Geothermal Technologies Workshop

March 31, 2009

Steven Johnson

Consultant to the Cooperative Research Network

(303) 249-6217 stevenxjohnson@msn.com

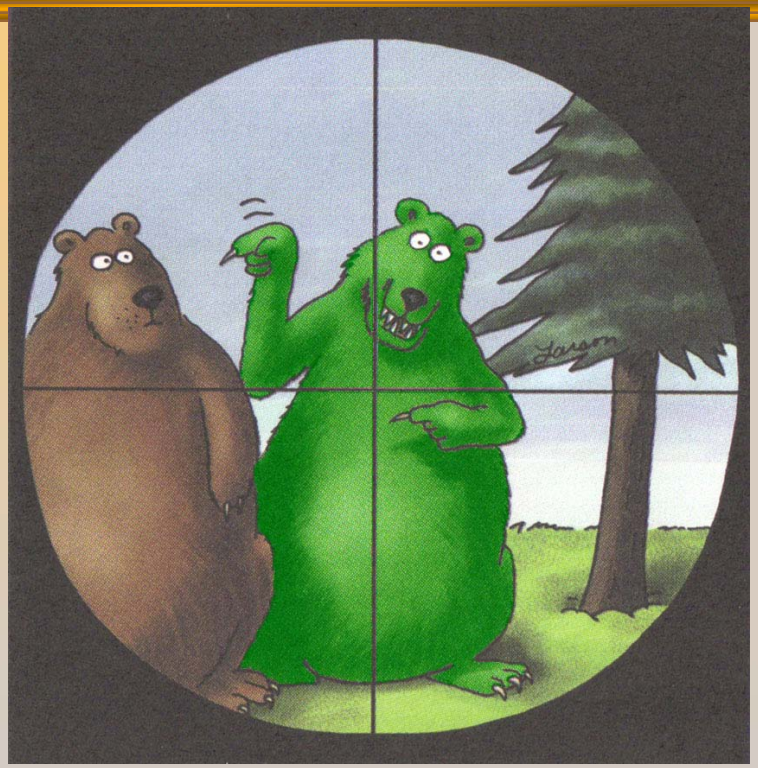
Today's Energy Market

- The new energy "crisis":
  - Fossil fuel shortages and price shocks
    - Propane
    - Fuel oil
    - Natural gas
  - Climate change becoming the issue (Co2)
  - Consumer and *government* focus on renewable energy and energy efficiency
  - Fuel switching from fossil fuels to electric resistance
  - Rising electric rates driven by the demand for more electricity and rising generation (fuel) costs

Today's Energy Market

- Fertile ground for efficient electric products and services
- Utilities can be key players and leaders!
  - And benefit from taking a leading role
- Or not?

Today's Energy Market



As utilities become environmental targets, do you want to be the "green" bear or the "brown" bear?

Today's Energy Market

What If a "Magic Box" Existed……..

1. That delivered heating and cooling from a "free" renewable energy resource!
2. That improved your utilities financial position!
3. That made your customers love you!
    1. By putting money in their pockets to spend locally on movies, dinners and other items.
    2. By giving you a "green" halo.

Would you, your boss, or your board be interested?

Today's Energy Market

- New strategic direction:
  - Market electric technologies that:
    - Increase margins from higher revenues, or reduced wholesale power costs
    - Meet DSM goals
    - Show environmental leadership
      - Renewable energy
      - Energy efficiency
    - Increase consumer satisfaction

Today's Energy Market

Or, in utility terms:

- Use electric technologies to minimize energy costs to consumers
- Use electric technologies to increase electric sales margins
  - Increase sales of positive margin kWh
- Use electric technologies to build your "brand"
  - Increase consumer satisfaction
- Be a leader in environmental efforts

Today's Energy Market

- The biggest target is conditioned space
  - Because that's where consumers spend the most $$$$!
  - That's where the biggest efficiency and environmental opportunities are

Today's Energy Market

- Ground source heat pumps (GSHPs) meet all of these screening criteria
  - Proven technology
  - Highest lifecycle return
    - Utility & consumer
  - Great load factor and electric margin
    - Replaces competing fuels
    - Avoids electric resistance loads
  - High environmental benefits
    - Delivers lots renewable energy (solar!)

