

Ground Source Heat Pumps (AKA Geothermal Heat Pump or Geoexchange): E3A Folder Forthcoming

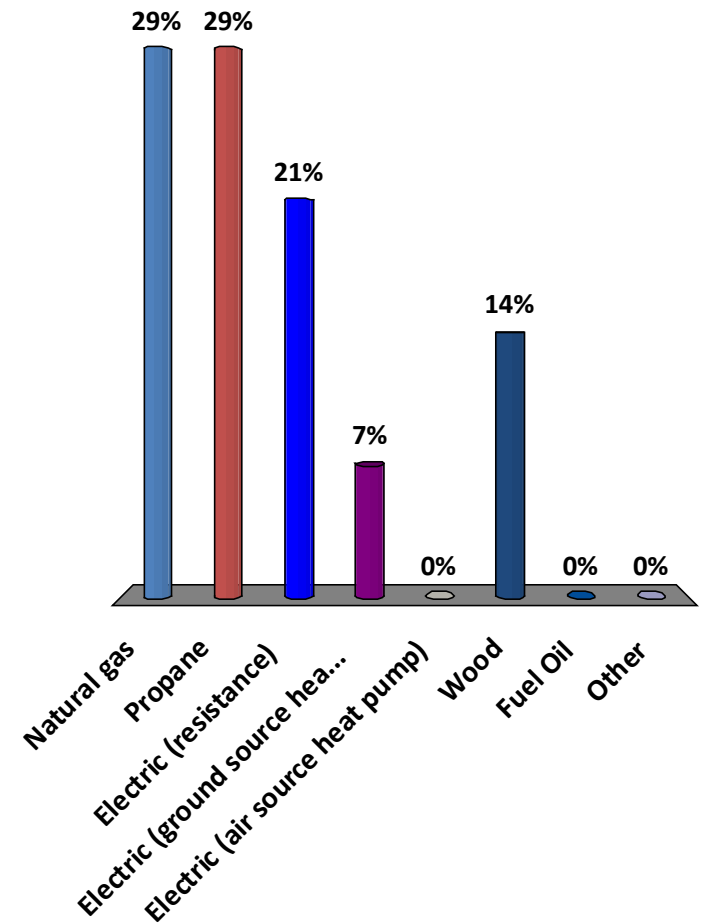
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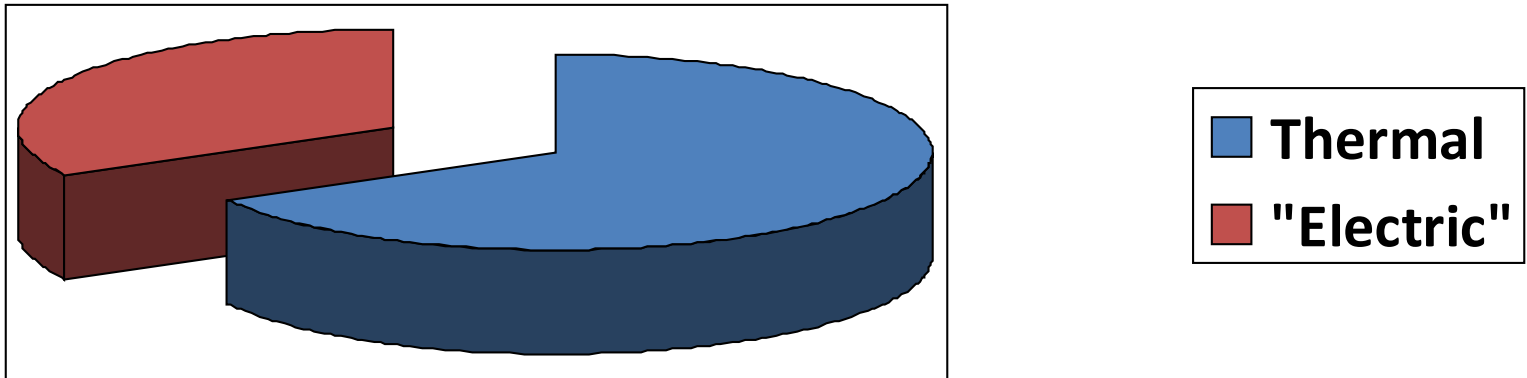
How do you heat your home?

- A. Natural gas
- B. Propane
- C. Electric (resistance)
- D. Electric (ground source heat pump)
- E. Electric (air source heat pump)
- F. Wood
- G. Fuel Oil
- H. Other



Eat the bigger part of the pie...

