



NFAT

*(Need for and
Alternatives To)*

Ground Coupled Heat Pump Systems and MB Hydro

Ed Lohrenz, B.E.S., CGD

204.318.2156

ed@geoptimize.ca

GEOoptimize.ca

■ Ed Lohrenz - background

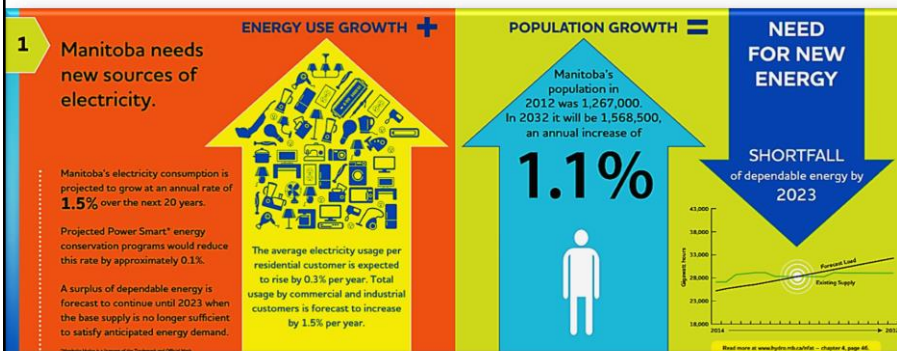
- Worked in geothermal industry since 1982
- Done residential & commercial design & installation, worked for manufacturer, equipment supplier, and since 2006 as a principal in engineering firm specializing in geo system design
- Pioneered geothermal systems integrated with ice rink & ice storage applications
- Directly involved in over 87 mega Watts of installed geo system capacity in Canada, the U.S. and internationally
- Developed commercial design course for the International Ground Source Heat Pump Association (IGSHPA)
- Published a number of papers and made presentations at Conferences for American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE)

Select projects I've been involved in

- Gibsons, BC - Town owned geothermal utility
 - Ambient temperature district geothermal system integrating waste heat recovery from ice rink
- Denver, CO – IKEA Store
 - Integration of ice storage and waste heat recovery for snow melt
- Winnipeg, MB - Seasons of Tuxedo shopping centre
 - District geothermal system
- Port Hawkesbury, NS
 - Integrated ice making and heating
- Kalgoorlie, Western Australia
 - Pool & leisure centre integrating horizontal & vertical ground heat exchangers

Electricity consumption increasing in MB

MB Hydro says energy consumption is growing at the rate of 1.5% annually... or about 80 mW annually.



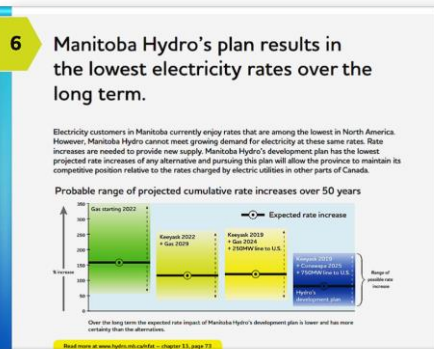
Hydro-electric generation is the best option

MB Hydro says the preferred option to meet the increase in demand is to build additional hydro-electric dams and transmission lines at an estimated cost of \$22 billion.



Preferred option results in lowest rates

MB Hydro says building the dams and transmission lines will result in the lowest electricity rates over the long term.



■ A more cost-effective alternative

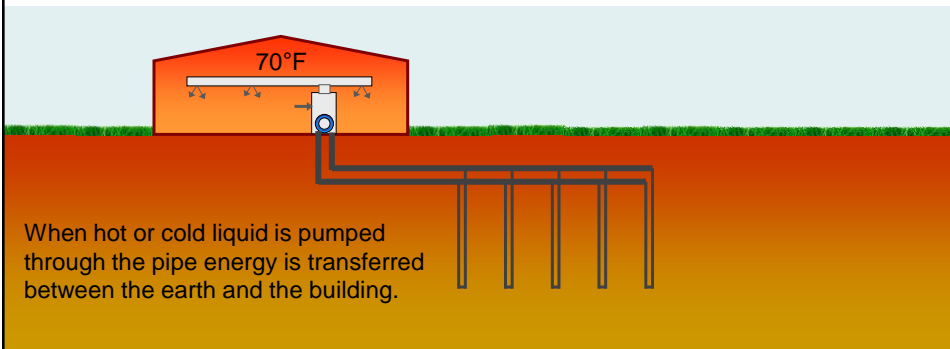
Geothermal heat pumps have been installed in MB since the early 1980's. I've owned 3 homes with geothermal systems since 1983, and recently replaced a heat pump on a 22 year old ground heat exchanger.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 7

■ A ground heat exchanger (GHX)

By burying plastic pipe in the earth around our buildings and circulating liquid through it, we can access the constant temperature of the earth.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 8

■ Ground heat exchangers

Many methods of installing a ground heat exchanger (GHX)

- Horizontal trench
- Vertical drilling
- Lake or pond



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 9

■ A heat pump works like a refrigerator

A heat pump works exactly like a refrigerator. If you place a water bottle in the fridge and replace whenever it cools, you can heat your kitchen your fridge. All you have to do is figure out what to do with all the cold water!



