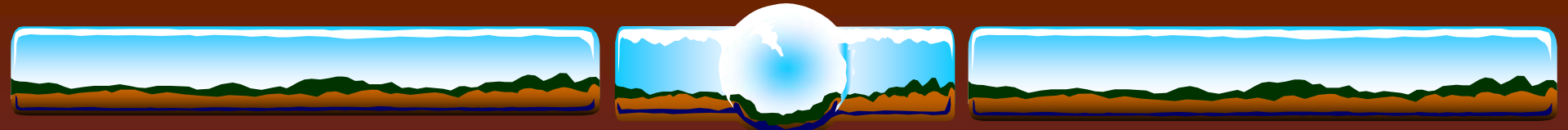


# Geothermal Heat Pump Systems: A Powerful Tool In Reducing GHG Emissions and our Dependence on Fossil Fuels

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*R. Mancini and Associates Ltd.*

*“Saving Energy and Resources is Our Business”*



*“The last time the world was 3 degrees warmer, which is what we expect later this century, sea levels were 25 metres higher. That is what we can look forward to if we don’t act soon.”*

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*James Hansen,  
Director, NASA Goddard Institute for Space Studies,  
March 2006*



# WHO ARE WE?

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- ❖ R. Mancini and Associates Ltd.
  - ❖ Has been involved in 80+ commercial and institutional GeoExchange projects internationally Since 1986
  - ❖ By far the most experienced GeoExchange consultants in Canada
  - ❖ Has developed much of the industry standards in use
  - ❖ Has designed some of the most challenging projects in North America



# WHO ARE WE?

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- ❖ Robert Mancini P.Eng.
  - ❖ Founder and President of R. Mancini and Associates Ltd. And Mancini, Saldan & Associates Ltd.
  - ❖ 34 years experience as a professional engineer
  - ❖ Membership in several industry organizations including:
    - ❖ CaGBC
    - ❖ ASHRAE
    - ❖ IGSHPA
    - ❖ Canadian GeoExchange Coalition
    - ❖ AEE



# What is a GeoExchange System?

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# What is a GeoExchange System?

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- ❖ A GeoExchange System is an extremely efficient way to heat, cool, generate heat energy, recover heat energy and store heat energy. It uses the earth as a heat source, a heat sink and as an energy storage device.

