



*Geothermal Heat Pumps
for Electric Cooperatives*


RUS Engineering Seminar

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A Touchstone Energy[®] Cooperative 

Who Is  ?

Electric cooperative with 30,000 meters and a system peak (winter) of 110 Mw & 94 summer.





500+ Geo Members & Adding 100+ Per Year

The collage features several images of buildings: a large resort-style house by a lake, a modern multi-story house, a house with solar panels, a large brick building with arches, a house with a garage, and another large house. To the right is a document titled "Intermountain Energy Has Over 100 Geothermal Systems on the Western Slope" which lists various projects and their details.



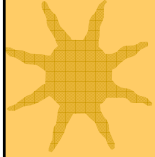
DMEA's Energy Vision

★ The new energy “crisis”:

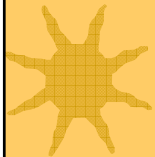
- Fossil fuel price shocks
- Climate change (CO₂) becoming the issue
- Member and government focus on renewable energy, energy efficiency and CO₂ reduction
- Fuel switching from propane/natural gas to electric resistance heating (plug-in and installed)
- Rising electric rates driven by increasing demand and rising generation costs
- Restrictions on new coal generation (or any?)



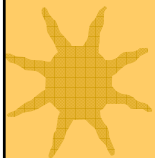
DMEA's Energy Vision



★ Fertile ground for new efficient electric products and services



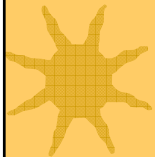
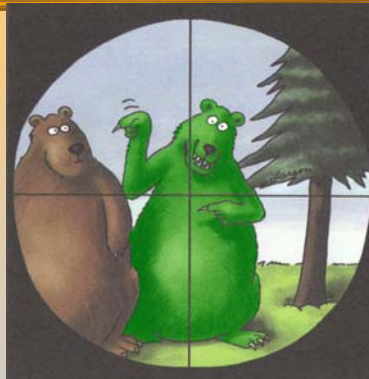
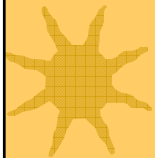
★ Cooperatives can be key players and leaders!



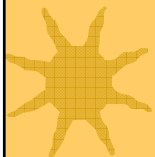
★ Or not?



DMEA's Energy Vision

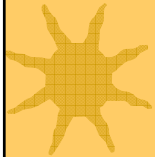
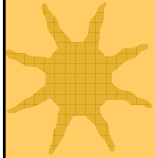
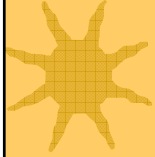


With energy now an environmental and political target, do you want to be the “green” bear or the “brown” bear?





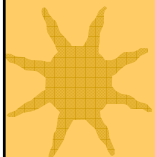
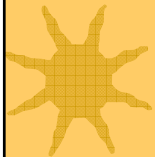
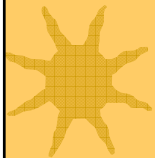
Geo for Cooperatives



- ★ Are you (or your boss, or your board) interested in:
 - Improving your system load factor
 - Optimizing your DSM, peak-time pricing and direct load control programs
 - Reducing pressure on your rates by increasing margins
 - Making your members happy
 - Getting the politicians off your back for not having green/ carbon reducing programs



Geo for Cooperatives



- ★ Ground source heat pumps (GSHPs) meet all of these screening criteria:
 - Proven technology
 - Highest lifecycle return
 - Utility & member
 - Great load factor and electric margin
 - Replaces competing fuels
 - High environmental benefits
 - Delivers lots renewable energy (solar!)
 - Net carbon savings

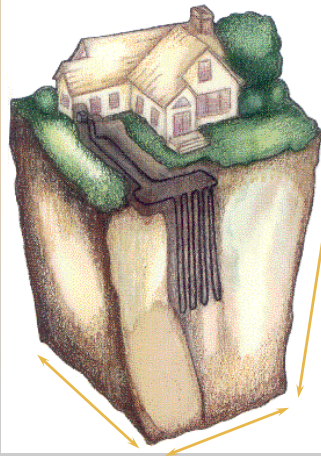


Geo for Cooperatives

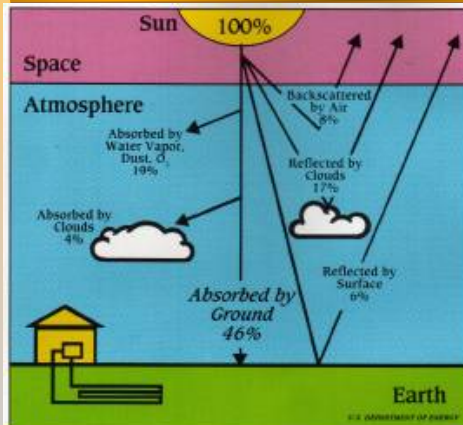
Mass market direct use geothermal technology

