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Net Zero Energy Building Possible

CLOSED LOOP ADVECTION DEVICE
CLAD Geothermal

50% less expensive | 90% smaller land | 50% more efficient

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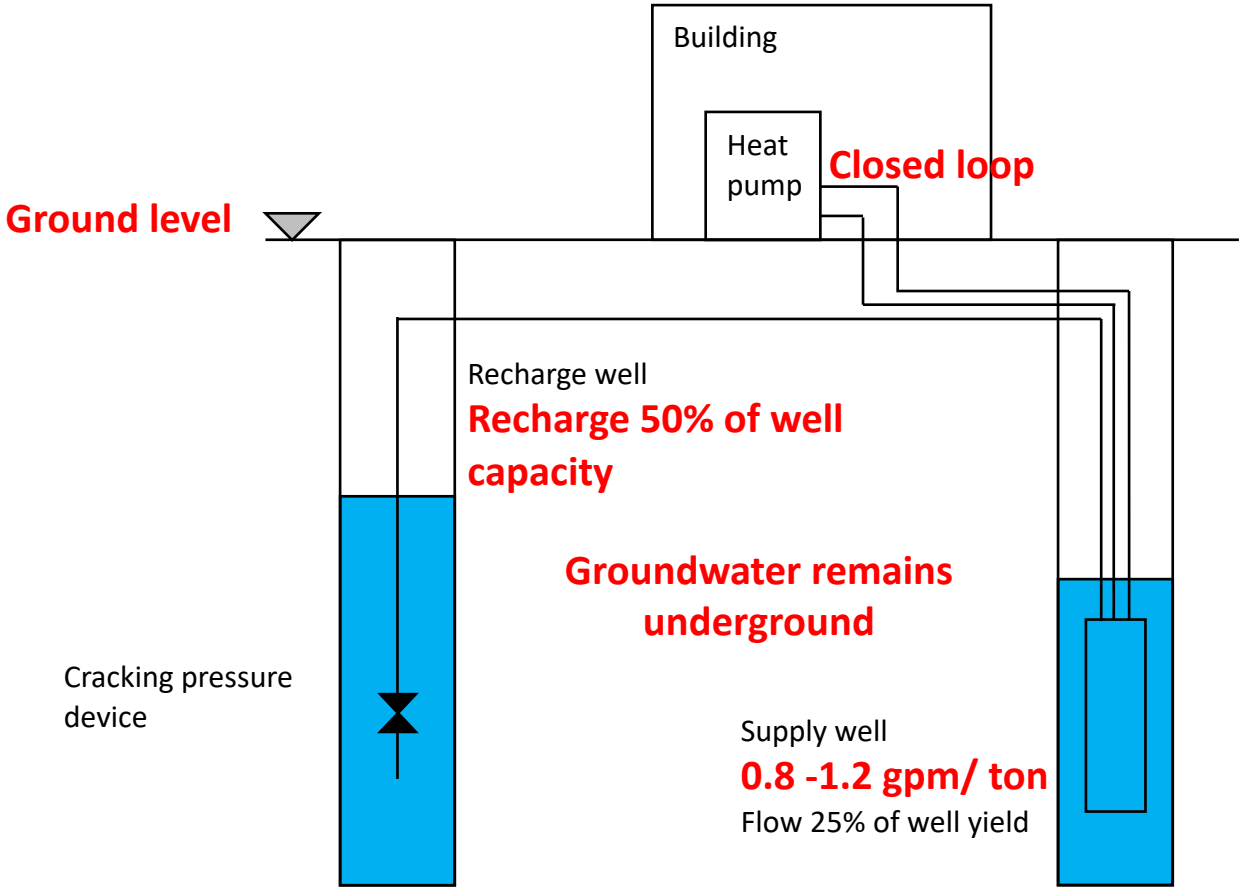
CLAD Concept