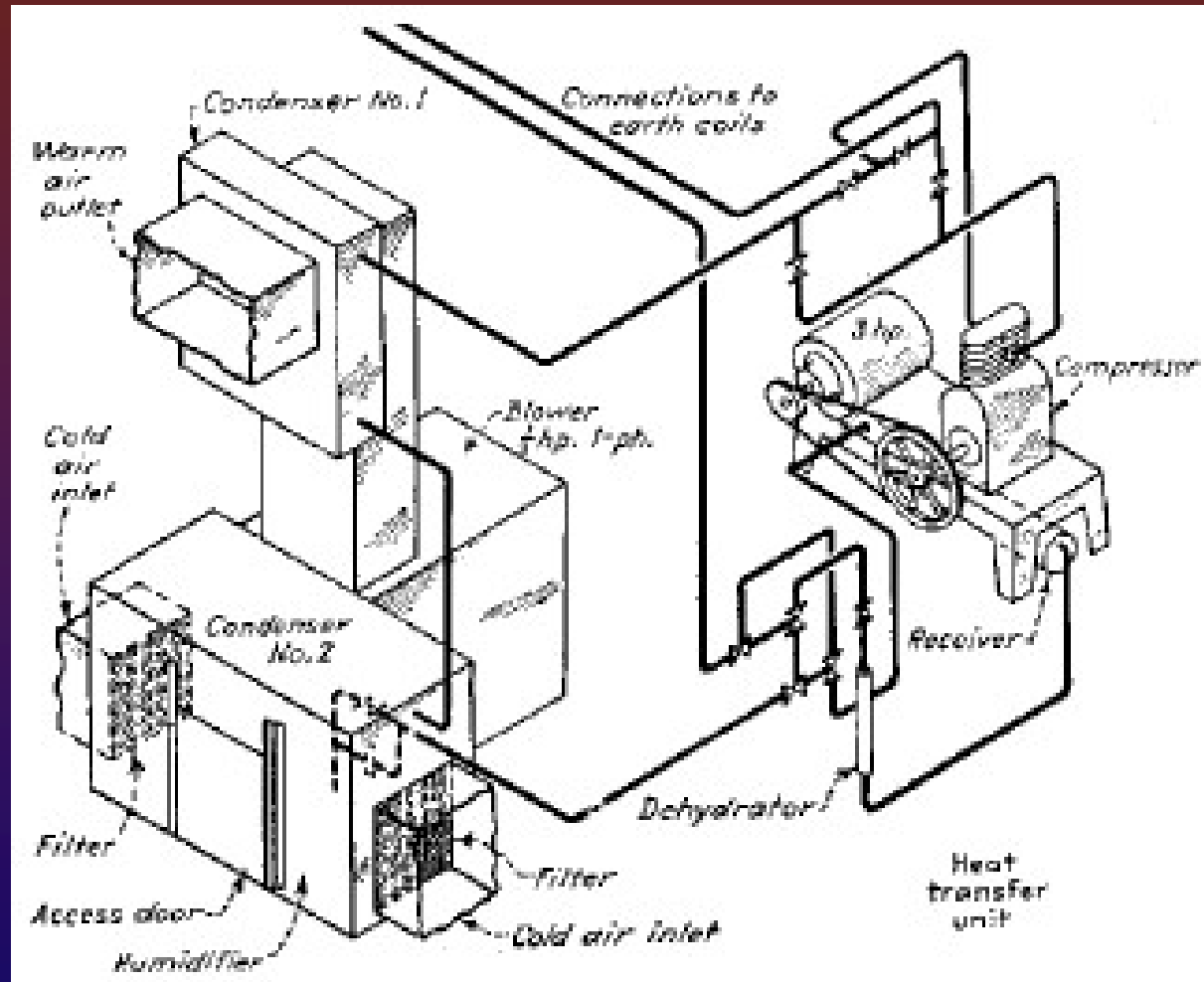


# What is a GeoExchange System?

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- ❖ GeoExchange Systems have been in use for over 50 years

# Schematic of a 1945 System







# What is a GeoExchange System?

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- ❖ A GeoExchange System comprises:
  - ❖ A heat pump or a series of heat pumps (similar in size to a residential furnace) located in the building.
  - ❖ A duct system to deliver conditioned air to space.
  - ❖ A connection to the ground.
  - ❖ A pumping system.



# What is a GeoExchange System?

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- ❖ A GeoExchange System:
  - ❖ Can provide **hot water** for:
    - ❖ Heating,
    - ❖ Domestic water heating,
    - ❖ In-floor heating,
    - ❖ Snow melting.
    - ❖ Heating outdoor air for ventilation.
  - ❖ Can provide **chilled water** for:
    - ❖ Cooling,
    - ❖ Refrigeration.



# What is a GeoExchange System?

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- ❖ A GeoExchange System:

- ❖ Can Store Heat Energy in the Ground:

- ❖ Energy rejected during cooling cycle is used for winter **Heating**,

- ❖ Energy extracted from the ground in winter heating cycle cools the ground therefore reducing energy consumption in summer **cooling**,