GreenHeat

heating & cooling a different world
with renewable energies



Geothermal Energy (Green Heat)

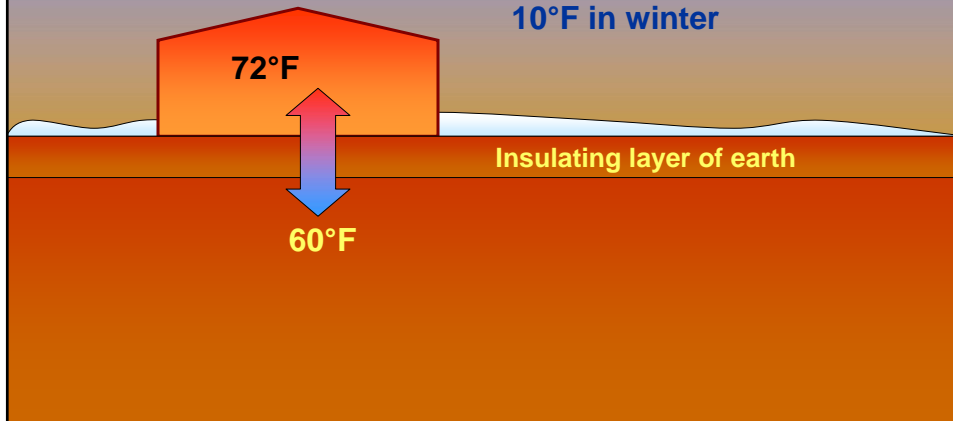


The sun stores almost half of the energy it delivers in ground.

The earth is like a "solar battery," absorbing nearly half of the sun's energy. The ground stays a relatively constant temperature throughout the seasons, providing a warm heat source in the winter and a cool heat sink in the summer.

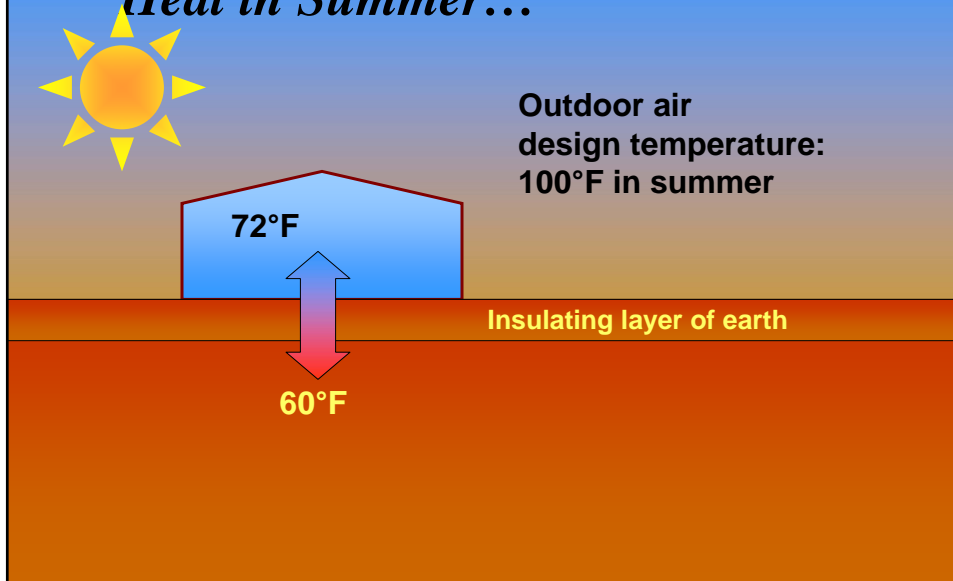
The Earth is the Source of Heat in Winter...