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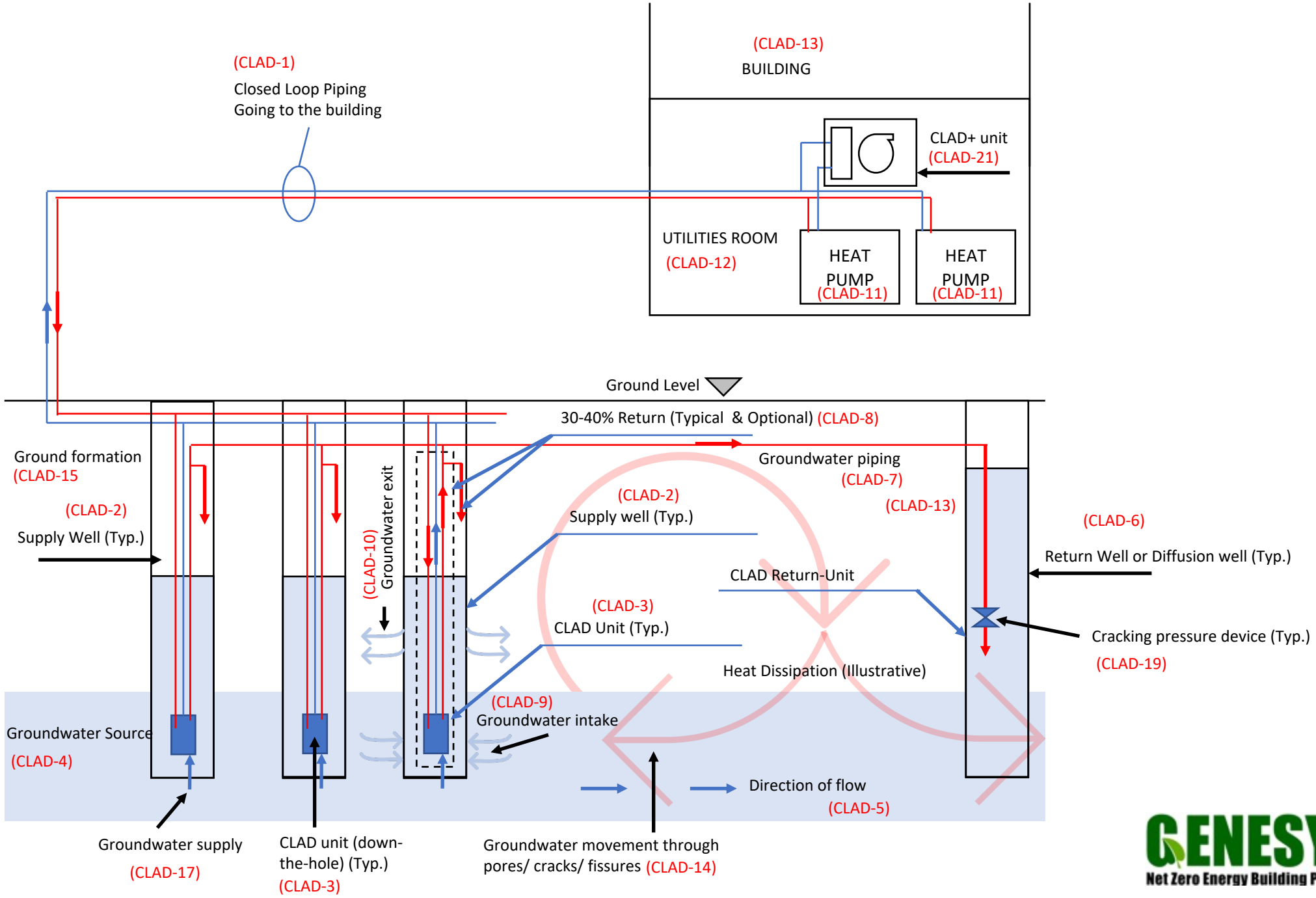

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Product Mix

Patent pending

- CLAD down-the-hole
- CLAD sub-surface
- CLAD Lake
- CLADER (installer)
- PAU (pitless adapter unit)
- BBE (software – business benefit estimator
- CLAD Sizer (design software)
- CLAD Cloud (IoT)

Standard Efficiency

Model	Ton	EWT (°F)	
		Cooling	Heating
CLAD-6	6	80	43
CLAD-20	20	80	43
CLAD-100	100	80	43