Today's Energy Market

Consumer perspective

- Piece of mind
  - Less volatile heating & cooling costs
  - Utility grade customer service
- Annual savings of $250 to $2,000 +
  - Utility programs can provide a range of cost savings
  - Rebates to no up-front investment (using a loop tariff or similar program)
  - Immediate positive cash flow is possible
  - **Very high total savings over 30 years (depending on energy costs)**
- They are doing their part for the environment

Today's Energy Market

Utility Geo Perspective

- Installed loop costs $6,000 (retail)
  = Premium over high end gas equipment
- Generates solid annual net margins from kWh sales
  - Can be higher than return on poles & wires
- Can generate a return independent of kWh sales

Today's Energy Market

One Utility Model

- Recover the cost of the loop and earn more than your cost of funds.
- **PLUS** make a return on incremental energy sales.
  - A geo house uses 2X the electricity of a non-geo home
  - It has a better load factor
  - It can be totally off peak with load control
- And earn loyalty from consumers for:
  - Helping them lower their total energy bill.
  - Supporting the environment.

Today's Energy Market

(for 70 degree heating and cooling comfort year round)

Propane **$2503**

(91% condensing system with 13 SEER A/C)

Electric **$2139**

(100% radiant/convector zoned system with 13 SEER A/C)

Natural Gas **$1540**

(91% ignitor condensing system with 13 SEER A/C)

GeoExchange **$670**

(350%+ Tranquility system with horizontal ground loop)

Assumes:

- *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@ $.086/kWh; Propane @ $2.00/gallon; Natural Gas @ $1.27/therm*

Today's Energy Market

Consumer perspective

- Geo Heat Pumps
  - They don't cost, they pay
  - Annual savings of $250 to $2,000 +
- Money left over for:
  - Dinner out
  - College for the kids
  - A tank of gas for the SUV
- Plus they are helping the environment
  - Same cost as a PV system, with a greater return in $$ and environmental (CO_2) savings

GSHP's and Your Future

- The equipment keeps getting better
  - "COP's" (% efficiency) are reaching 5 (500%)
  - Water-to-Water units can replace old boilers
  - Consoles and splits have relatively low installation costs
- Fits load control and peak time pricing
  - Can be tied to a gas furnace for load control
  - Water to water units support thermal storage

GSHP's and Your Future

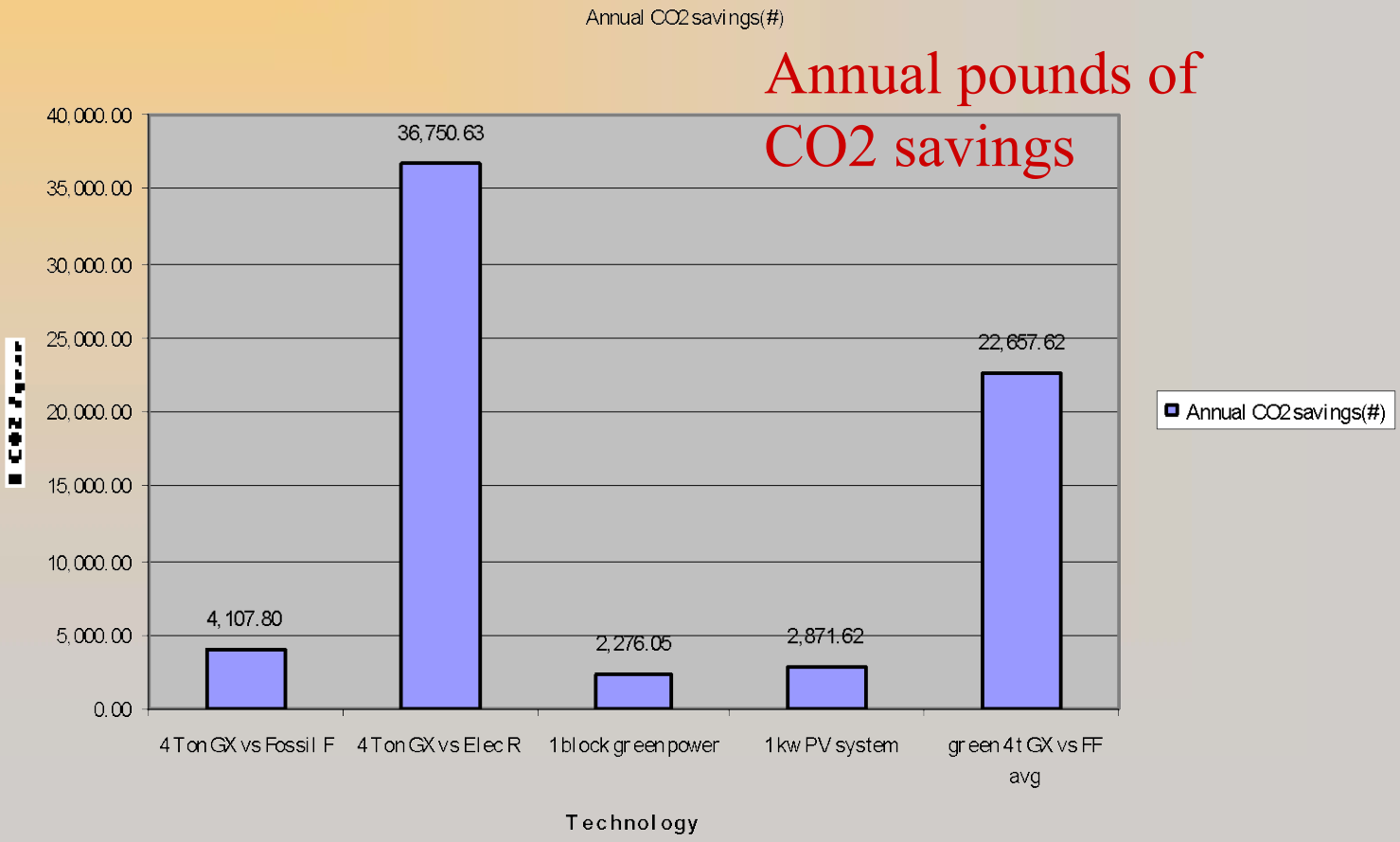
- The USDA/RUS can now provide 35 year loan funds for GSHP loops (new in the Farm Bill)
  - The GSHP loops become utility plant
  - Instant first cost savings for co-op members
    - Drives positive cash flow cash flow
    - New margin opportunity
    - Long term utility relationship and member satisfaction
  - Levels the electric utility playing field with natural gas
- Establishes a model for Investor Owned and Municipal utilities