Thermal vs. "Electric" - Household Use 2012



Renewable energy heating & cooling options

- Biomass
- Geothermal (aka ground source)
- Solar thermal

**Conservation and energy efficiency
first!**

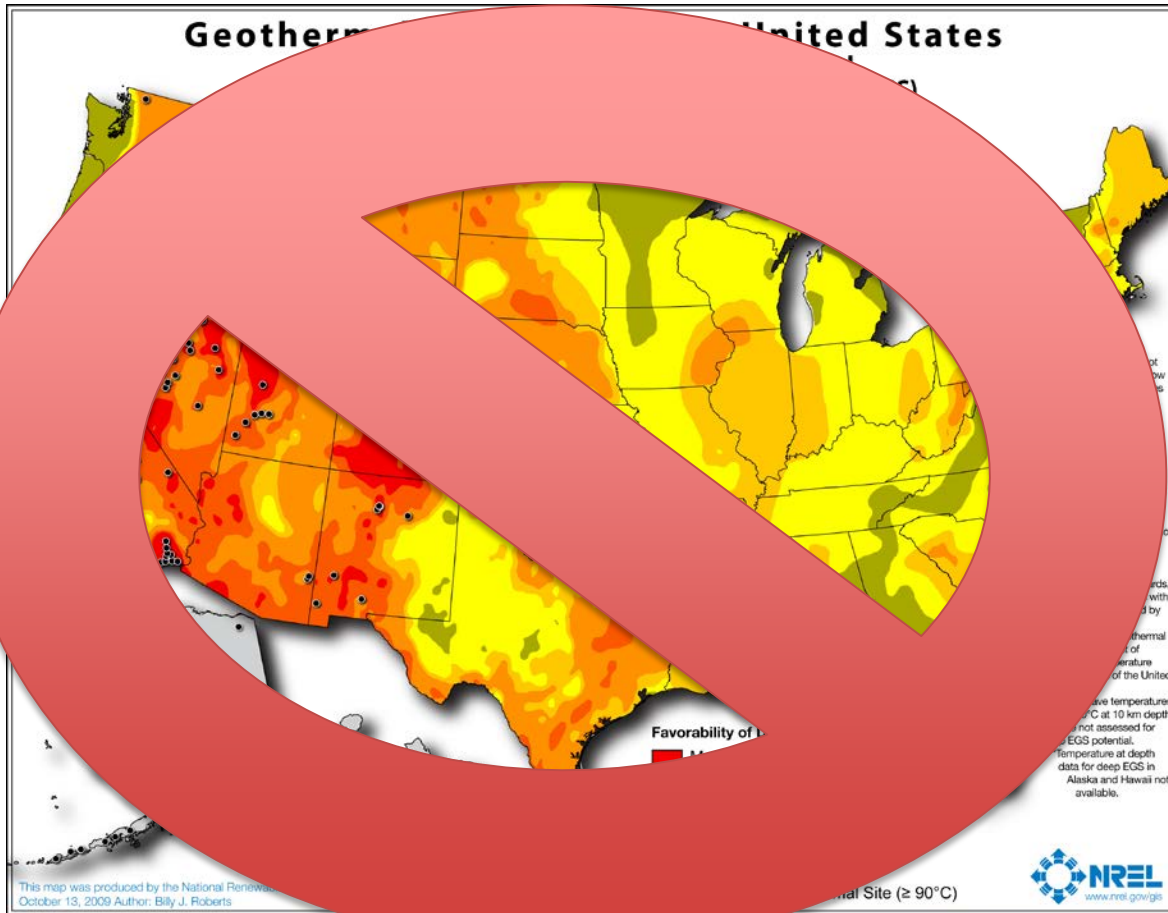


Produce “low-grade” energy for “low grade” application...