High Efficiency

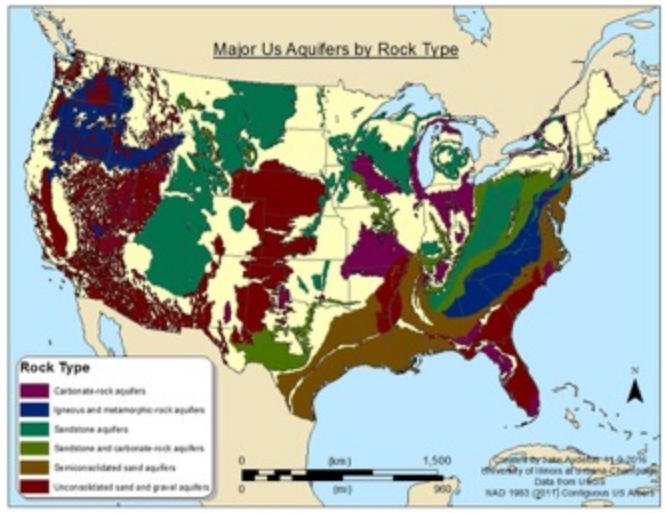
Model	Ton	EWT (°F)	
		Cooling	Heating
CLAD-6 HE	6	70	45
CLAD-20 HE	20	70	45
CLAD-100 HE	100	70	45

Ultra High Efficiency

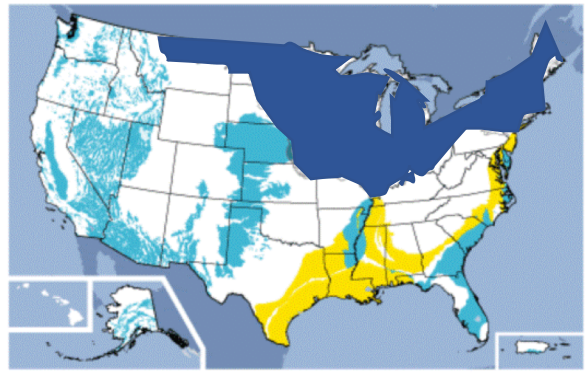
Model	Ton	EWT (°F)	
		Cooling	Heating
CLAD-6 UHE	6	60	47
CLAD-20 UHE	20	60	47
CLAD-100 UHE	100	60	47

The capacities and entering water temperatures are based on a nominal ground temperature of 56 ° F.

US Aquifers



PRINCIPAL UNCONSOLIDATED AND SEMICONSOLIDATED SAND AND GRAVEL AQUIFERS

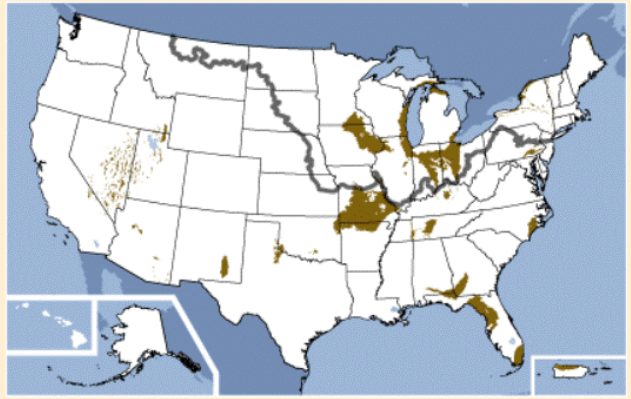


Unconsolidated sand and gravel aquifers at or near the land surface.

Semiconsolidated sand and gravel aquifers.

Sand and gravel aquifers of alluvial and glacial origin are north of the line of continental glaciation.

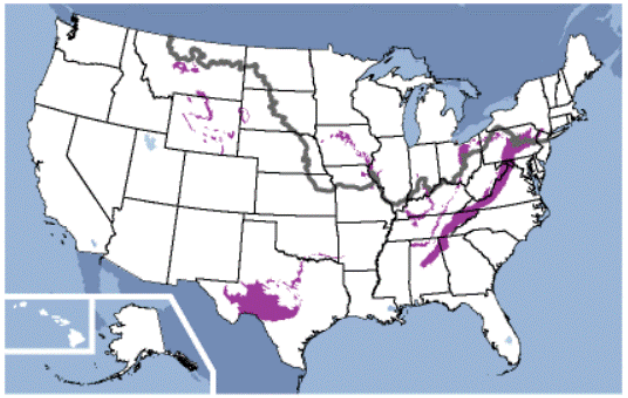
PRINCIPAL CARBONATE-ROCK AQUIFERS



Carbonate-rock aquifers at or near the land surface

Limit of continental glaciation. North of this line, glacial sand and gravel aquifers overlie bedrock aquifers in many places

