AB Hirschfeld Towers – Saving Money and Going Green
Denver Housing Authority- New Energy

AB Hirschfeld Towers, a low-moderate income residential property owned and managed by Denver Housing Authority

History of Building

Build in 1967, this 42 year-old building is named after the late A.B. Hirschfeld, founder of AB Hirschfeld Press and former Chairman of DHA's Board of Commissioners. In 2008, the AB Hirschfeld Towers was cited for its outstanding architectural design with an "Eagle Award" from Housing Colorado.

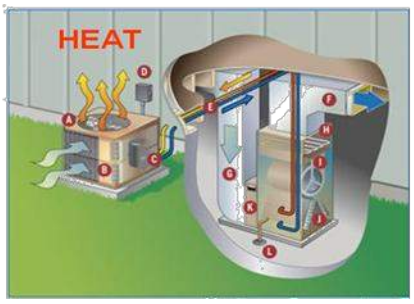
The AB Hirschfeld Towers remodel included a significant change in the way the building is heated and cooled. Denver Housing Authority wanted a system that worked better, cost less to operate, increase comfort, reduced maintenance, eliminated any external mechanical equipment, and reduce the carbon footprint. One system fit this demanding criteria – a closed loop ground source heat pump system (GSHP, or GeoExchange© system).

How It Works

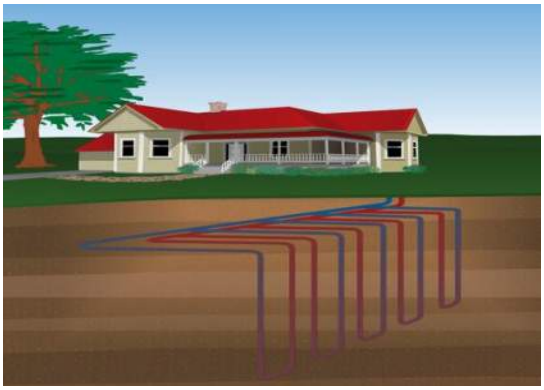
A heat pump is nothing new. We are surrounded by them – conventional air conditions, refrigerators, even the air conditioner in your car, are all heat pumps.

For example, a refrigerator removes heat from the food inside of the appliance and dissipates the heat to the outside of the box; this is the heat you feel on the backside of the device. With the reversing forced air heat pumps used in the AB Hirschfeld building, they either remove heat from the inside to cool the individual apartment, or extract heat from the earth to heat the same space. The difference is the heat pumps swap heat with water through a piping system. These units are tied into a closed loop heat exchanger within the earth, composed of plastic pipes installed in 81 boreholes that 450' in depth each.

Refrigerators transfer heat from food into the kitchen.

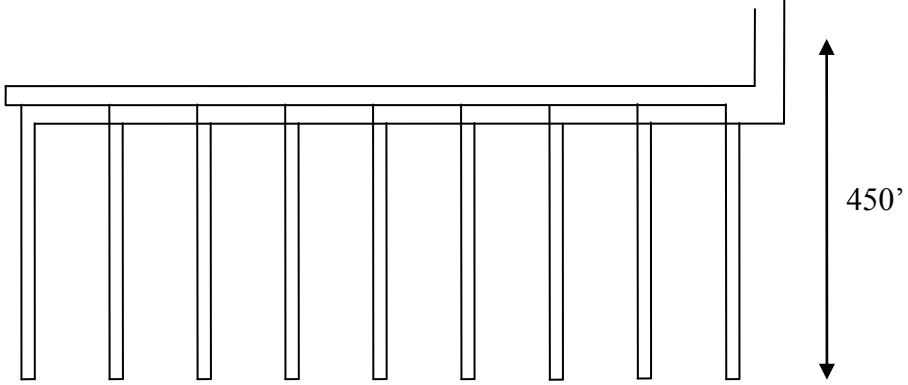


Air conditioners and air-source heat pumps transfer heat from inside houses to the air outside.