- Geothermal heat pumps (GHPs)
 - How it works, where it works, and how a system might perform



Ground Source Heat Pumps – Where

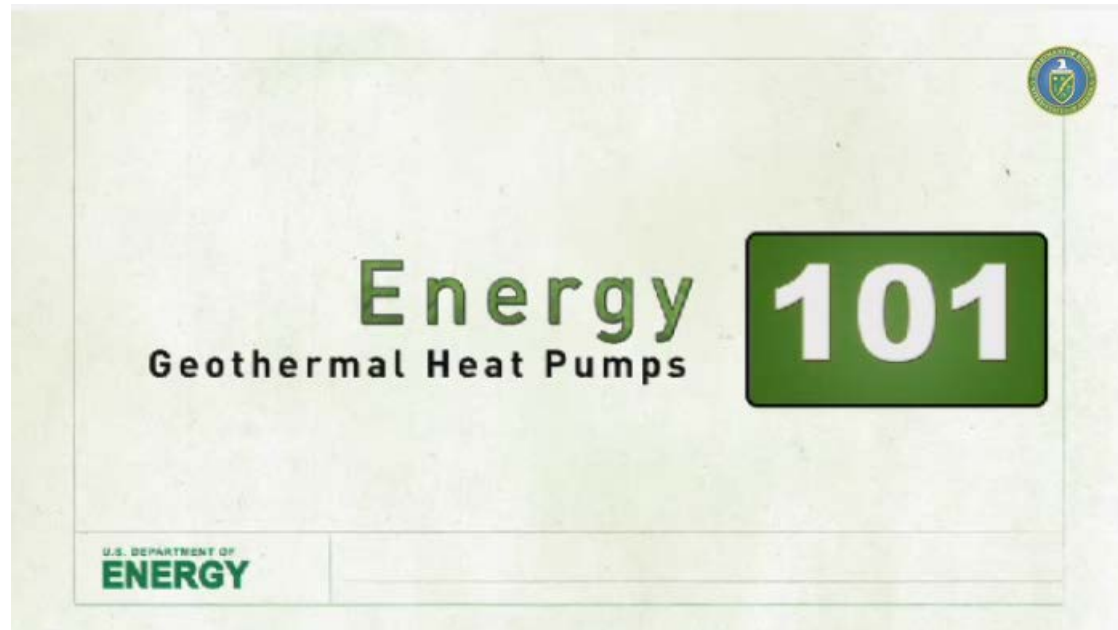


AKA Geothermal Heat Pump – How

- Uses relatively constant temperature of sub-surface to heat and cool buildings
 - Like a cave
- Use stored solar heat
 - Mostly...
- Fluid circulated to exchange heat
 - Like a refrigerator



AKA Georexchange – How

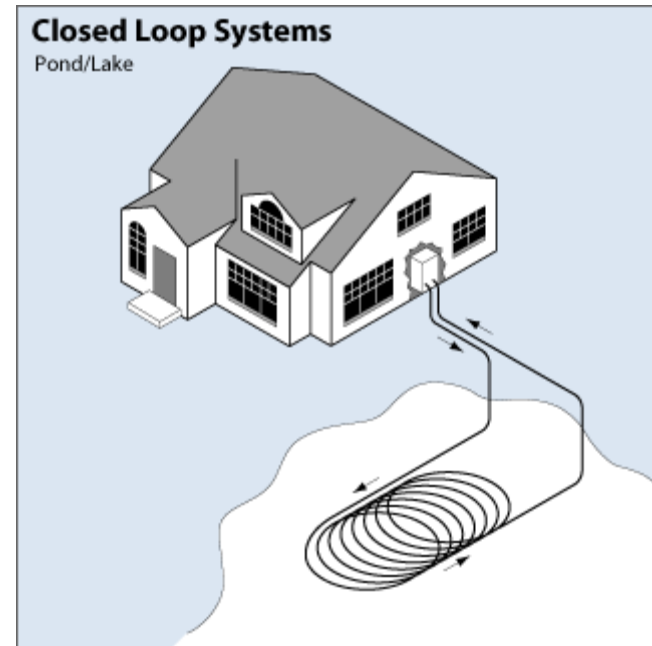
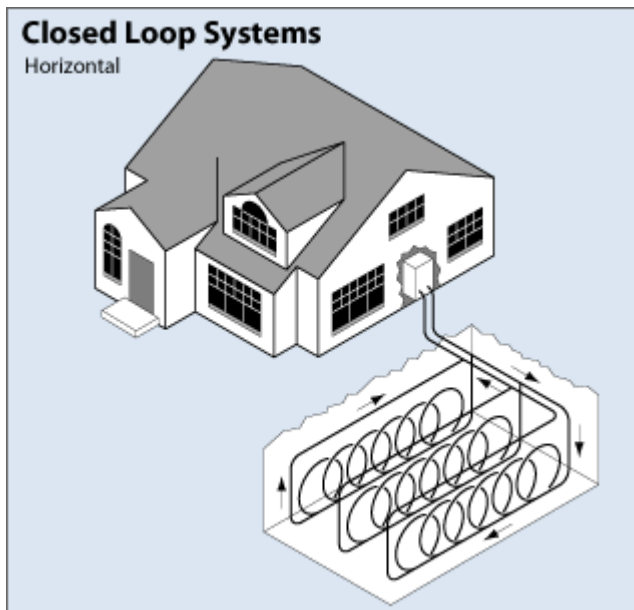