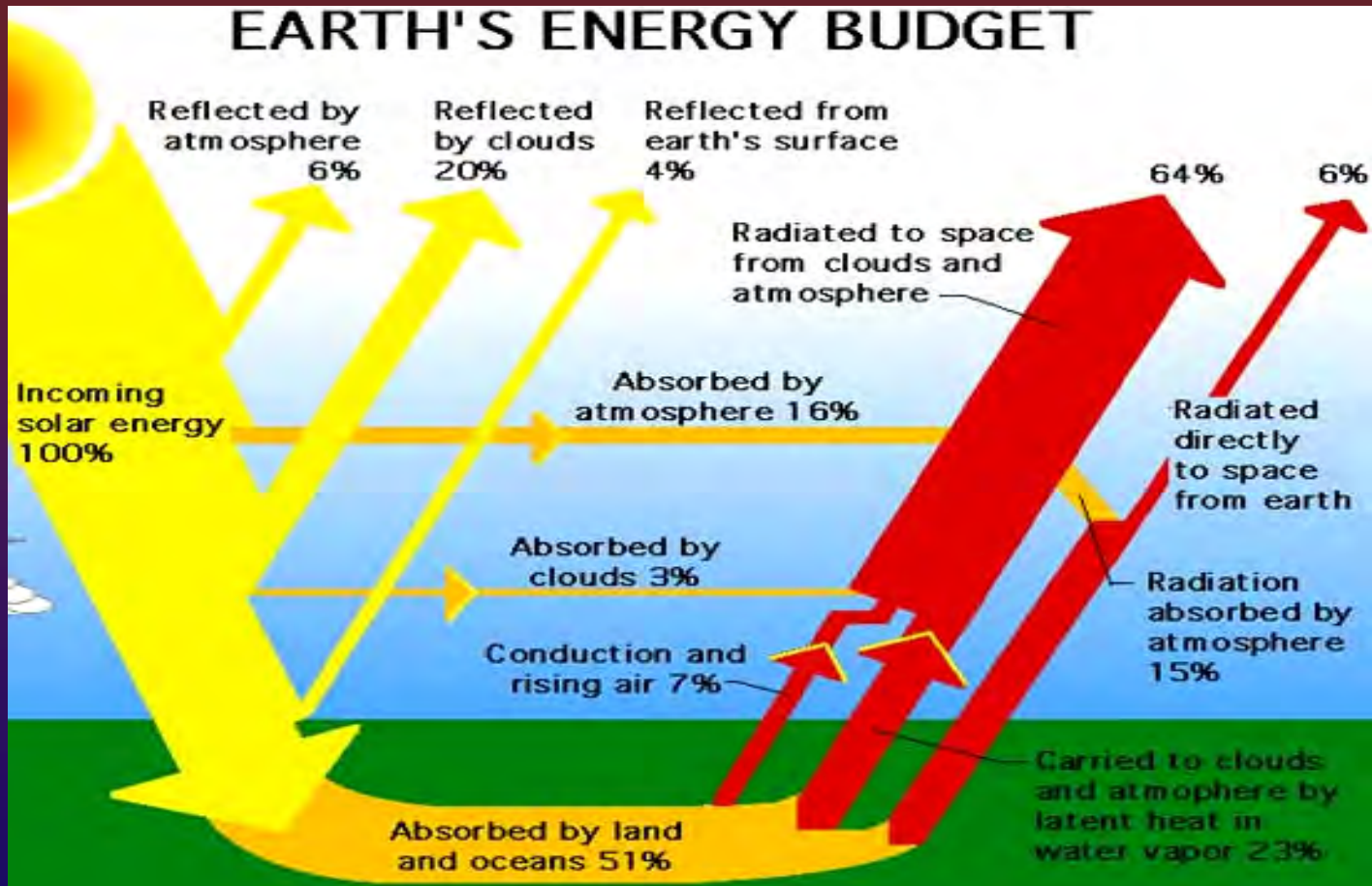


# Where Does the Energy come from?

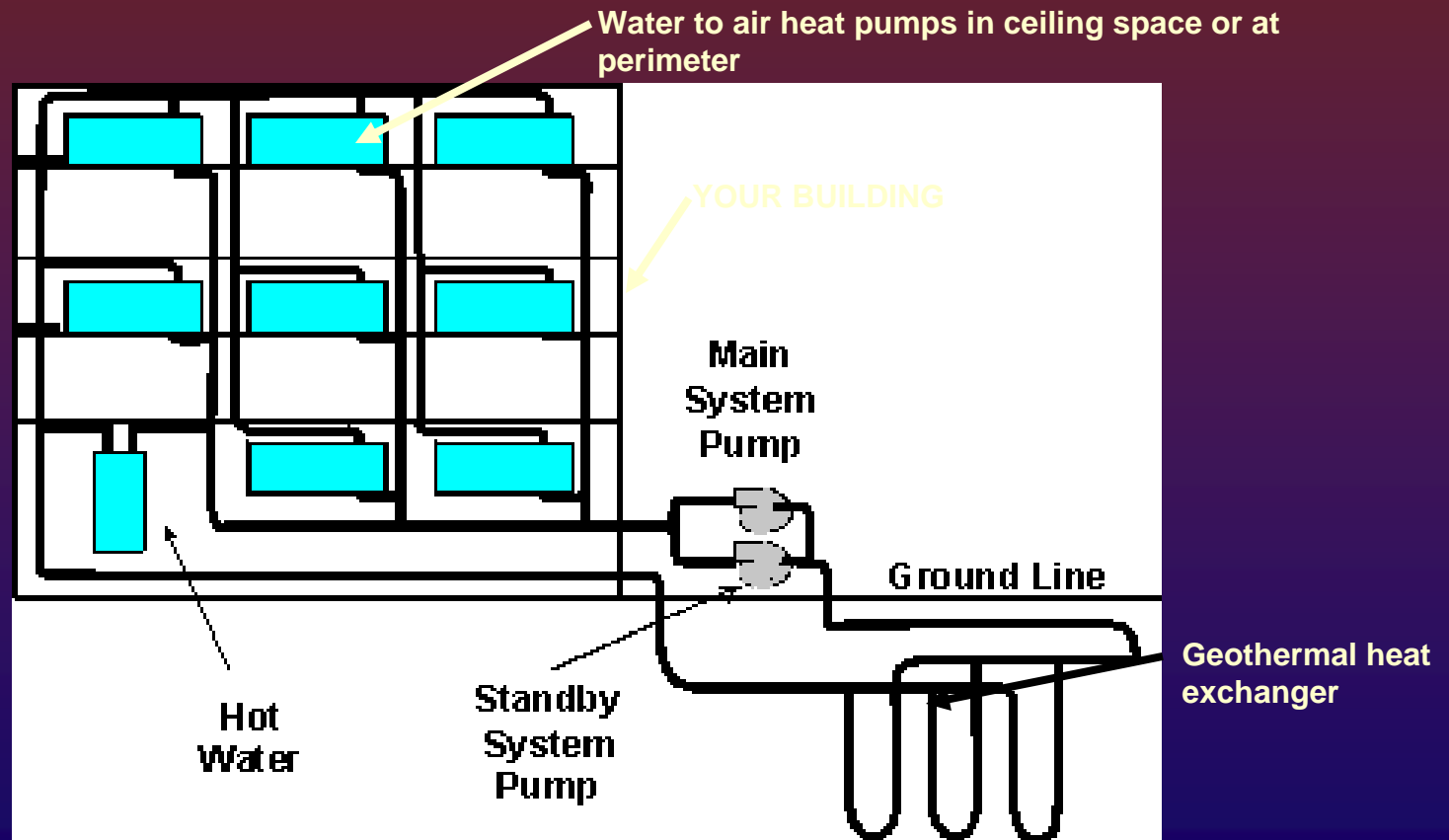
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- ❖ 1 unit from the electrical grid;
- ❖ 3 to 5 units from the earth;
- ❖ In Addition;
  - ❖ Some from Recovered energy (from building sources)
  - ❖ Some from other technologies such as solar collectors.