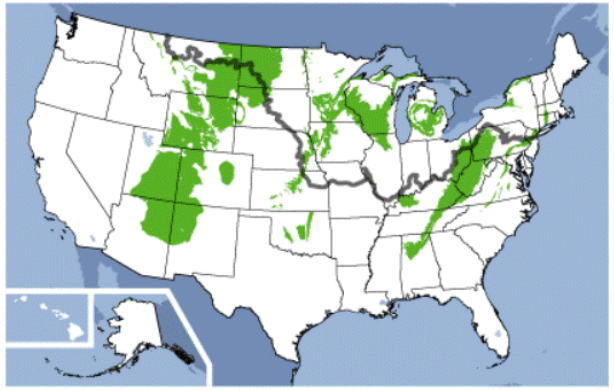
PRINCIPAL SANDSTONE AND CARBONATE-ROCK AQUIFERS



Sandstone and carbonate-rock aquifers at or near the land surface

Limit of continental glaciation. North of this line, glacial sand and gravel aquifers overlie bedrock aquifers in many places

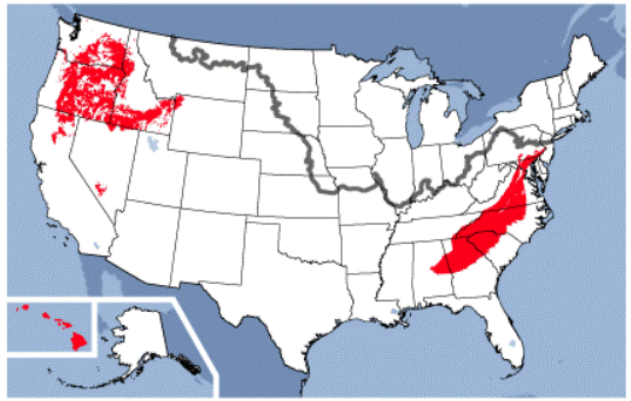
PRINCIPAL SANDSTONE AQUIFERS



Sandstone aquifers at or near the land surface.

Limit of continental glaciation. North of this line, glacial sand and gravel aquifers overlie bedrock aquifers in many places.

PRINCIPAL IGNEOUS AND METAMORPHIC-ROCK AQUIFERS



Igneous and metamorphic-rock aquifers at or near the land surface.

Limit of continental glaciation. North of this line, glacial sand and gravel aquifers overlie bedrock aquifers in many places.

