Kentland’s Standing Column (SCW) Case Study

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Photos of Kentland Installation
Photos of Kentland SCW Well
Technology Origin/Background
Coupling to the Earth & Performance
How does SCW differ from Open and Closed Loop?
Maryland Game Changer Grants Program
Kentland by the Numbers
Control & Monitoring
Advantages & Disadvantages of SCW
Questions??
Search for Low Cost Energy Source began after the 1973 Oil Embargo for my new home in Laytonsville in 1976
- Did not have access to Natural Gas
- Air Source Heat Pumps use resistance heat below 32 F and have short life
- GWHP had been used in the South from the 1950’s – Cocoa Beach 1968
- I installed the first Geo in my new home in 1976.
- Initially the system used spring water but shifted to a well after two years
- As a result of Newspaper articles and home show – GeoSolar was formed
- 1000’s of systems were install from Pa in the North, Bethany in the East, Cumberland in the West and Charlottesville in the South
- All Systems were open loop and used well water in 1980’s until mid 1990’s, then closed loop and now Standing Column of Water (SCW)
- The wells were shared with domestic water use
- After the heat pump modifies the water by about 10 F it is discharged to the same well, another well, drain field, dry well or lake.
- We have been replacing units that been in use for 28 to 30 years
Geothermal systems are the most energy-efficient, environmentally clean, and cost-effective space conditioning systems available ("Space Conditioning: The Next Frontier," EPA 430-R-93-004, April 1993).
Ground Source Performance

- Capacity/Output (Tons), Heating COP, and Cooling EER

- #1 - Open Loop is best – direct contact with 53 F EWT water

- #2 - Standing Column of Water - direct contact – 50 to 45 F EWT water

- #3 - Vertical Closed Loop – Contact thru Plastic Pipe – 32 F EWT

- #4 - Horizontal Close Loop and Ponds/Lakes – Contact thru Plastic Pipe – 30 F
<table>
<thead>
<tr>
<th>Model</th>
<th>Fluid Flow Rate</th>
<th>Entering Water Temperatures</th>
<th>Capacity and Efficiency Data</th>
<th>Energy Star Rated Products</th>
<th>GeoSolar Energy</th>
<th>BOSCH</th>
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EER= +25%
COP= +17%
Heating= +20%
Cooling= +8%
Maryland Game Changer Grant

- Program announced in Summer of 2013
- Funds were about $1,000,000 for Geo or Bio Fuel Grants
- Goal was to fund projects that reduced the installation cost and/or that improved performance
- Grants were competitive
- Team was Kentland Community, Harvey Hottel and GeoSolar Energy
- Total job was $270K – Grant was $120K
- Took about 2 months
- We were told that the conversion of the existing 550,000 Maryland Wells appealed to selection committee
Standing Column of Water (SCW) – Hybrid of Open & Closed

- Often half the cost of closed loop – wide spread use in North East
- Typical Depth is about 70 feet of water per ton vs 160 feet for closed
- Water is take off of one end of well and returned to the other end
- Bleed line improves performance
- Customer gets a water well – win win
- Most have hose bibs for Lawn or Pool
- Well only needs to yield 3 or 4 GPM
- Often use constant pressure pump
- Have Drillers who drill out existing well
- No drilling permit required for existing well
- Rock area West of I95/
- 550,000 water wells in Maryland
- Fewer Holes/ Space– Less Damage
- 30 Year Howard Co House 7 tons 400’ well
- Use CuNi Heat Exchanger
Kentland by the Numbers