Outdoor air design temperature: 10°F in winter

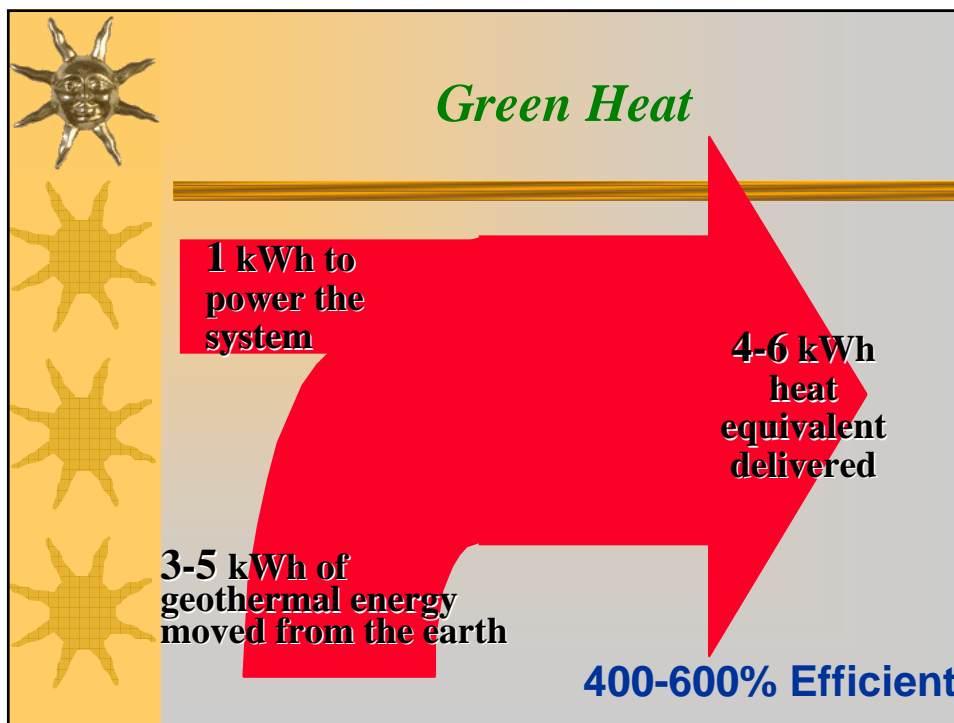
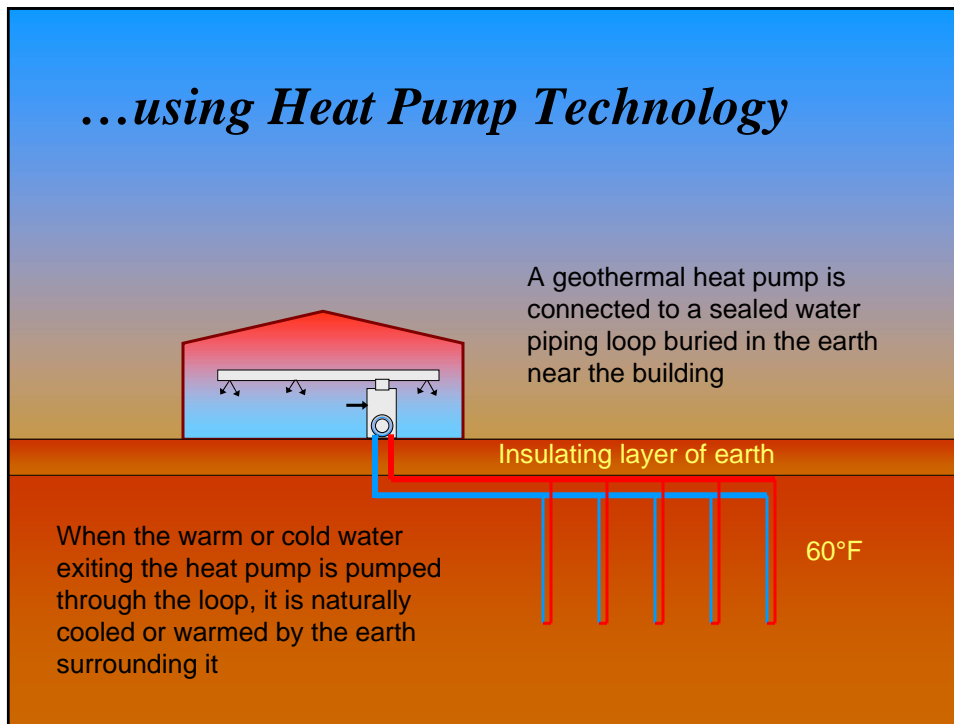


...and an Efficient Place to Reject Heat in Summer...