Geothermal Heat Pump - What

- Space heating, cooling, and potentially water heating system for buildings
 - Heats fluid – typically air – to 90-110°F (winter)
 - Cools fluid by using ground as heat sink (summer)
 - Can be equipped with a “desuperheater” to supply hot water
 - Uses waste heating in summer
 - Increases load in winter, although does use waste heat from exchanger
- Works nearly everywhere
 - No special resource (e.g. hot springs needed)

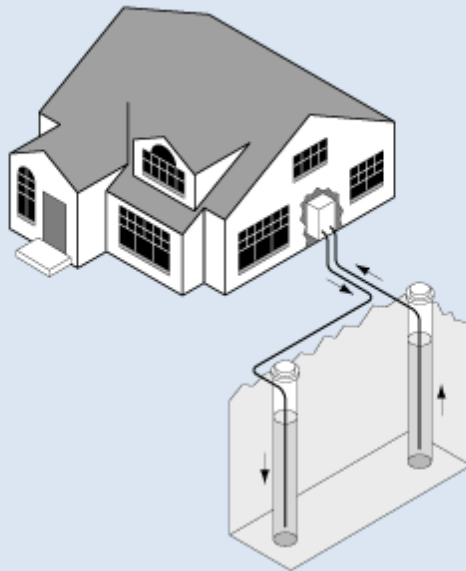


Geothermal Heat Pump – Design

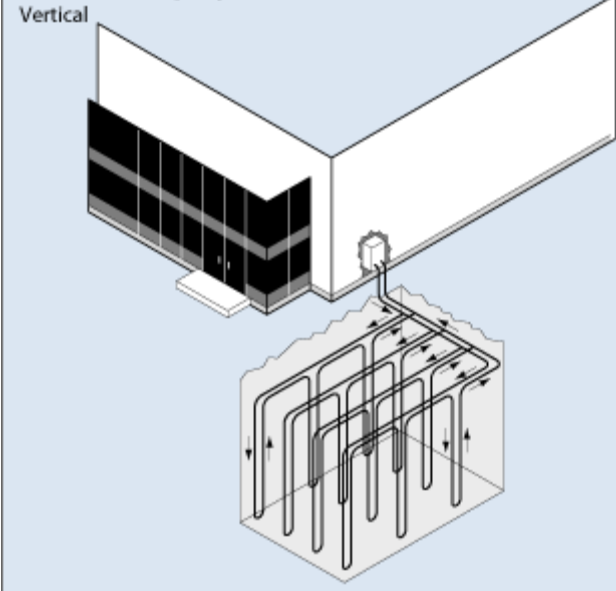


Geothermal Heat Pump - Design

Open Loop Systems



Closed Loop Systems



Geothermal Heat Pump - Where

- Requirements
 - Adequate space for loop field
 - More for horizontal
 - Existing duct work or hydronic system
 - Some soils (wet, clays, etc.) are better than others (sands)
- Best applications
 - Locations with high heating costs
 - Propane, electric (?), etc.
 - Need to replace existing HVAC system
 - New construction

Geothermal Heat Pump – Benefits

- Requires no backup, although electric backup often provided
 - Uses electricity to run pump and heat exchanger
- Very efficient
 - Generally 250-600% “efficient” (3-6 COP)
 - 1 unit of electricity yields 2.5-6 units of heating or cooling
- No combustion required
- Quiet and comfortable heat
- Limited exposure to changes in regulatory policy



Geothermal Heat Pumps – Drawbacks

- Initial Cost
 - Approximately \$7500/ton = \$15,000-30,000 per house
- Need space for loop field
 - Vertical very feasible but generally more expensive
- Not easily corrected if designed/installed incorrectly
 - Select a reputable installer
 - International Ground Source Heat Pump Association
- Can be difficult to incorporate into retrofits
 - Boiler systems, small ductwork, etc.