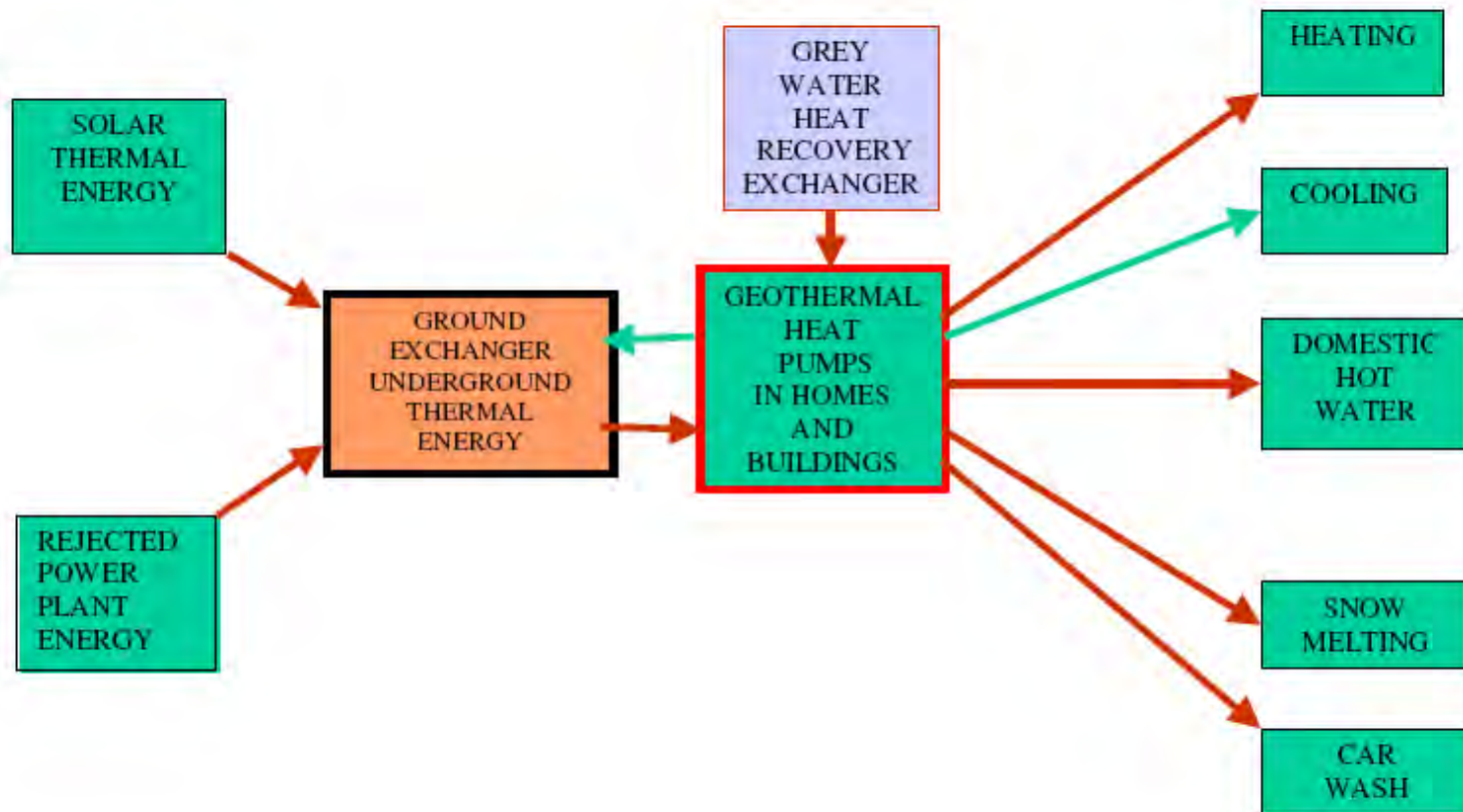
# Where Does GeoExchange Energy Come From?