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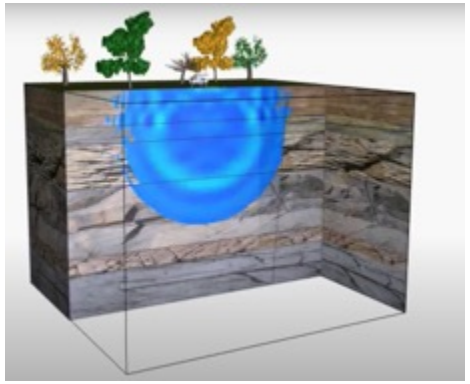
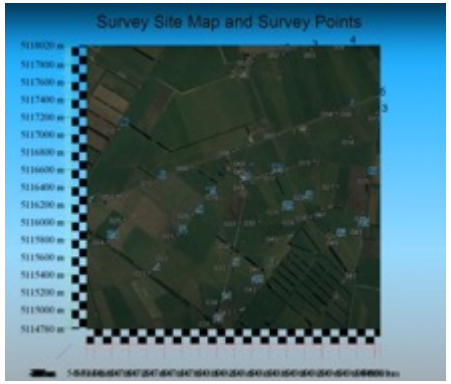
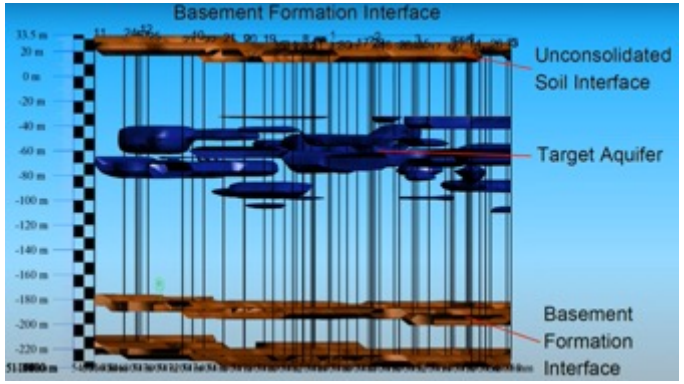
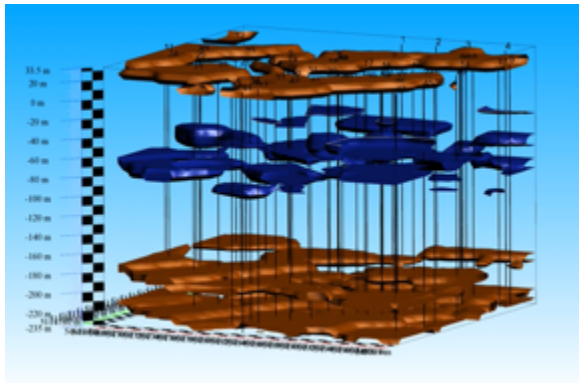
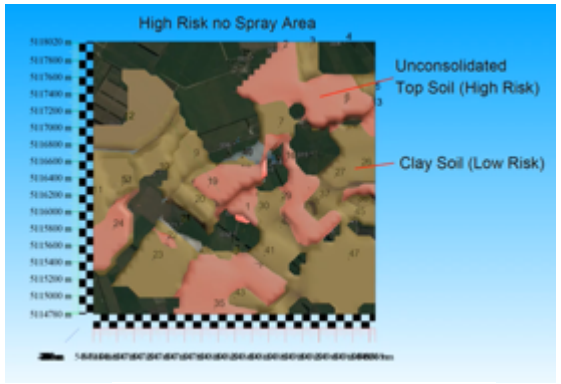
Site Survey Tools