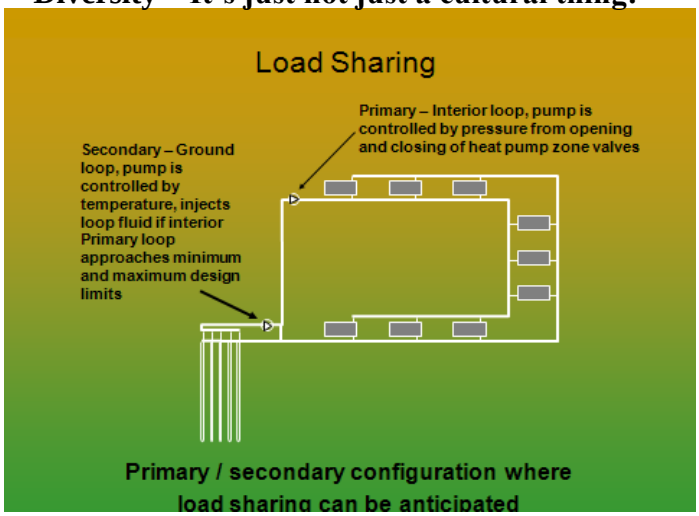
Vertical Closed-Loop

A pair of pipes with a special U-bend assembly at the bottom is placed into bore holes from 150 to 400+ feet deep



This perspective conceptually describes how the ground loop is configured for the AB Hirschfeld Towers. Eighty one boreholes 30’ apart were drilled to 450 feet each for the GSHP heating and cooling system, using nine sets of boreholes hosting a single plastic pipe u-bend each tied to nine header pairs to service the building.

Diversity – It’s just not just a cultural thing!

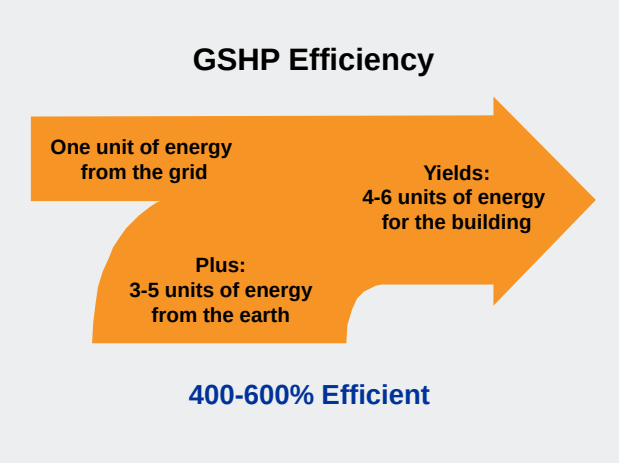


Engineers like diversity too, although for a different reason. AB Hirschfeld Towers is set up to take advantage of natural heating and cooling diversity whenever possible, swapping heating and cooling energy within the building’s individual apartments whenever possible through the heat pump water piping system. By recycling energy, additional savings are realized, while reducing the carbon impact even further.

GeoExchange© technology is not new either. A patent for this technology was issued in Switzerland in 1912; heat pumps were used in the 19th century to make ice. The design parameters and methodology for commercial HVAC systems have been standardized for over 30 years, but until recently many mechanical engineers and architects are unfamiliar with the design, specifications and installation of this type of system, and many wrongly assume the cost to install the system is excessive.

Efficiency

Efficiency of a mechanical system can be defined simply as "what you bought vs. what you get". Most conventional mechanical systems yield some percentage less than what is paid for in energy. Unlike a conventional system, a GSHP system always yields more energy than what is paid for, as most of the energy used is free from the earth.



Safety

The heat pumps do not burn any fossil fuels. As a result, no combustion gases are generated by the system, and no venting is required, further reducing building penetrations and related costs.

Installation Cost

The GSHP system was installed for about the same cost as a conventional mechanical system, including the ground loop. The design team evaluated a hybrid cooling tower/closed loop GSHP system and determined the direct cost for

either the hybrid or 100% ground loop driven system would be about the same. After further review, it was determined the hydrid system would actually cost more as the infrastructure needed for additional electrical power, controls and space would be required. Operating cost would increase, as would the requirements for additional piping, valving, pumps and controls. Maintenance would have increased as well.

Operating Cost

The Hirschfeld Tower facility is expected to **cost less than $0.50 per sq. ft**. per year to operate, and often less. Compared to the previous mechanical system estimated **operating cost of over $1.00 per sq. ft. per year**, *this savings alone will reduce the cost to both the occupants and taxpayer*, and is less subject to significant utility cost increases. As there is no external mechanical system subject to vandalism, weather, maintenance is automatically reduced by 50%, as the ground loop has no moving parts to degrade or wear out. In fact, the purpose-built high density polyethylene pipe used for the ground heat exchanger is backed by a 50 year, non-prorated warranty by the manufacturer.