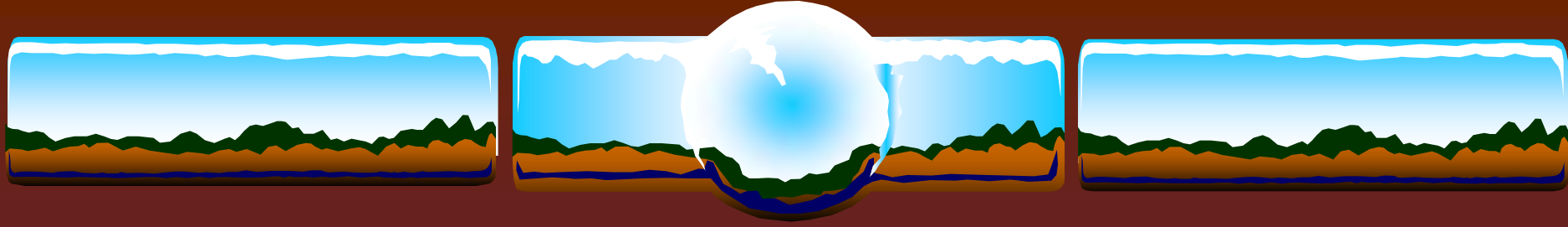


# GeoExchange Concept



# GeoExchange Integration





# GeoExchange Source Options

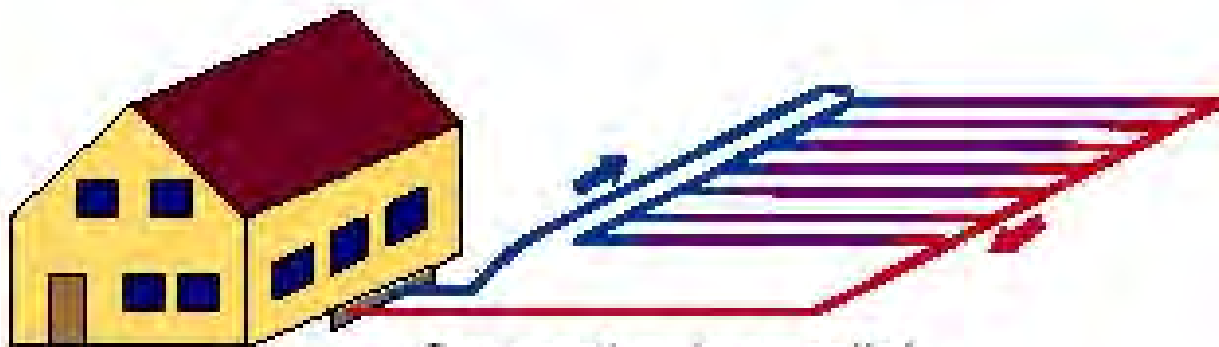
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# Horizontal Earth Source



Connection in series

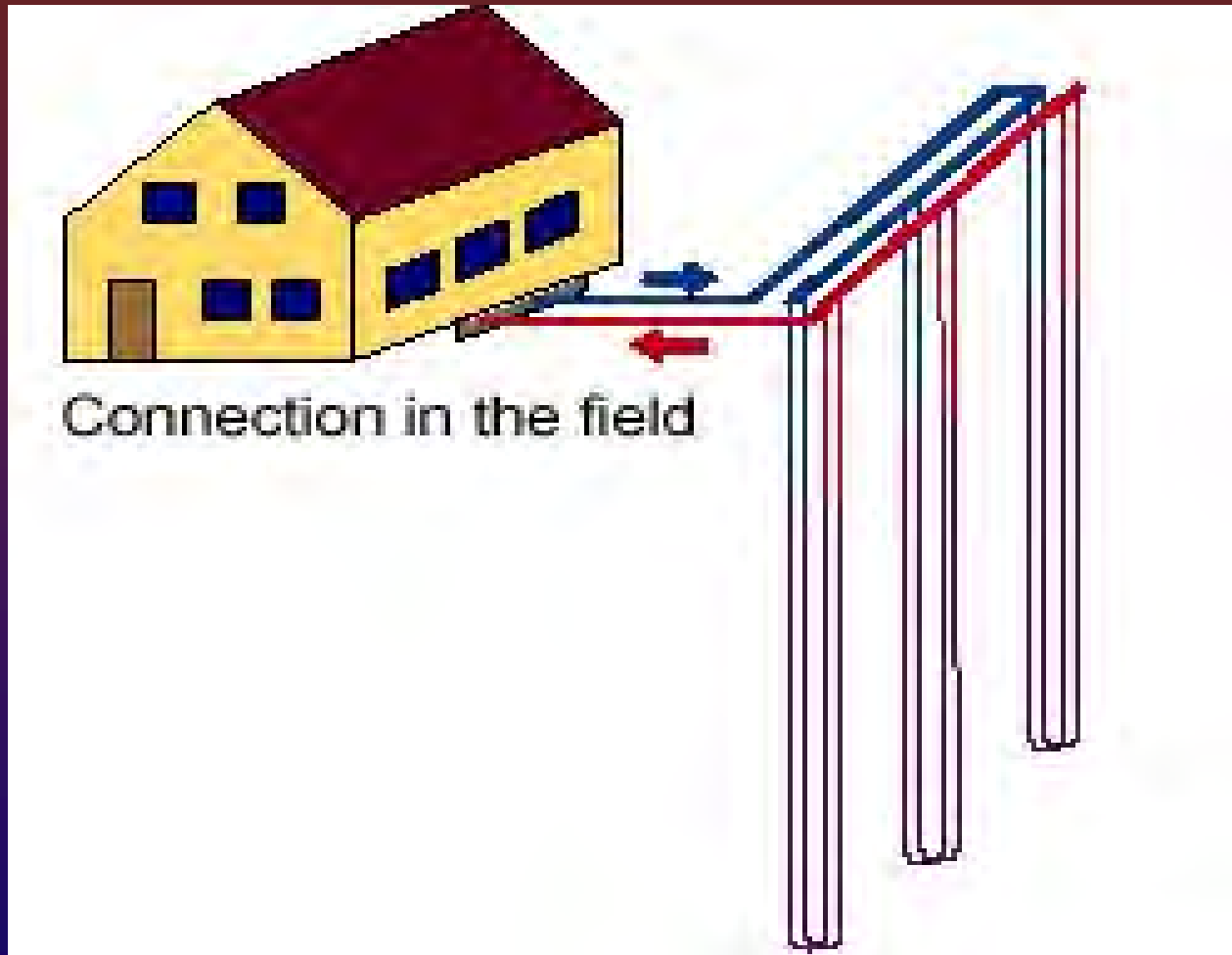


Connection in parallel



## Vertical Earth Source

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## Horizontal "Slinky" Earth Source