Incentives – Maximize your economic return

- Utility incentives
 - Efficiency and heat pumps
- State incentives
 - Check www.dsireusa.org
- Federal incentives
 - Robust and plentiful

Can be used with most types of renewables (not just thermal)!

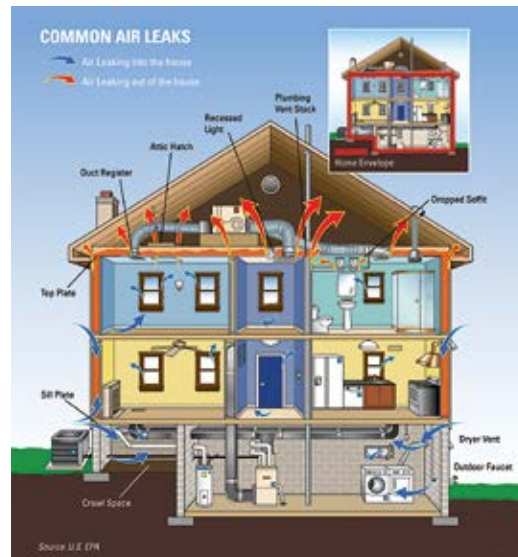
Utility

- Generally love them!
 - Check www.dsireusa.org



Incentives – Federal

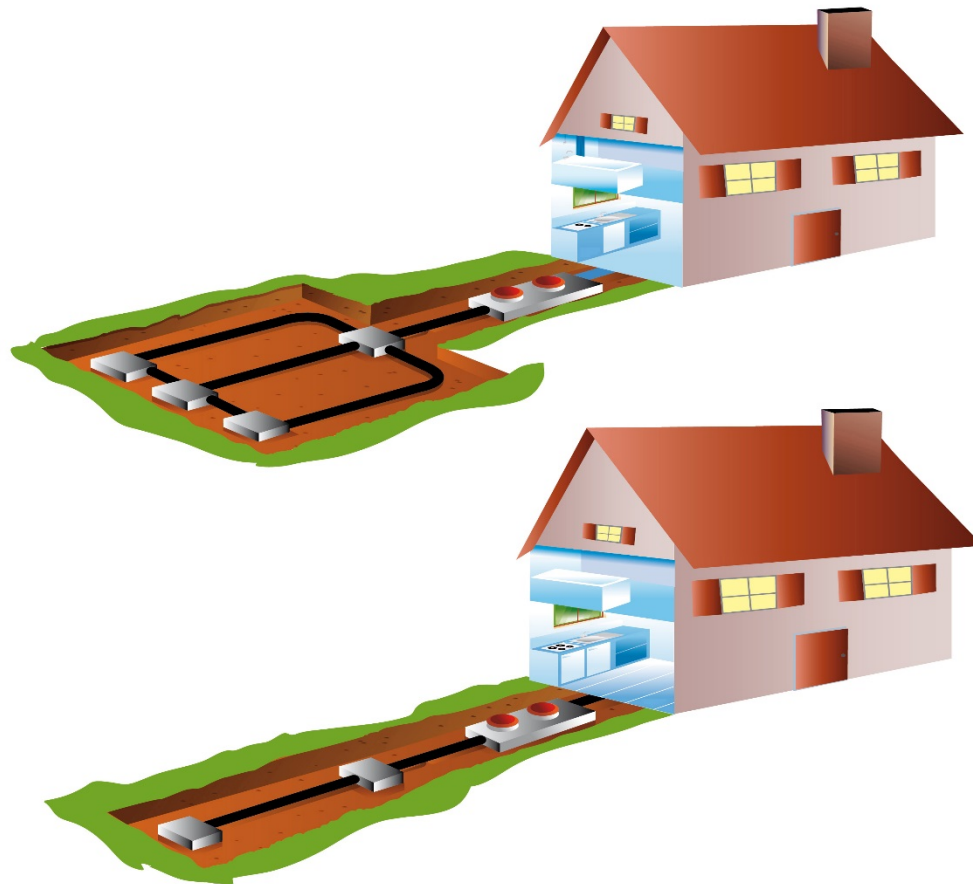
- Residential Tax Benefits
 - 30% tax credit on solar (thermal & PV), wind, & geothermal heat pumps (no limit)
 - Tax exclusion on utility rebates (not taxable income)