Background

The original mechanical system for this 40+ year old facility relied on a conventional boiler and cooling tower system to generate heated or chilled water to service forced air hydronic fan coils. It was state-of-the-art at the time, and a reasonable amount of maintenance was anticipated.

One of the drawbacks of the conventional system was the requirement for an outside air condenser unit for cooling. It not only required significant space outside of the building on a very limited piece of property and architectural barriers to hide it, it also generated noise complaints from the neighbors. Maintenance was also costly on the system to maintain its performance.

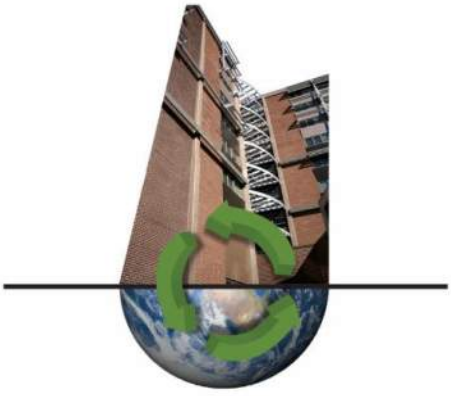
Green

As the GeoExchange© system **does not** burn any fossil fuel, and only uses enough electricity to move energy between the building and ground loop, green house gas (GHG) emissions are significantly reduced, even considering the point source of power generation.

Major Geothermal advises the need to run a 48 hour thermal conductivity test, a key part of the design of the GeoExchange© system.

Engineering

The design team responsible for the AB Hirschfeld Tower GSHP system is the The Farnsworth Group (F-G) and Major Geothermal (MG). F-G has a substantial record of designing simple, but effective mechanical systems, often for LEED certified buildings, including the federal CIS building in Englewood. MG has designed and peer reviewed hundreds of GSHP systems nationally and internationally. These two firms have specified several GeoExchange© systems together throughout Colorado and Wyoming.



AB Hirschfeld Towers
GEOThermal…Our New Energy

A Product of DHA
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AB Hirschfeld Towers
Project Sheet

Development Information

Owner: **Denver Housing Authority**

Address: **333 West Ellsworth Avenue**
Denver, Colorado 80223

Project Data

Project Value: **$ 32,315,093**

Funding Sources:

HUD Capital Fund Program Revenue Bonds 2007	**$ 9,189,540**
Energy Performance Contract Bonds	**2,797,888**
Private Financing Wells Fargo Bridge Bonds, Series 2007	**7,750,000**
LI Housing Tax Credits	**$ 12,577,665**

Land Area: **2.5 Acres**

Original Year Completed: **1967**

Total Units: **209**

Project Information

Leveraging DHA's HUD capital fund through an energy performance contract, DHA transformed AB Hirschfeld Towers into a sustainable energy-efficient building with enhanced architectural design. In 2008, AB Hirschfeld received an Eagle Award for building design. Renovation occurred through extensive community participation, planning, design and demolition of 250 obsolete public housing units. Replaced with, 209 contemporary, energy-efficient, senior and non-elderly disabled mixed finance rental units. The renovation included: abatement, upgrades to all mechanical systems and building envelope. Most significantly a pilot **$1.9 million geothermal system** was installed to maximize energy efficiency through earth heating and cooling technology. 81 geothermal cores were drilled on the 2.4 acre site. Significant energy efficiency measures will be realized through interior & exterior lighting and water flow controls throughout. A state-of-the-art security system was installed for the building interior and perimeter. Exterior site reconfiguration was done to improve residential parking lots, open space, irrigation, patio, respite areas and new main entrance.

The reconfigured ground floor of AB Hirschfeld Towers includes manager & maintenance offices, a welcoming atrium, private resident entrance, library, and well defined *community space* of approximately 4,160 square feet for senior programming such as counseling, physical fitness programs, employment, training & education, nutrition and senior health programs.

AB Hirschfeld Towers
Project Sheet

Development Information

Development Schedule

Construction:	**December 2007 – October 2008**
Relocation	**April 2006 - January 2007**
Demolition/Abatement	**January 2007 - December 2007**
Construction/Geothermal Systems	**December 2007 – October 2008**
Occupancy	**December 2008**

Unit Configuration

	Studio	1 BR	2BR	Total
Total:	**70**	**132**	**7**	**209**

Project Team

Project/Program Manager:	**Denver Housing Authority**
Architects:	**Parikh Stevens Architects**
Contractors:	**Pinkard Construction Co.**
Partners:	**Colorado Housing and Finance Authority** **Xcel Energy** **Honeywell Building Solutions**

Cost Savings

Efficiency
Unlike a conventional system, a GSHP system always yields more energy than what is paid for, as most of the energy used is free from the earth.