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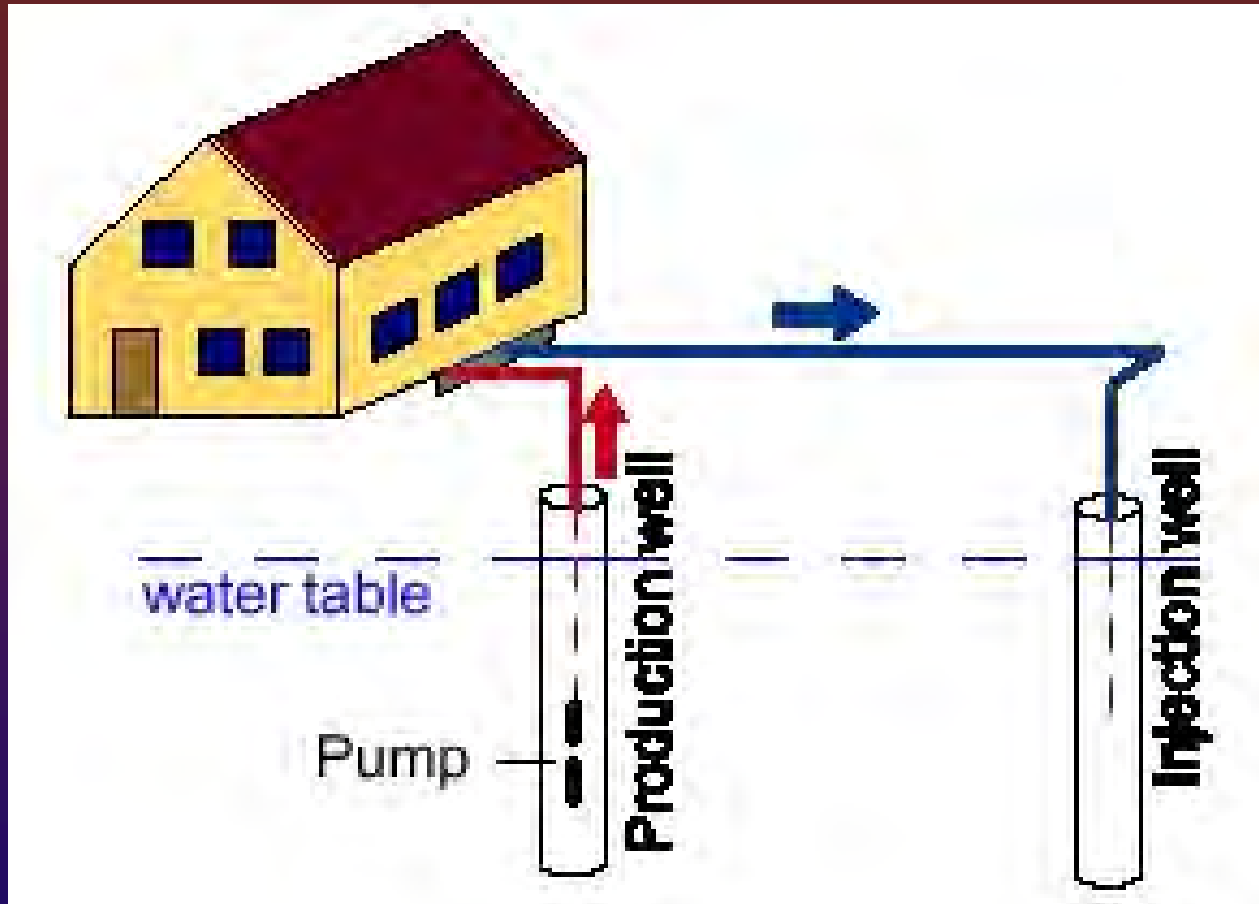


