source systems
  - Raise new technical and policy issues

Local Issues/Opportunities

- Often no regulations or ordinances to allow for GHP technology or use
- Lack of familiarity with technology
  - Misconceptions
  - No information regarding technology at scale
- Lack of Authority – State must lead the way
- Concern about using existing public infrastructure or aquifers
  - Potable water systems – contamination or terrorist issues
  - Sewage System- what do you do at scale?
  - Aquifers – contamination and multiple perf0rations
- Solution: Public education- National Studies of issues of concern. – **Make it a safe decision for them to make!**

State Issues/Opportunities

- **Current PSC rules do not contemplate wide spread use of non regulated alternatives**
  - Current rules geared to existing technologies
  - E.G. -Fuel Switching Issue – GHP use more electricity than gas
- **Lower front end costs- Rate Base GHP external system costs!** Include pro-rata costs in monthly utility bills – or provide a fund to pay for such costs and place tax lien on property until such costs are repaid.
- **Other Possible PSC Changes or approaches**
  - establish Renewable Energy Portfolio standards (RPS) that include GHP as part of energy alternatives
  - pay more for all types of energy saved or returned to the grid or distribution system (Avoided costs for Gas Companies?)
  - carbon off set and/or Renewable Energy Credits (RECs) market so utilities benefit directly from installation of GHP systems
- **Solution:** Fundamental review of incentives and laws and how to best integrate all small scale renewable alternatives with existing large scale technology options

Conclusions of Oak Ridge Report regarding GHP

Every building in America sits on the ground, and the ground is generally cooler than outdoor air in summer and warmer in winter. GHPs use the only renewable energy resource that is available at every building's point of use, on-demand, that cannot be depleted (assuming proper design), and is potentially affordable in all 50 states. GHPs may be among the most affordable renewable energy resources, especially considering the investments in electrical transmission that will be necessary to deliver many of the best wind, solar, and geothermal power generation resources to market.

* **Geothermal (Ground-Source) Heat Pumps: Market Status, Barriers to Adoption, and Actions to Overcome Barriers** (Oak Ridge National Laboratory December 2008

It’s not easy being **GREEN**…

Or maybe it is.

now that's **THE POOP!**

Credits

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