Installation Cost
As the GeoExchange© system does not burn any fossil fuel, and only uses enough electricity to move energy between the building and ground loop, greenhouse gas (GHG) emissions are significantly reduced, even considering the point source of power generation.

Operating Cost
The Hirschfeld Tower facility is expected to cost less than $0.90 per sq. ft. per year to operate. Compared to the previous mechanical system estimated operating cost of over $1.20 per sq. ft. annually. This savings alone will reduce the cost to both the occupants and taxpayer, and is less subject to significant utility cost increases over time. Maintenance is also reduced by 50% because of the efficiency of the mechanical systems.

John Barnard, of Major Geothermal, prepares to run a 48-hour thermal conductivity test, a key part of the design of the GeoExchange© system.

Brought to you by the
Engineering Design Teams:

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Hirschfeld Towers

Saving Money & Going Green with a GeoExchange® System

Owned and Operated by the
Denver Housing Authority

The Hirschfeld Tower remodel significantly changed how the building is heated and cooled. Denver Housing Authority's goal was to have a green building with low-operating costs, increased comfort, and reduced maintenance. To meet this goal, the project team installed a new closed-loop, ground-source heat pump system, called a GSHP, or GeoExchange© system.

Issued in Switzerland in 1912, the GSHP patent technology was used to create ice from heat pumps throughout the 19th century. The design parameters and methodology for commercial HVAC systems have been standardized for over 30 years, but until recently many mechanical engineers and architects are unfamiliar with the design, specifications and installation of this type of system, and many wrongly assume the cost to install the system is excessive.

Engineering Design Team
Working together, the design team responsible for the Hirschfeld Tower GSHP system was Farnsworth Group) and Major Geothermal (MG). Farnsworth has a substantial record of designing simple, yet effective mechanical systems, often for LEED® (Leadership in Energy and Environmental Design) award buildings, including the U.S. Citizenship and Immigration Services' Denver Service Center in Centennial, Colorado. MG has designed and peer reviewed hundreds of GSHP systems nationally and internationally. These two firms have specified several GeoExchange© systems together throughout Colorado and Wyoming.

How It Works

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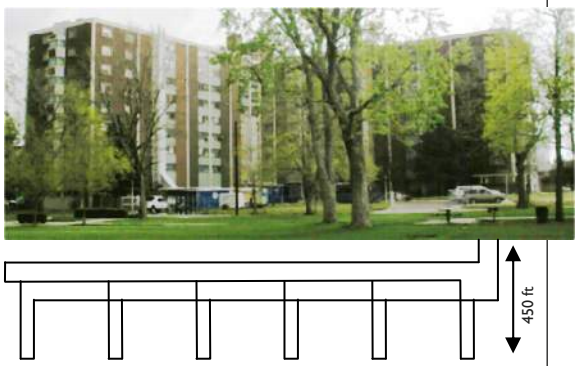

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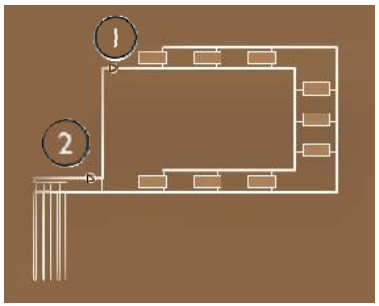

GeoExchange© System
Load Sharing to Save Energy
Natural heating and cooling occurs through heating and cooling energy swapping within the building.

1. The primary loop is controlled by pressure from opening and closing of heat pump valves
2. The secondary ground loop is controlled by temperature, injecting loop fluid if interior primary loop approaches minimum and maximum design limits

Hirschfeld Towers CO_2 Estimated Reduction* with the GeoExchange© System

Lbs/Kwh	**1.93**
GSHP	**236** *tons CO_2 per year*
Boiler/Chiller	**419** *tons CO_2 per year*
Net Estimated Reduction	**183** *tons CO_2 per year*
Net Estimated Reduction, 25 years	**4,575** *tons CO_2 total*

* Derived from U.S. DOE/EIA data, actual load calculations, and efficiency of competing mechanical systems