## Pond Source (Retention Ponds)

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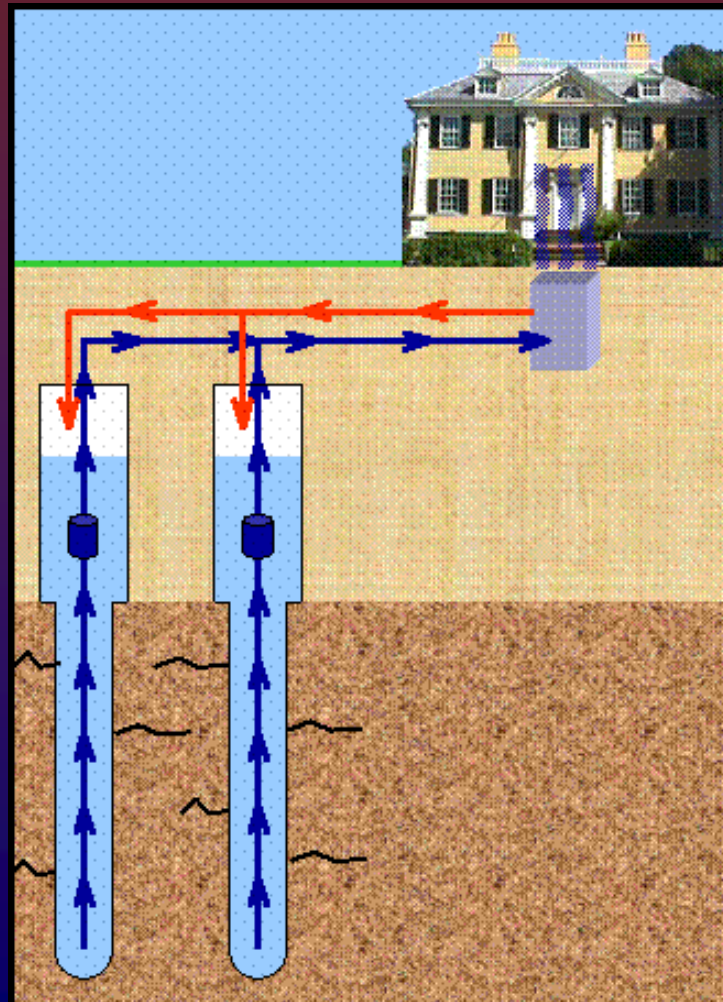


# Ground Water Source



# Ground Water Source

## STANDING COLUMN WELLS



# Drilling Equipment





# GHG Reduction Potential



The image features three horizontal panels at the top, each showing a stylized landscape with a blue sky, green hills, and brown ground. A large, glowing blue and white globe is positioned in the center, overlapping the middle panel. Below the panels, the title 'GHG Reduction Potential' is written in a large, white, serif font, underlined with a red line.

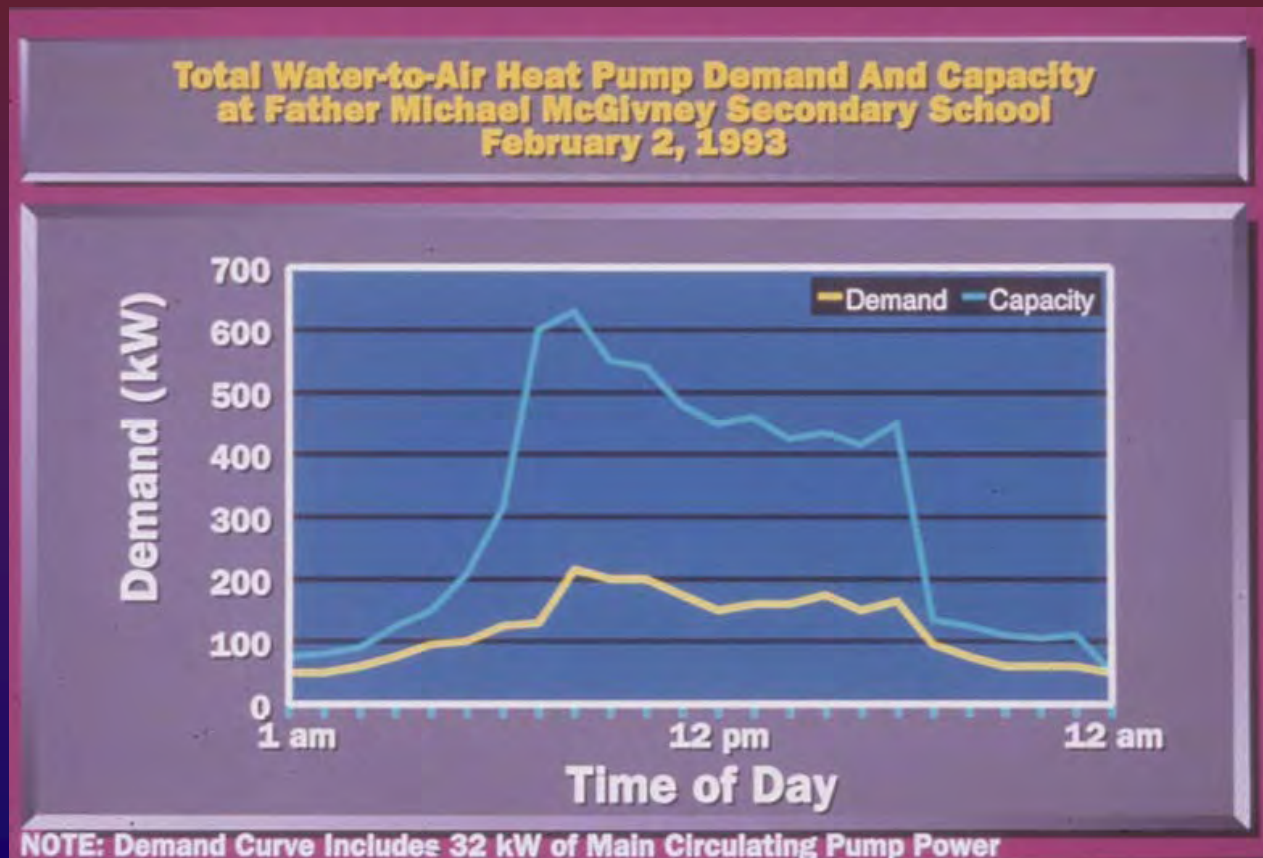
# GHG Reduction Potential

- ❖ From Electrical Energy;