Outdoor air design temperature: 100°F in summer

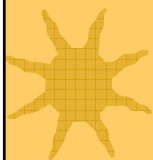
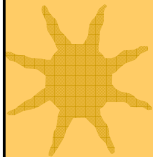
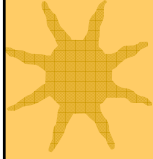


...using Heat Pump Technology





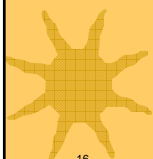
Geothermal Heat Pumps



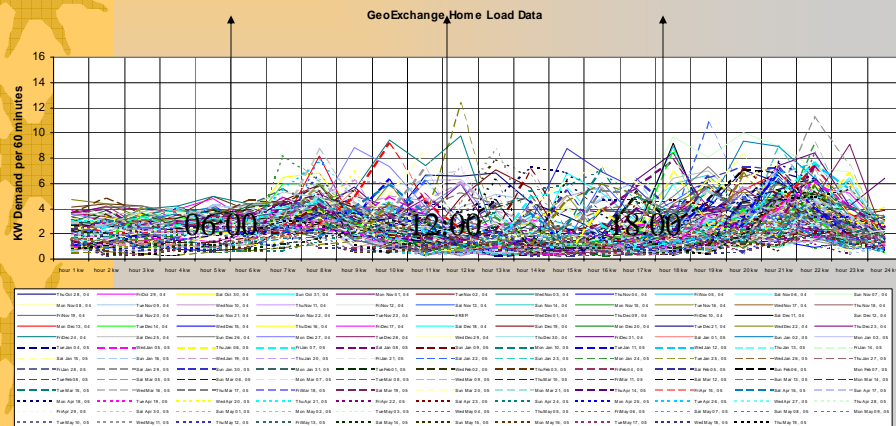
- ★ Are a market proven technology.
- ★ Cut total heating & cooling bills.
- ★ Tap renewable solar energy from the earth.
- ★ Can be “bolted” on to a gas heating system.
- ★ Have low power requirements that can be provided by zero carbon renewable sources!
- ★ Provide immediate positive cash flow with conventional financing!
- ★ Offer dispatchable demand side management.



Geo for Cooperatives



DMEA’s Program value analysis based on load data





Geo for Cooperatives

CDA Winter Peak Results

	segment 1	segment2	segment 3	segment 4	segment 5	segment 6	segment 7	segment 8	Average Home (kW)
	no HVAC or water heater	evap. cooler only	central AC only	water heater only	water heater and central AC	heating only	heating and water heater	heating, water heater and central AC	
Population distribution within segments:									
% population	30%	22%	4%	28%	1%	1%	13%	0%	100%
WINTER PEAK: January and December 2000, 5-9 PM									
Main heating	0.00	0.00	0.00	0.00	0.00	1.67	1.75	1.83	0.26
Secondary heating	0.01	0.00	0.00	0.01	0.00	0.05	0.03	0.00	0.01
Water heater	0.00	0.00	0.00	0.44	0.46	0.00	0.42	0.50	0.19
Central AC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evaporative cooler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Freezer	0.15	0.15	0.16	0.16	0.15	0.14	0.16	0.20	0.16
Miscellaneous	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
Total	1.50	1.49	1.50	1.96	1.95	3.20	3.70	3.86	1.96
DMEA Residential Sector Projection:									
Residential MW	10.8	8.0	1.3	13.2	0.3	1.1	11.8	0.4	47.0
% of Residential MW	23%	17%	3%	28%	1%	2%	25%	1%	100%