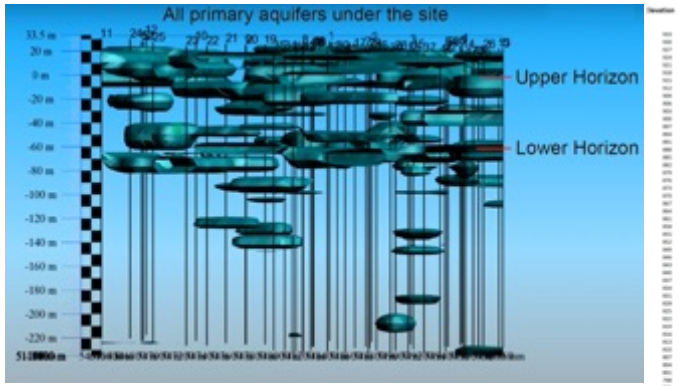


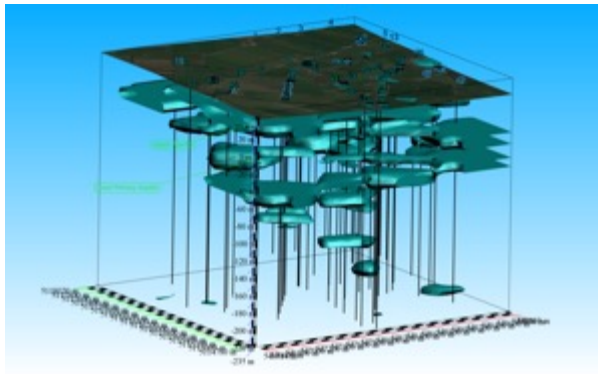


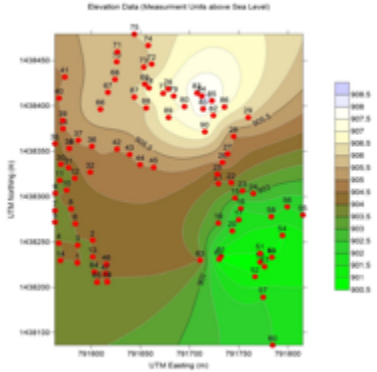


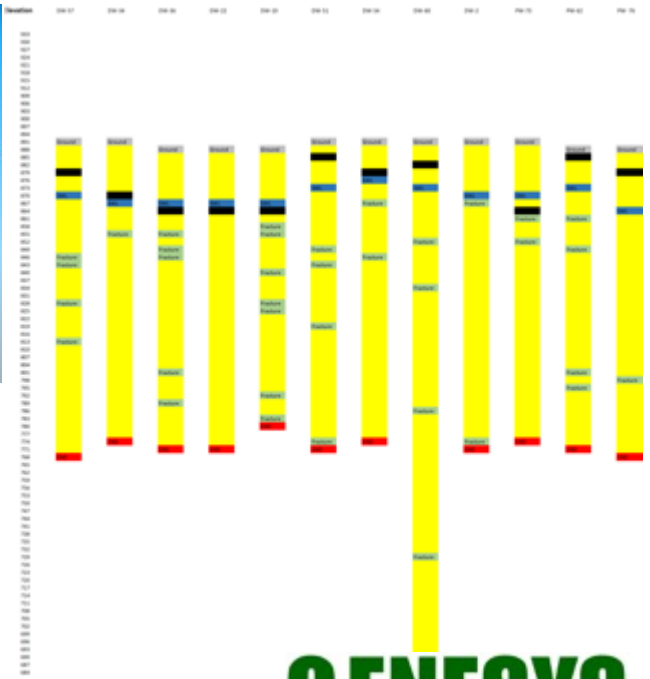












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Design & Sales Tools

- CLAD Sizer
  - Inputs
    - Hydraulic conductivity
    - Hydraulic gradient
    - Radius of influence
  - Output
    - Capacity per production well
    - Capacity per diffusion well
    - Pump selection parameters – flow/ total head

- Cost estimator & proposal builder
  - Database
    - Component cost tables
  - Inputs
    - Number of wells
    - Editable pipe lengths
  - Output
    - Bill of quantities (BOQ)
    - Standard editable proposal

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Design & Sales Tools

- BBE – Business Benefits Estimator System
  - Hourly iterative performance builder
  - Equipment options
    - Scroll, screw, and centrifugal chillers – air-cooled & water-cooled (cooling only)
    - Split systems – air-cooled & water-cooled (cooling only)
    - Heat pumps – air source, water source, and dual source
    - Furnace
  - System option
    - Geothermal – closed loop, open loop, standing column, CLAD, Lake loop
    - Hybrid (geothermal and cooling towers)
  - Input options
    - ASHRAE cities/ weather data/ geographical data (pre-loaded database)
    - Preloaded load profiles (bell curve/ constant/ cooling only/ heating only/ manual entry)
    - Utility rates
  - Output
    - Hourly analysis
    - Savings summary & payback
    - Triple bottom line analysis (commercial, environmental & social impact)

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Summary ….

- Building loop is a closed loop
- Use of glycol possible
- 10 times more efficient than closed loop – 90% less ground area
- Assures scalability
- No thermal build-up
- No abandoning of wells due to underground leakages
- Product readiness
- Component reliability – HXs are field tested in critical applications
- Standardized design and sizing tools

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FAQ's ….

1. How much water do you need for a 6 ton unit?
   - 7.2 GPM (~1.2gpm/ton)

2. What size diameter well and how deep?
   - 5", 6" and 12" casing for 6, 20 and 100 tons…Typically 50 –70 ft .

3. How many supply wells per diffusion well?
   - 2-3 depending on ground conditions. Can also discharge into surface water, storm drain etc.

4. Any water quality issues? How is it handled?
   - Material, surface finish, no O2 exposure, turbulent flow in HX

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FAQ's ….

5. What about pressure drops and pump energy?
   - High turbulence BUT only in a short length. Cracking pressure device.

6. Is the well pump always turned on? How is it controlled?
   - No. Temp controlled and variable speed. Passive heat transfer possible.

7. Issues with permit? What has been your experience?
   - Show all your cards!!

8. Can I order a few today?
   - Absolutely!

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