- ❖ 76.4% of our electricity needs in Ontario comes from GHG generating plants such as hydro, and nuclear.

- ❖ The system uses a fraction of its energy from the grid.

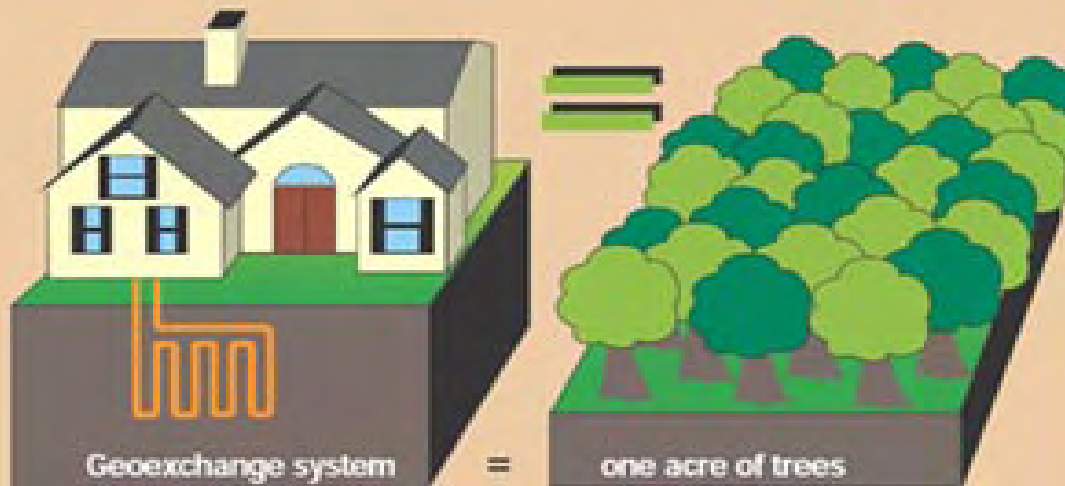
# GHG Reduction Potential



# GHG Reduction Potential



Putting a geoexchange system in a typical home is equal, in greenhouse gas reduction, to planting an acre of trees.



Source: Geothermal Heat Pump Consortium [www.geoexchange.org](http://www.geoexchange.org)

# GHG Reduction Potential

The infographic features a central illustration of a house with a geoechange system (a loop of orange pipes) installed in the ground. To the right, two blue cars are shown on a road, with an equals sign between them. The text explains that the GHG reduction from a geoechange system in a typical home is equivalent to taking two cars off the road. The logo 'Geoechange Factoid' is in the top left, and the source information is at the bottom.

**Geoechange Factoid**

Putting a geoechange system in a typical home is equal, in greenhouse gas reduction, to taking two cars off the road.

Geoechange system = removal of two cars

Source: Geothermal Heat Pump Consortium [www.geoechange.org](http://www.geoechange.org)

# GHG Reduction Potential

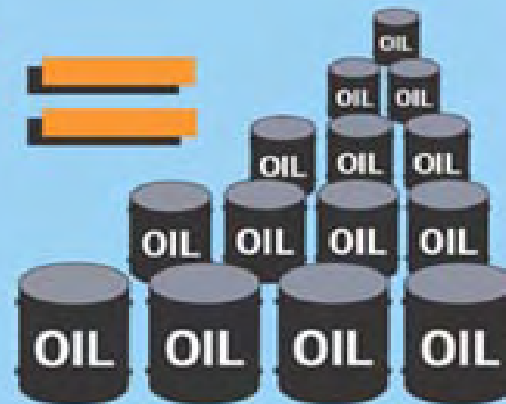


Current geoechange installations  
equal 14 million barrels  
of crude oil saved per year



650,000  
installations

=



14,000,000 barrels of oil saved

Source: Geothermal Heat Pump Consortium [www.geoexchange.org](http://www.geoexchange.org)



# GHG Reduction Potential

## ❖ Interesting Facts:

- ❖ The average home system (2,500 sf.) can reduce CO<sub>2</sub> emissions by 2.5 to 5 tonnes annually.
- ❖ According to the Washington based Geothermal Heat pump Consortium, there are 750,000 installations in the USA, these are the equivalent of:
  - ❖ Taking 971,000 cars off the road;
  - ❖ Planting 289 million trees; or
  - ❖ Reducing oil consumption by 16.1 million barrels.



# Thank-you

*R. Mancini and Associates Ltd.*

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