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 10

■ What a geothermal system looks like

One type of geothermal heat pump looks much like a gas or electric furnace. It is connected to ductwork just like a furnace. It can also be connected to a hot water tank to produce some of the hot water for the home.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 11

■ An opportunity

127,000 electrically heated homes in Manitoba. Each draw about 11 kW of power, and during cold weather draw about 1,400 mega Watts of power.

That's as much as the proposed Conawapa dam!



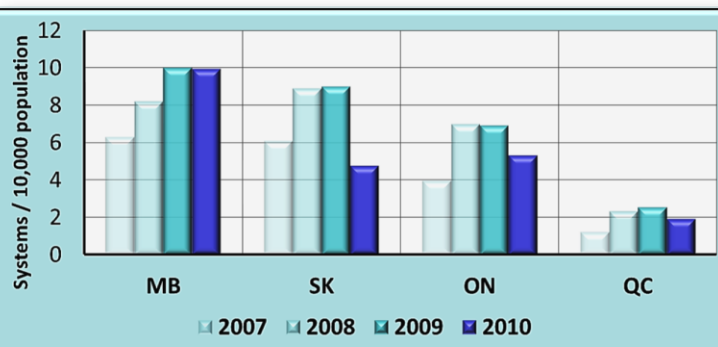
Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 12

Why consider geothermal heat pumps?

- Technology established and proven in Manitoba
- Less expensive to implement than building dams & power lines
- Employment & skills in Manitoba for the long term
- Better for the rate payer
- Better for the provincial economy
- Better for the environment

Geothermal systems proven in Manitoba

Consistently, more geothermal heat pump systems have been installed in MB, on a per capita basis, than anywhere else in Canada... about 10 systems per 10,000 residents every year... or about 1,200 annually



* Estimates from the Canadian GeoExchange Coalition, Manitoba Geothermal Energy Alliance and Manitoba Hydro

Residential systems in Manitoba

More than 40 homes in the Waverley West development in south Winnipeg installed geothermal systems in 2011. Several First Nations communities have started installing geothermal systems. Systems have been installed in Manitoba since 1980.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 15

Commercial systems in Manitoba

The Seasons of Tuxedo Shopping Centre and the Steinbach Credit Union building on Lagimodiere Blvd. are only 2 of many commercial geothermal projects built in Winnipeg in the last several years.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 16

■ Residential geothermal systems

An average home reduces electricity demand by about 7.3 kW and cost, on average, about \$25,000 to install – about \$3,400/kW.

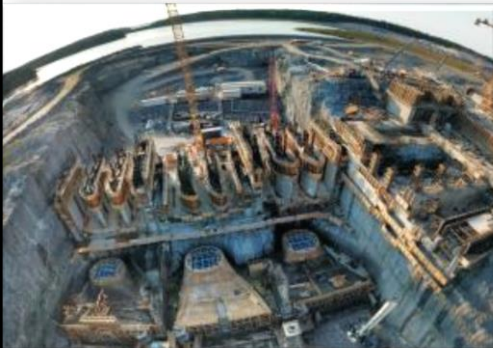


\$3,400 per kW

Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 17

■ Dams & power lines

Projected cost of Wuskwatim, Keeyask, Conawapa dams and Bipole III is \$22.25 billion. Together, they will deliver 2,380 mW of power to Southern Manitoba – about \$9,350/kW

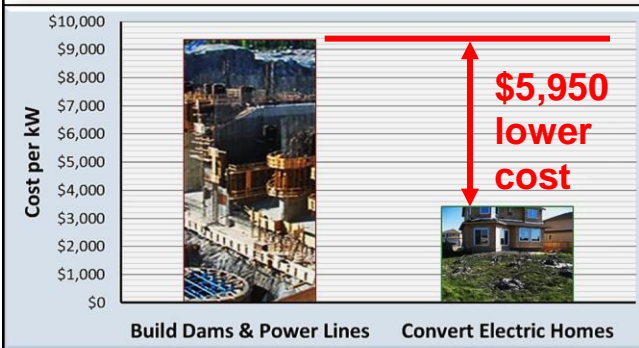


\$9,350 per kW

Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 18

■ Cost of dams versus geothermal systems

The cost to build dams and power lines to deliver power to Manitobans is about three times the cost of reducing electrical demand by installing geothermal systems in existing, electrically heated homes in Manitoba.