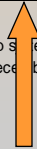
GeoExchange Results: Winter Performance

Segment or Customer	Square Footage	Heating Mode				
		Usage in Winter Peak Month (Jan.-Dec.) kWh	Coincident Winter Peak (Jan.-Dec.) kW	Coincident Winter Peak Load Factor	Site-Specific Winter Peak (Jan.-Dec.) kW	Site-Specific Winter Peak Load Factor
Segment 7 [†]	1,997	856.2	1.75	0.66	-	-
Carron	2,673	1,638.6	2.17	1.01	2.75	0.80
Kintz*	3,000	1,988.5	2.18	1.23	10.37	0.26
Pistor	2,053	1,569.4	1.77	1.19	3.86	0.55
Unit A	1,906	798.6	2.02	0.53	3.76	0.29
Unit B	1,516	401.6	0.67	0.80	2.08	0.26
Unit C	1,601	1,270.4	1.58	1.08	2.52	0.68
Unit D	1,750	1,417.0	2.31	0.82	7.22	0.26
All Geoexchange	-	9,084.0	12.71	0.96	-	-

Notes:

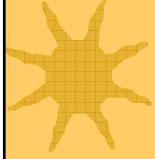
[†] 81% of the customers with electric heat have non-electric backup systems.

* Kintz winter peak based only on 4 near-peak days in January (December data stops on 12/5/2000)

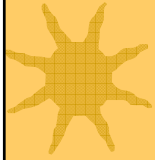




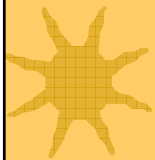
Geo for Cooperatives



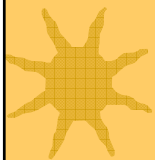
Value to DMEA



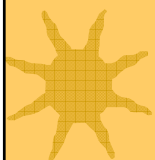
- ★ Installed loop costs \$6,000 (retail).
 - Premium over high end gas equipment with AC.
- ★ Generates \$410.64 in annual margins.
 - \$12,319 total revenue over 30 years.
 - An IRR of 5.45%.
- ★ DMEA's return on poles & wires.
 - 2004 ROI 3.8%.
- ★ We have tested several "financing" tools and are now piloting a "loop tariff."



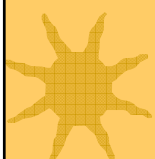
Geo for Cooperatives



Value to DMEA.



- ★ \$410.64 * 100 units (annual unit goal).
 - = \$41,064/year.
 - = \$1,231,920 over 30 years.
- ★ 600 units on our lines since program implementation.
 - \$250,000 in annual margins.



Not bad for energy efficiency!



Geo for Cooperatives

Value to Cooperatives.


- ★ You can recover the cost of the loop, interest expense, program costs and earn more than your cost of funds.
- ★ Increase your margins with incremental electric sales.
- ★ Improve your load factor w/o load control and even more with it!.
- ★ Earn loyalty from your members for:
 - Helping them lower their total energy bill.
 - Supporting the environment by reducing carbon emissions.



Geo for Cooperatives

Value to Members

- ★ Piece of mind
 - Less volatile heating & cooling costs
 - Utility grade customer service
- ★ Annual energy savings of \$250+ to \$2,000 +
 - No up-front investment (using DMEA programs)
 - Immediate positive cash flow
- ★ They are doing their part for the environment



Geo for Cooperatives

70 degree heating and cooling

Electric Resistance	\$2640
<small>(100% radiant/convector zoned system with 13 SEER A/C)</small>	
Propane	\$2474
<small>(91% condensing system with 13 SEER A/C)</small>	
Natural Gas	\$1021
<small>(91% ignitor condensing system with 13 SEER A/C)</small>	
GeoExchange	\$724
<small>(350% efficient system with horizontal ground loop)</small>	
<small>Assumes:</small>	
<ul style="list-style-type: none"> • Typical 2,000 sq foot home (48,000 Btu/hr heating load & 20,000 Btu/hr cooling load) • Average temperature design data for Montrose, CO • Energy costs: Electricity @ \$.093/kWh; Propane @ \$1.96/gallon; Natural Gas @ \$.76/therm 	
DMEA member value	

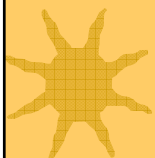
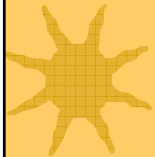
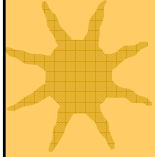


Geo for Cooperatives

- ★ The equipment keeps getting better
 - Unit efficiency is reaching 500%
- ★ Geo supports load control and peak time pricing
 - Can be tied to a gas furnace for load control
 - Water to water units can support thermal storage