GSHP's and Your Future

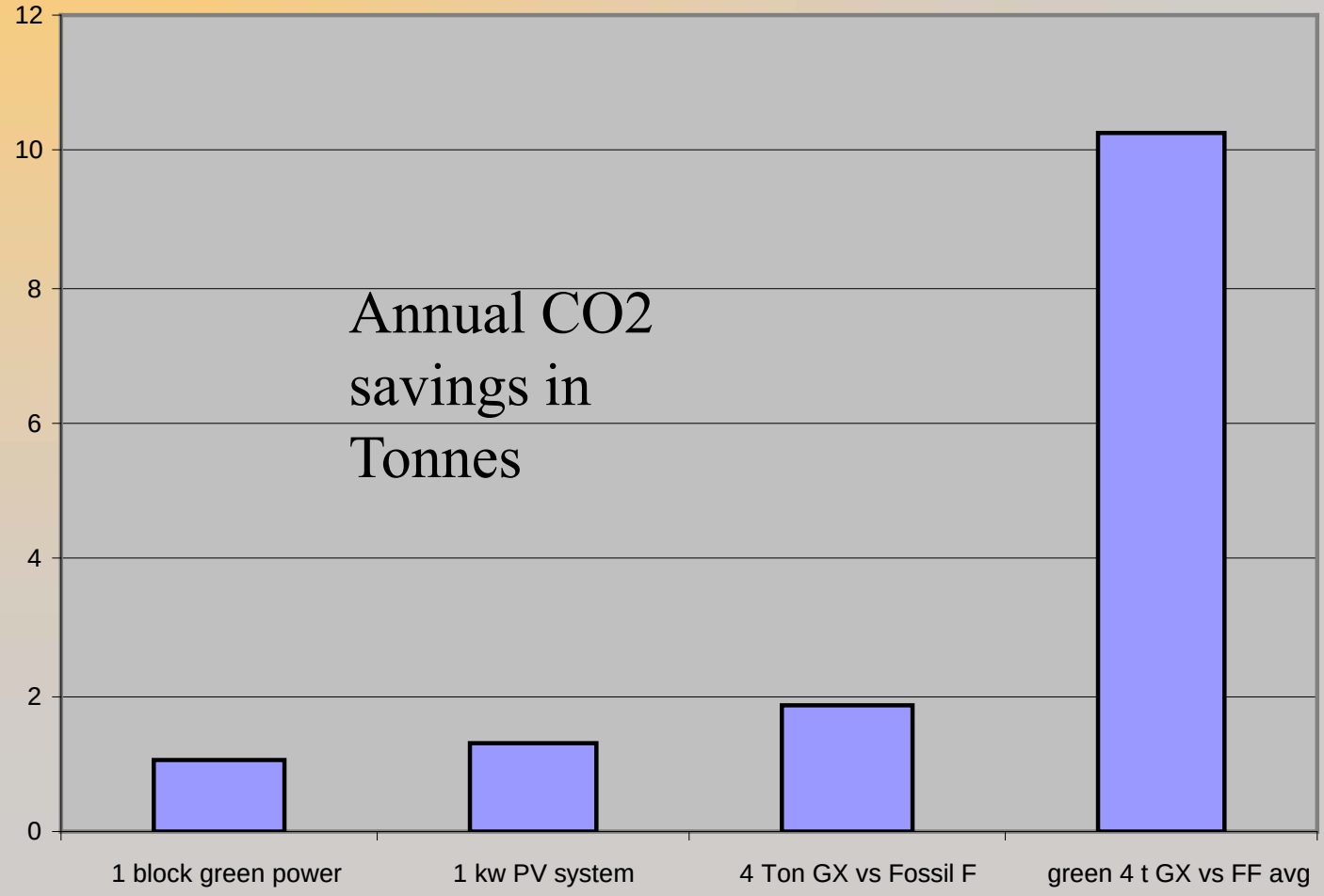
- DOE is working to officially designate GSHPs as a renewable energy resource
- This would set the stage for utility loops or Geo programs to obtain Co2 credits
- A GeoExchange systems saves more Co2 than an equivalent investment in solar PV.
  - Based on Montrose kWh carbon load and weather data.
  - Your value will vary.
  - The less Co2 in a kWh the bigger the net savings

