

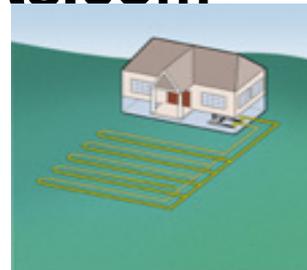
Geothermal Heat Pump Worksheet Training

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Cost Worksheets

- Focus of today's presentation
- Feature step-by-step instructions
- Leverage existing Western tools and information
- Are designed to compare, in laymen's terms, the energy savings for heating and cooling.
 - Water heating is not a focus of these cost worksheets at this time.

Overview of the Geothermal Heat Pump Calculators

- In MS Excel Format
- Two separate worksheets
 - Residential Perspective
 - Utility Perspective
- Requires users to provide critical information
- Analysis computes summary of benefits
- Assumptions may be changed as necessary

Residential Heat Pump Calculator- Customer Perspective

- Helps customers compare geothermal heat pumps against alternative heating and cooling equipment
- Customers need to provide the following information:
 - System size for the geothermal heat pump
 - Annual heating costs for both systems
 - Annual cooling costs for both systems

Customer Calculator Screen Shot- Introduction Page

USING THE RESIDENTIAL GEOTHERMAL HEAT PUMP CALCULATOR

This calculator is designed to help residential customers compared geothermal heat pump systems, sometimes called ground source heat pumps, to a variety of alternative heating and cooling systems.

To use this calculator, you will need the following information:

1. System size in tons
2. Annual heating costs for the two systems you are comparing
3. Annual cooling costs for the two systems you are comparing.

Annual heating and cooling costs are available from a variety of website calculators. The heating and cooling calculators developed by Washington State University for the Western Area Power Administration are provides this information based on regional data; however, any number of calculators can provide you with information you need to use this calculator.

***Once you have your information available, you are ready to use this calculator.
Advance to the Residential Cost Calc Worksheet***

Step 1: Installation Cost Comparison

Input data in the green shaded cells; the other fields are automatically calculated				
STEP 1. INSTALLATION COST COMPARISON			With Duct Work	
	Alternative	Geothermal Heat Pump	GHP w Duct Tune Up	GHP with Duct Work
Number of Tons	3	3	3	3
System Installation Cost	\$3,498.00	\$5,459.60	\$6,059.60	\$11,210.60
Lifetime Loop Lease Costs (if any)	\$0.00	\$0.00	\$0.00	\$0.00
Total Costs	\$3,498.00	\$5,459.60	\$6,059.60	\$11,210.60
Installation Benefits				
Tax Credits (if any)	\$0.00	\$0.00	\$0.00	\$0.00
Rebates (if any)	\$0.00	\$0.00	\$0.00	\$0.00
Net Installation Costs	\$3,498.00	\$5,459.60	\$0.00	\$0.00
System Cost Premium	\$1,961.60		\$2,561.60	\$7,712.60

Step 2: Energy Cost Comparison

STEP 2.

ENERGY COST COMPARISON

Click on following link for heating calculator

<http://energyexperts.org/CalculatorsTools/AirConditioningCostCalculator.aspx>

Click on following link for cooling calculator

<http://energyexperts.org/CalculatorsTools/HeatingCostCalculator.aspx>

Follow instructions and copy the heating and cooling costs in the shaded green cells

- Customers can use any variety of energy programs to compare systems

Additional Sources of Information

- **Geothermal costs based on housing type:**
 - <http://www.earthcomfort.com/costcalculator.html>
 - http://www.waterfurnace.com/savings_calculator.aspx
- **Comparisons of energy costs by region for standard equipment and geothermal heat pumps**
 - http://www.sbgeothermal.com/energy_use_calc.htm
 - <http://www.useelectric.com/calculators.asp>
 - <http://www.southern-dist.com/tools.html>
 - <http://www.hvacopcost.com/>
- **Fuel price comparisons**
 - http://ces.ca.uky.edu/energy/calculators/fuel_price_comparison/index.htm#

Customer Inputs for Energy Cost Comparisons

Annual Energy Costs			
Type	Alternative	Geothermal Heat Pump	Difference
Annual Heating Costs	\$1,077.65	\$649.78	\$427.87
Annual Cooling Costs	\$389.32	\$227.99	\$161.33
Total Annual Heating and Cooling Costs	\$1,466.97	\$877.77	\$589.20

Summary Results

SUMMARY OF BENEFITS FOR GEOTHERMAL HEAT PUMP SYSTEMS		With Duct Tune Up	With Duct Work
Initial cost difference	\$1,961.60	\$2,561.60	\$7,712.60
Life cycle savings	\$7,342.73	\$7,342.73	\$7,342.73
Net life cycle savings (life cycle savings - additional cost)	\$5,381.13	\$4,781.13	(\$369.87)
Simple payback of additional cost (years)	3.33	2.92	-0.42

Residential Heat Pump Calculator- Utility Perspective

- Helps utilities calculate the effects of residential geothermal installations in their service territories
- Requires utility to provide the following information:
 - Engineering assumptions
 - Default compares a geothermal heat pump to a 78% Efficiency furnace and 10.8 EER air conditioner
 - Residential retail kilowatt hour rates
 - Wholesale kilowatt hour and peak demand charges