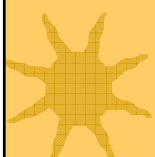
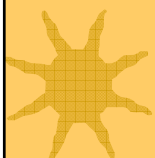
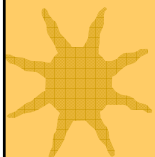
Geo for Cooperatives



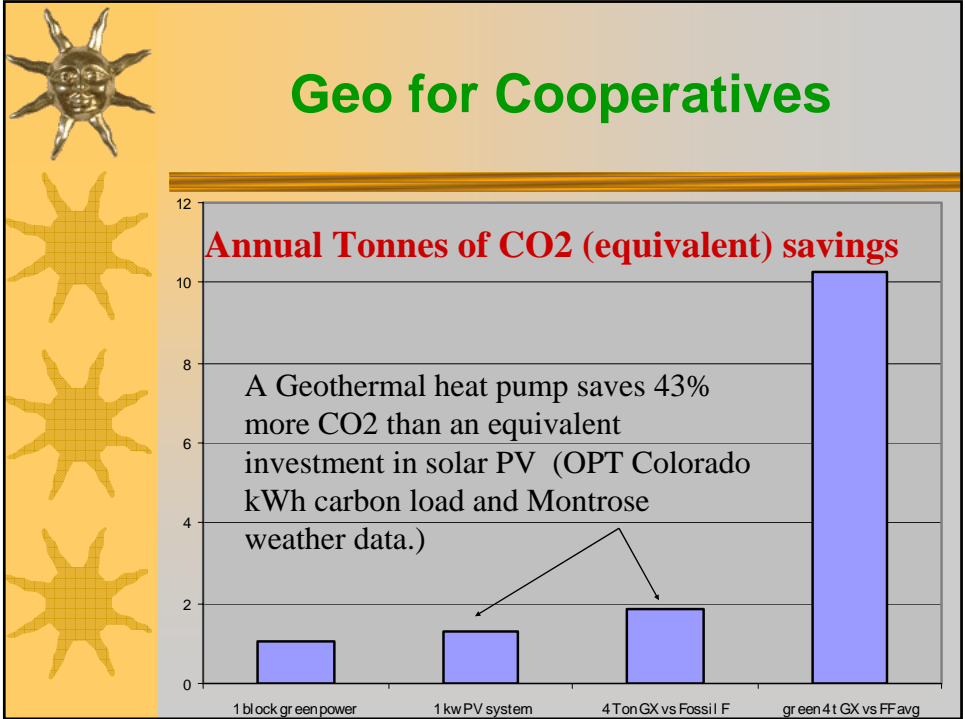
- ★ DOE is working to officially designate GSHPs as a renewable energy resource.
- ★ Cooperatives will be able to obtain credit for CO2 savings from GSHP programs.



Geo for Cooperatives



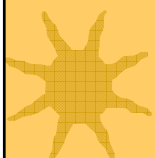
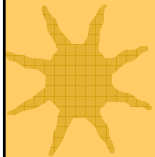
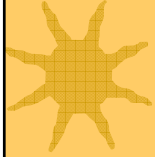
- ★ Geothermal heat pumps produce the lowest carbon dioxide emissions, including all source effects, of all available space-conditioning technologies (EPA, 1993).
- ★ A GeoExchange systems saves CO2 on par with an equivalent investment in solar PV.
 - Based on DMEA's electric energy carbon load and weather data.
 - Your results will vary (and will probably be better).



-
- Geo for Cooperatives**
- ★ Many states and cities are establish their own emissions reductions targets.
 - Boulder, Colorado has adopted the Kyoto target of a 7% reduction of greenhouse gases from 1990 levels by 2012.
 - ★ California has set reduction targets of lowering emissions to 2000 levels by 2010, to 1990 levels by 2020 and 80% below 1990 levels in 2050.



