

Geothermal Heat Pump Technology

**What's new in the business of capturing the
“Energy We Already OWN”**



Geothermal National and International Initiative Inc.
1615 M. Street N.W. Suite 800 Washington DC 20036

The Road to 30%!

Geothermal Heat Pumps, not only satisfy a need by keeping you warm in the winter and cool in the summer but they use the energy you already own, the **“Energy Under Our Feet”** to do it.



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The Energy Under Our Feet in \$\$\$\$

A cubic acre (200 ft x 200 ft x 200 ft) equals 8 million cubic feet x 800 BTUs per cubic foot at delta T = 20 degrees F = 6,400,000,000 BTUs.

Divide that by 3500 BTUs (3,413 BTUs per kWh)
= 1,800,000 kWh at \$.08 per kWh =
\$146,285.00 savings annually.



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What is the Cost !!!

A four ton unit extracts an equivalent of 8.94 Kilowatts of energy from the ground. (NREL)

What this means is that 30,510 BTU's per hour is extracted from the ground and 3413 BTUs is equal to one kW of energy.

A geothermal system extracts (or produces) this energy 24 hours a day, 365 days a year.



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Commercial GSHP Economics

Geothermal HVAC Cost:	\$ 300,000	50 tons at \$6000 per ton
Conventional HVAC Cost:	\$ 125,000	50 tons at \$2500 per ton

Additional Cost:	\$175,000	
Income Tax Rate:	35%	
Energy Credit:	10%	
Utility Rebate	\$ 15,000	50 tons
Annual Energy Cost Savings:	\$ 20,000	\$1 per sq ft per year
Energy Inflation:	3%	

Depreciation reduces the 7year payback to 1.5 years!!!



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How do GHPs Impact Energy Use?

Heating Eqpt Type	<u>Geothermal</u>			<u>Heat Pump</u>			<u>Natural Gas</u>				
	Heat MWh	Cool MWh	HW MWh	Heat MWh	Cool MWh	HW MWh	Heat MWh	Heat Mcf	Cool MWh	HW Mcf	
State City											
IL Chicago	8.5	1.3	3.6	23.9	2.6	6.6	1.1	148.8	2.6	34.3	
OR Portland	6.2	0.6	3.8	10.9	1.0	6.4	0.9	113.2	1.0	33.0	
AZ Phoenix	2.1	6.8	1.9	3.9	11.4	4.8	0.4	47.4	11.7	24.7	
TX Dallas	2.9	4.9	2.3	6.2	8.2	5.2	0.5	61.6	8.4	26.9	
MA Boston	7.2	1.1	3.9	17.2	2.2	6.7	1.0	128.6	2.3	34.7	

If GHP benefits are looked at in terms of MWh only we don't fare well



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How do GHPs Impact Carbon Emissions?

Heating Eqpt Type	Geothermal		Baseline	Heat Pump		Natural Gas		
	MWh	CO2e	CO2e	MWh	CO2e	MWh	Mcf	CO2e
IL Chicago	13.5	8.6	17.0	33.2	21.3	4.3	180.2	15.1
OR Portland	10.6	2.3	10.0	18.2	4.0	2.4	143.5	10.4
AZ Phoenix	10.8	8.2	15.2	20.1	15.3	12.5	70.1	14.3
TX Dallas	10.1	9.1	15.8	19.6	17.7	9.3	86.3	14.3
MA Boston	12.3	8.4	15.4	26.1	17.8	3.8	160.5	13.6

In total carbon emissions we fare extremely well !!!



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Annual CO2e Emissions – 2000 sq. ft. Existing Home

Census Region	Housing Units (millions)	Baseline CO2e Emissions (Mtons/yr)	Geothermal CO2e Emissions (Mtons/yr)
Northeast	19.6	16.5	7.7
Midwest	24.5	20.6	12.9
South	38.9	6.0	7.6
West	22.5	18.5	9.3
Weighted Average		17.7	9.2

Carbon estimated to trade for \$10 - \$100 per metric ton per year



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What is the Societal Cost for the GHP Benefits?

- Average for U.S. Grid Electricity is 11.4 ¢/kWh
- Average for Solar Electricity is 16 to 30 ¢/kWh
- Average for Wind Electricity is 8.5 ¢/kWh
- Average for Geothermal Steam Electricity is 6.5 ¢/kWh
- Average for Residential GHP is 5 ¢/kWh (2.7 ¢/kWh w/ incentives)
- Average for Commercial GHP is negative 4.1 ¢/kWh (negative 4.6 ¢/kWh w/ incentives)



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Renewable Portfolio Standard

There are 28 States that now have or are developing a Renewable or Energy Efficient Portfolio Standard (RPS / EEPS) and GHP's will play a large part in the achievement of the goals outlined in these programs.

Two major GHP manufacturers have been purchased by foreign companies, both of which recognize the potential in this technology.



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WHAT MUST WE DO TO GET TO YES!

While many GHP projects receive the necessary approvals to commence, a large percentage of them are never completed due to the fact that many funders of renewable energy projects focus their attention on projects valued at \$50 million or more which typically does not include a GHP project.



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There are now various options to consider in the financing of the GHP project.

- Loop or System Leasing Companies
- Energy Services Companies that will include the project along with other ECM's in a long term contract



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- The financial community is investigating GHP's as an ever growing RE / EE business and perceive value in becoming involved.
- The advent of Renewable Energy Credits (REC) and/or Emission Credits will be another way that utilities can “rate base” this technology.



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We estimate that currently there are over **Two Million** GHP systems installed Nationally. While this is a large number it represents less than 1% of all HVAC in the US. Although the footprint is small they have an annual savings of over **16 Billion kWh** and a reduction of electric demand by over **5.2 million kW**. (1 ton of Geo saves .55-.88 kW)



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With **30%** of the (residential & commercial) HVAC market there would be a savings of **177,239,835 kWh** and a demand reduction of **36,564,000 kW or 36,564 mW.**

This would increase dramatically if we included the institutional market.



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This would mean carbon would be reduced by **35,486,053 metric tons** and CO₂ would be reduced by **130,115,529 metric tons.**

This is the equivalence of **removing approximately 29 million cars** off the road or planting over **8 billion trees.**



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AND

It would mean the creation or retention of
over **5 MILLION jobs.**

(Jobs may or may not be mutually exclusive. Individual jobs may be performed by the same individual in a particular classification or position.)



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REMEMBER

Geothermal Heat Pump Technology gives us a “**TRIPLE E**” solution. It provides:

- E**nergy Independence
- E**nvironmental Security
- E**conomic Prosperity



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