Residential Geothermal Heat Pump Calculator Savings Based on Engineering Assumptions			
Step 1: Determine Costs			
Electric Costs		Program Costs per Installation	
Customer Electric Rate (cost per kWh)	\$0.12	Administration	\$0.00
Utility Costs		Loop Lease	\$0.00
Wholesale power per kWh	0.05	Rebates/ton	\$150.00
Coincident Peak Demand per KW	\$12.00	Number of tons installed	30
Step 2: Determine Number of Installations		Revenue from financing/installation	\$0.00
Estimated Number of Installations	10		
Net Effects from Geothermal Heat Pump Installations			
Customer revenue from kWh sales	\$10,630.02		
Increased kWh sales cost	(\$4,429.17)		
Avoided kW Cost	\$187.20		
Net Effect	\$6,388.04		
Revenue from Financing (loop leases, loans)	\$0.00		
Total Net Effect	\$6,388.04		
Utility Program Costs			
Net Revenue Effects	\$6,388.04		
Administration	\$0.00		
Loop Lease	\$0.00		
Rebates	\$4,500.00		
Total Program Costs	\$4,500.00		
TOTAL REVENUE	\$6,388.04		
TOTAL COSTS	\$4,500.00		
NET GAIN/LOSS	\$1,888.04		
Savings Analysis			
	Alternative HVAC System	Geothermal Heat Pump	Savings
kWh consumption	8,642.86	97,226.32	88,583.46
kW consumption	33.00	17.4	15.60
Customer Revenue	\$1,037.14	\$11,667.16	\$10,630.02
Utility Cost- kWh	\$432.14	\$4,861.32	(\$4,429.17)
Utility Cost- kW	\$396.00	\$208.80	\$187.20
Net Revenue to Utility	\$1,865.29	\$16,737.27	\$6,388.04

ADDITIONAL ANALYSIS- CALCULATING CARBON EMISSION SAVINGS		
Estimated kWh savings	88,583.46	
Carbon Equivalent Calculator	E:http://www.usctcgateway.gov/	
Click on this link and follow the directions		
Example:		
This is equivalent to one of the following:	kWh	Metric Tons of Carbon
60 _____	442,917.32	279
50 _____	Passenger cars not driven for one year	
31,777 _____	Passenger cars and light trucks not driven for one year	
649 _____	Gallons of gasoline	
3.74 _____	Barrels of oil	
36 _____	Tanker trucks filled with gasoline	
	Household electricity use for one year (number of households)	



Utility Calculator Screen Shot- Introduction Page

RESIDENTIAL GEOTHERMAL HEAT PUMP CALCULATOR- UTILITY PERSPECTIVE

USING THE Residential Geothermal Heat Pump Calculator – Utility Perspective

This calculator is designed to help **utilities** calculate the effects of residential geothermal heat pump installations in their service territory.

To use this calculator, you will need the following information:

1. Engineering assumptions to compare an alternative heating and cooling system with a geothermal heat pump system.
2. Residential kWh retail rates
3. Wholesale kilowatt hour charges and peak demand charges

The calculator's default is to compare a standard (78%) gas furnace and 10.8 EER Air Conditioner with a geothermal heat pump.

This information can be altered based on individual utility conditions, by changing the values in the **green** shaded cells in the spreadsheet.

Once you have this information available, you are ready to use this calculator.

Advance to the Cost Analysis Worksheet

Step 1: Determine Costs

Step 1: Determine Costs

Electric Costs		Program Costs per Installation	
Customer Electric Rate (cost per kWh)	\$0.08	Administration	\$0.00
Utility Costs		Loop Lease	\$0.00
Wholesale power per kWh	0.065	Rebates/ton	\$0.00
Coincident Peak Demand per KW	12.50	Number of tons installed	150

Step 2: Determine Number of Installations

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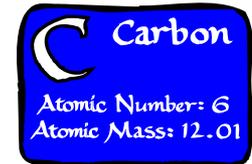
Estimated Number of Installations	50
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Net Effects from Geothermal Heat Pump Installations

<i>Net Effects from Geothermal Heat Pump Installations</i>	
Customer revenue from kWh sales	\$36,762.14
Increased kWh sales cost	(\$28,789.63)
Avoided kW Cost	\$975.00
"Net Effect"	\$8,947.51
Revenue from Financing (loop leases, loans)	\$0.00
Total Net Effect	\$8,947.51

Example of the Carbon Emissions Calculator

- To determine the carbon benefits of various energy efficiency programs



US Climate Technology Gateway

Calculating Carbon Emissions

- The Greenhouse Gas Equivalencies Calculator is designed to translate greenhouse gas (GHG) reductions from (e.g., metric tons of carbon dioxide equivalent) into terms that are easier to understand (e.g., equivalent number of cars not driven for one year).

<http://www.usctcgateway.net/tool/>

Carbon Emissions

Example

- Example using estimated carbon emission savings from 1,000,000 kWh
- 1,000,000 kWh = 632 metric tons

1,000,000 kWh savings are equivalent to:

137

Passenger cars not driven for one year- reducing from the highways

OR

71,982

Gallons of gasoline (using less gas)

OR

16,205

Number of tree seedlings grown for 10 years (planting trees)

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Example

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