- Building is a two story 9,000 Square Feet – Lots of Glass
- Replaced three 15 year old Trane Air Source Machines
- Cathedral Ceiling on the Upper Floor
- On WSSC/city water and sewer – use 1.3M gallons costing $15K/year
- 4 offices, 100 person meeting room and kitchen, Gym, Showers
- 24 tons with 4 machines – 2 are two stage and other 2 are singles
- Two wells 900 feet deep of pure granite – cased to ~ 100 feet
- Static water at 14 feet with a yield in each of 4 GPM
- Pumps are Gould 2 Hp variable speed constant pressure
- Pumps are at the 100 foot level to reduce wire cost
- Flow rate is 14 Gpm per machine when running
- Water is drawn in at the bottom of the well with a 2” pipe
- Water is returned at the top down below the static water level
- We picked up 1 to 2 F after about 300 feet - 60 F at the bottom
- Installation was completed by the end of August 2013
- Been through the worst of winters – heating is critical design – 46 F EWT
- Savings have been about 40%
Photos of Kentland Control Panel

- Filters
- Digital In & Out Thermometers
- Solenoid & Flow Restrictor Valves
- Temperature Thermistor

GeoSolar Energy

BOSCH
One Year Operating Cost is Estimated to be $4400 or $.50/Sq Ft.
Venstar Colortouch Thermostat

- Up to 4 Stage of Heating and 2 Stages of Cooling
- Switchable Programmable or Non-Programmable
- Adjustable Timers & Deadbands
- Set Point Limiting
- Simple-Stat Operation for ease of use
- Preprogram using Computer via SD Card for Bosch Machines
- WiFi Card that works with Cloud, Computer, Droid, or iPhone
- Graphs a week of usage with all three stages shown
- Has Timer in addition to Deadband
SCW Advantages Revisited

- About 20% improved performance in capacity and efficiency over closed loop due to warmer water in heating
- Less Drilling - Only 70 feet per ton vs 150 feet for closed loop
- Many more well drillers than Geo firms – greater competition
- Many new homes have wells deep enough to support SCW
- 550,000 existing wells in Maryland – Many can be drilled deeper
- Less Construction Damage and Space – ¼ the number of holes
- Water well can be use for domestic use if not on city water
- For those on city water – can be used to fill pool, water lawn, etc.
- Fire Sprinkler - eliminate 300 gallon tank & pump in new houses
- If a better closed loop heat exchanger is developed – could be used
Scw Disadvantages

- Systems need water filter that needs to be cleaned of stone or sand
- Well Pump is more difficult to replace
- Extra Cost of CuNi Heat Exchanger
- May Need Bleed Line to improve performance
- Requires more engineering and specialized components – Most manufacturers don’t have training available
- Bad Water
  - Low pH - Bosch CuNi down to 5
  - Iron Bacteria
Summary and Conclusion

- Systems ran fine through the super cold winter – leaving water only went down to 39F – met the Gamechanger goals

- Achieving 40% energy savings after 1 year of operation

- Well water tested & within WSSC acceptance range – Could be used for filling pool in the future

- Implementing SCW in other projects
Questions????
GeoSolar
Air Source HP
Gas Heat & AC
Oil Heat & AC
Propane & AC

One Year Cost

$0
$1,000
$2,000
$3,000
$4,000
$5,000
$6,000
$7,000
$8,000

GeoSolar
$1,706
Air Source HP
$2,698
Gas Heat & AC
$2,664
Oil Heat & AC
$6,303
Propane & AC
$7,286

Total Cost in 20 Years

$0
$50,000
$100,000
$150,000
$200,000
$250,000
$300,000
$350,000
$400,000

GeoSolar
$43,739
Air Source HP
$69,185
Gas Heat & AC
$73,335
Oil Heat & AC
$345,666
Propane & AC
$312,062

Did you know? Energy Star rated home builders are allowed to market their homes as Energy Star houses even when they install costly oil and propane heating systems.

Changing from oil to GeoSolar
save $287K
over a 20 year mortgage.

Changing from propane to GeoSolar
save $253K
over a 20 year mortgage.

Assumptions: Electricity 11.3, 2% annual increase. Gas $1.20, 2.8% annual increase. Oil $4.00, 9.2% annual increase. Propane $3.50, 6.9% annual increase.