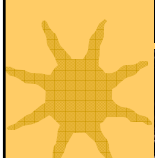
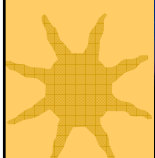
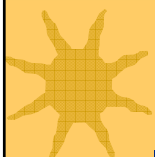
Geo for Cooperatives



- ★ In the Northeast, the Regional Greenhouse Gas Initiative (RGGI) is being developed to introduce a carbon dioxide cap-and-trade program for utilities in participating states; the program will begin in 2009.
- ★ In the West, six states and two Canadian provinces are committed to cut greenhouse gases 15% by 2020 from 2005 levels. Participants include Oregon, Washington, California, New Mexico, Arizona, Utah, British Columbia and Manitoba



Geo for Cooperatives

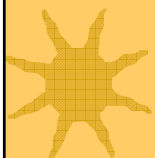
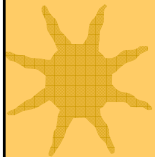
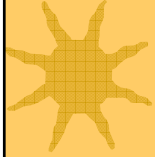


Geothermal Heat Pumps are the Most Efficient way to use Green Electricity for Heating, Cooling & Water Heating





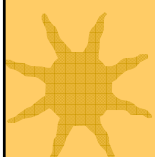
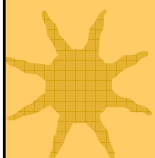
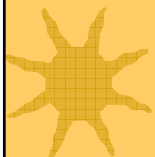
Geo for Cooperatives



- ★ An average residential ground source heat pump will save 10 Tonnes of CO₂ per year using all green power when replacing conventional gas/propane heating & cooling.
- ★ This is a message utilities can use in the political process.



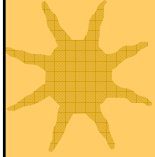
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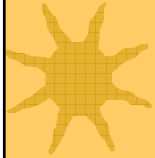
- ★ The RUS is working to get GSHP loops into their standard loan program.
 - The GSHP loops become utility plant.
 - Loops look like street lights for billing.
 - New margin opportunity (earnings on plant).
 - Instant first cost savings for your members.
 - Drives positive cash flow cash flow for members.
 - Long term utility relationship and member satisfaction.
 - Levels the electric utility playing field with natural gas, propane and oil heating.



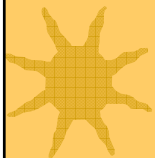
Geo for Cooperatives



★ H.R.2419



★ Food and Energy Security Act of 2007
(Engrossed Amendment as Agreed to by Senate)

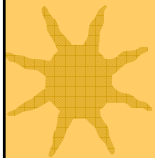


– SEC. 6108. ELECTRIC LOANS TO RURAL ELECTRIC COOPERATIVES.

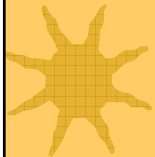
– “The committee notes that assistance is authorized for renewable energy including geothermal ground loops”



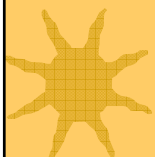
Geo for Cooperatives



Geothermal Heat Pump Development Act of 2007 (Introduced in Senate as 2314 IS).



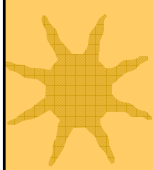
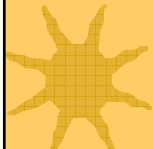
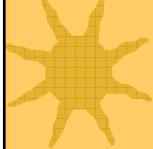
★ To amend the Internal Revenue Code of 1986 to make geothermal heat pump systems eligible for the energy credit and the residential energy efficient property credit, and for other purposes.



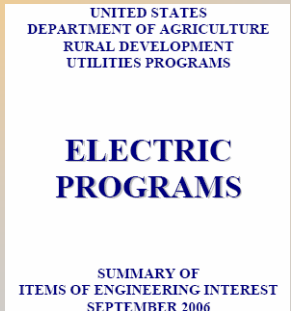
★ section 48(a)(3) of the Internal Revenue Code of 1986 is amended by adding equipment which uses the ground or ground water as a thermal energy source to heat a structure or as a thermal energy sink to cool a structure.



Geo for Cooperatives



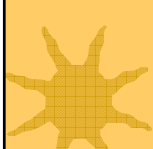
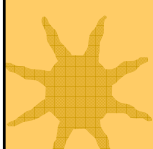
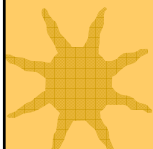
★ <http://www.usda.gov/rus/electric/engineering/2006/en-in-06.pdf>



RENEWABLE ENERGY.....	14
THE STATUS OF WIND ENERGY IN THE UNITED STATES.....	14
INTRODUCTION TO GROUND SOURCE HEAT PUMPS.....	16



Thank You For Your Attention! Questions?



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