GSHP's and Your Future

Annual pounds of CO2 savings



GSHP's and Your Future



GSHP's and Your Future

- Prices for the 2008-2012 European Union Emission Trading Scheme (EU ETS) validity period are currently $29 dollars per metric ton. (A metric ton or tonne is equivalent to 2,205 pounds)
- The Chicago Climate Change (CCX) facilitates trading of carbon emissions on a voluntary basis, at a little over $3 per metric ton as of September, 2007.

GSHP's and Your Future

- "Offset providers" sell to individuals and companies to "reduce carbon footprints" including emissions for travel to attend conferences or events.
- Prices average about $12 per ton, depending largely on the types of projects implemented to derive the offsets.

GSHP's and Your Future

- Assuming an $3.00 to $29 per tonne/year value
  - A residential 4 ton unit that saves 2 Tonnes /year
  - With a 30 year unit life (loop warranty)
  - = $180 to $1,740 lifetime value
- At 10 Tonne savings per year (green power)
  - $900 to $8,700
  - Remember the loop costs $6,000

GSHP's and Your Future

Many regions, states and cities are establishing 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.

GSHP's and Your Future

- 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 began 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

GSHP's and Your Future

- Canada is implementing a national Geo incentive effort for retrofits. Many Provinces and utilities are matching this incentive for customer grants of up to $8,000 per home.
- Congress is working on a $2,000 tax incentive
- Is your utility ready for the consumer response?

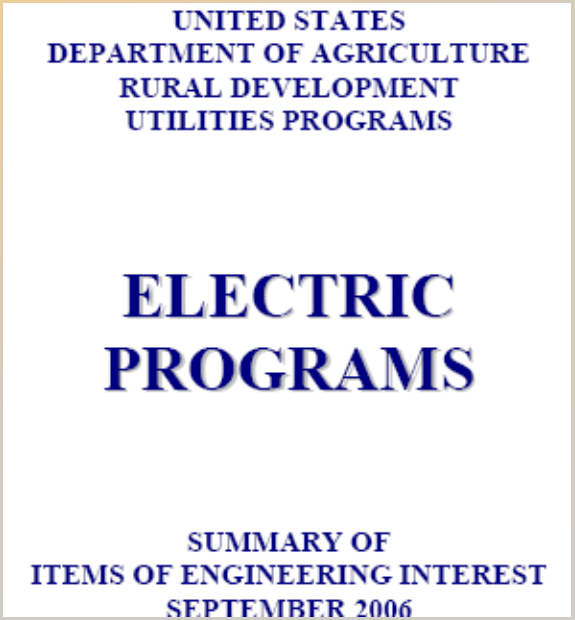
GSHP's and Your Future

Magic Box =

=

GSHP's and Your Future

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



UNITED STATES
DEPARTMENT OF AGRICULTURE
RURAL DEVELOPMENT
UTILITIES PROGRAMS

ELECTRIC PROGRAMS

SUMMARY OF
ITEMS OF ENGINEERING INTEREST
SEPTEMBER 2006

Thank You For Your Attention!

If you ever need a hand you can reach me at:

Steven Johnson

stevenxjohnson@msn.com

303 249-6217