Incentives - Federal

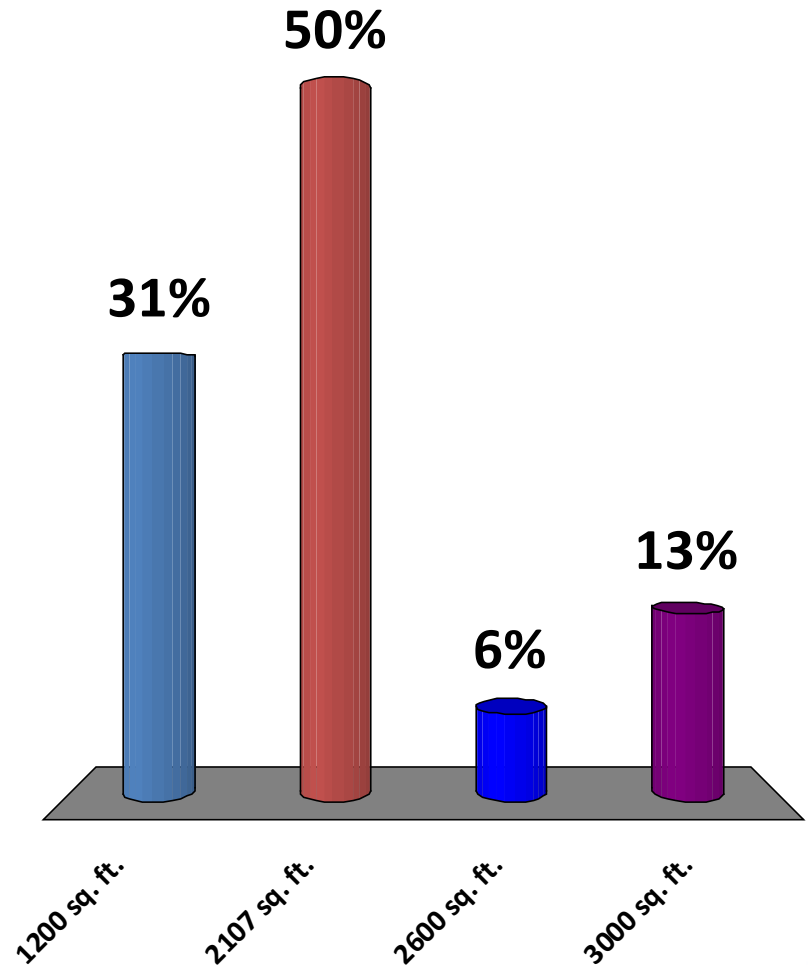
- Commercial
 - Tax credits
 - 30% for wind and solar
 - 10% for geothermal
 - Production tax credits for larger systems
 - Modified Accelerated Cost Recovery System (MACRS)
 - Rapid depreciation
 - USDA Rural Development REAP grants and loans
 - 25% grants for RE and EE

Geothermal HP – Let's build one...



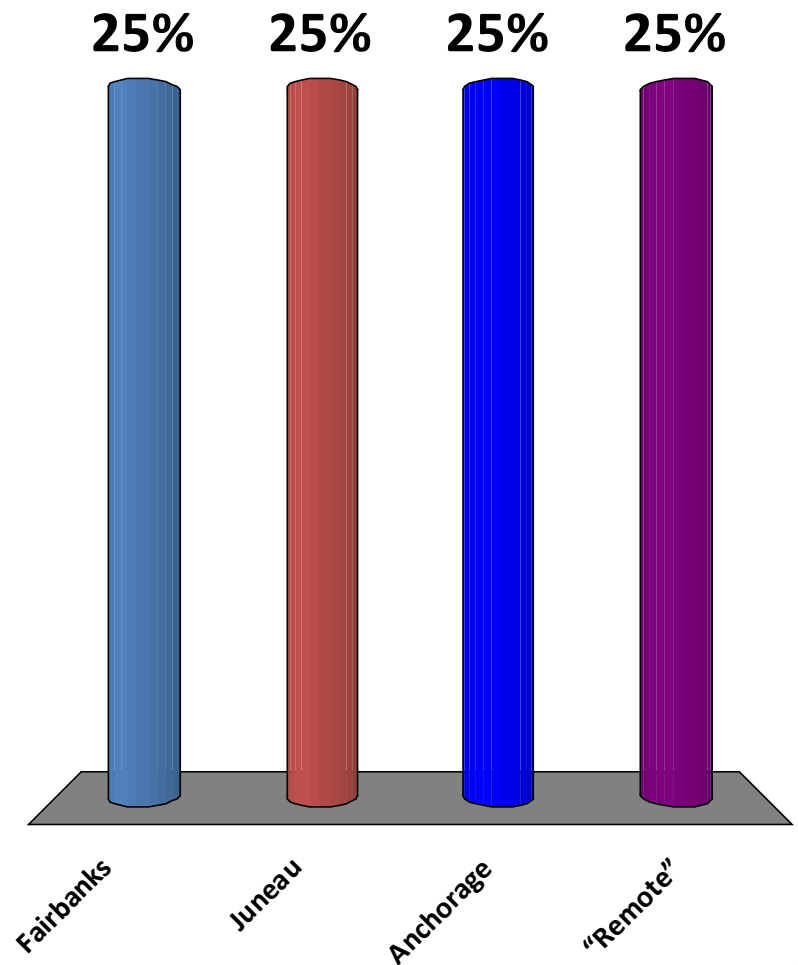
How big is our house?