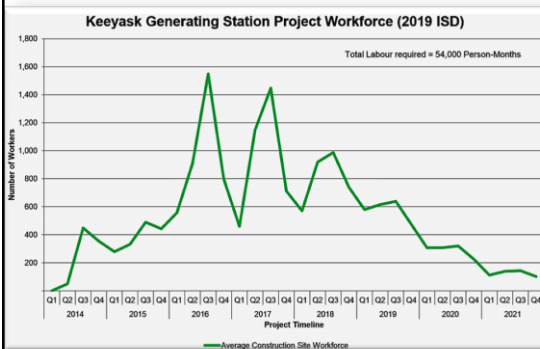
Need for and Alternatives To - and the Ground Coupled heat Pump Industry

Slide

19

■ Building dams creates employment

Building Keeyask creates an estimated 54,000 person-months of employment. Employment spikes during the summer months 3 and 4 years after the start of the project.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry

Slide

20

■ Installing geo systems creates employment

Installing a residential GCHP system creates about 100 hours, or 0.6 person-months of employment. Installing 127,000 systems creates an estimated 76,200 person-months of employment.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 21

■ Manufacturing and apprenticeship

Installing geothermal heat pump systems creates employment in

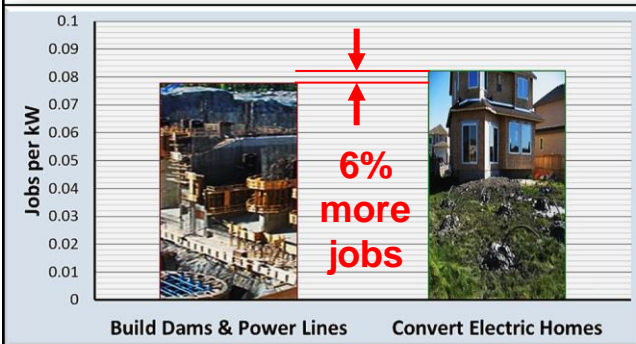
- Manufacturing in Manitoba
- Service sector
- Engineering



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 22

Jobs created by dams versus geothermal

Converting electrically heated homes to geothermal heat pumps creates more jobs per kW than building dams (*not including manufacturing jobs*)



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 23

Projected rate increase with Hydro plan

To pay for the projected \$22.25 billion cost to build Wuskwatim, Keeyask, Conawapa and Bipole III, Hydro has said electricity rates will have to increase 3.95% annually for the next 20 years.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 24

■ Taking advantage of lower cost geothermal

Converting one home to geothermal reduces electricity demand by about 7.3 kW. Converting 11,000 homes per year reduces electricity demand by 80 mega Watts...the increase projected by MB Hydro. This can be achieved for about \$3,400/kW, or about \$274 million.

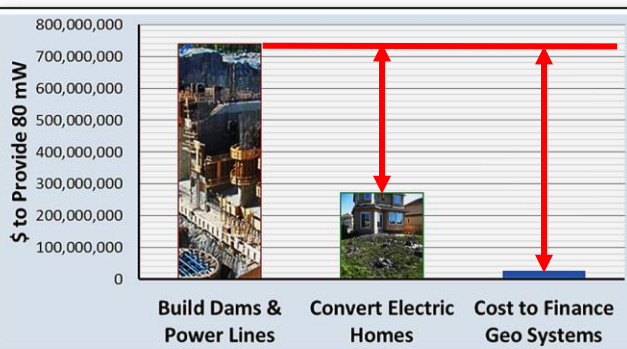


Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 25

■ Geo systems can be financed at almost \$0

Simply financing the cost of converting electrically heated homes over 20-25 years for a homeowner would reduce conversion cost to almost zero cost!

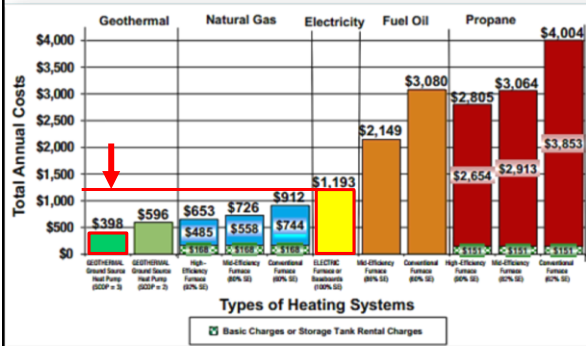
It would follow that 3.95% increase could be significantly reduced.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 26

Energy cost savings for consumer

A GCHP system reduces electricity consumption by a factor of 3 to 4. If an electrically heated home costs \$1,193 to heat, it would cost \$398 to heat with a GCHP system – a saving of almost \$800 per household.



127,000 homes x \$800 savings =
\$101,600,000 per year

Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 27

More disposable income in Manitoba

A typical homeowner converting from electric heat to geothermal heat pump system reduces energy cost by about \$800 annually.

By deferring the need to build dams and transmission lines, Hydro rate increases can be much smaller.



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 28

■ Better for the environment

Reduced electricity consumption in Manitoba allows Hydro to export power to U.S. utilities, helping reduce GHG emissions.

Does it matter if power is produced by dams or reduced consumption?



Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 29

■ Dams versus geothermal systems

	Building Dams	Installing Geothermal
Cost to build	\$9,350 / kW	\$3,400 / kW (\$0 if financing systems)
Job Creation	0.078 / kW	0.082 / kW
Annual Rate Increase	3.95% / year	< 3.95% / year
\$ into MB Economy	\$0	\$101.6 million / year
Environment	Good for environment	Better for environment

Need for and Alternatives To - and the Ground Coupled heat Pump Industry Slide 30