- A. 1200 sq. ft.
- B. 2107 sq. ft.
- C. 2600 sq. ft.
- D. 3000 sq. ft.



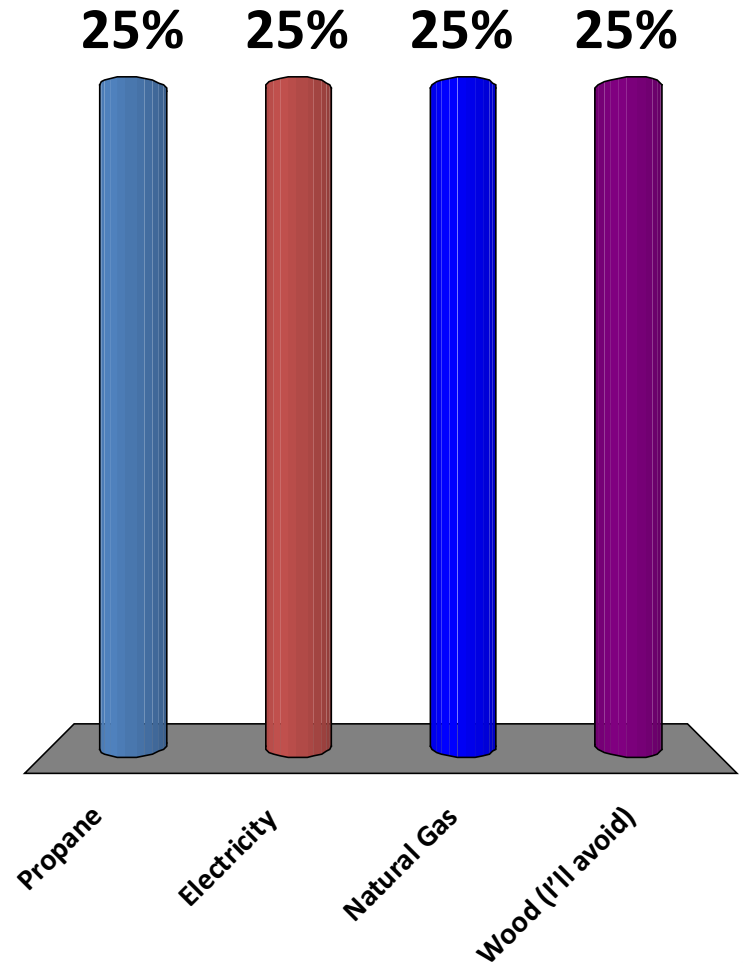
Where is it located?

- A. Fairbanks
- B. Juneau
- C. Anchorage
- D. "Remote"



How is it currently heated?

- A. Propane
- B. Electricity
- C. Natural Gas
- D. Wood (I'll avoid)



References

- RETScreen
 - www.etscreen.net
- NREL – Energy Analysis
 - Distributed Generation Renewable Energy Estimate of Costs – Updated August 2013
 - www.nrel.gov
- Air Conditioning Contractors of America
 - Residential Load Calculations
 - Outdoor Design Conditions 8th ed v 2

Alternatives to GSHP

- Efficiency first!
 - Smaller the better
- Air source heat pumps
 - Mini-Splits



Air source heat pump – Mini-split

- What –Provides cooling and majority of heat
- Where –Pulls heat from outside the building down to 15-30 degrees
- Why – 150-300% “efficient”
- How much – ~\$6000-8000



Thank You for Attending



www.E3A4U.info