CLOSED LOOP ADVECTION DEVICE
CLAD Geothermal

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

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Closed loop
Supply well
0.8 - 1.2 gpm/ton
Flow 25% of well yield

Recharge well
Recharge 50% of well capacity

Groundwater remains underground

Cracking pressure device

Building
Heat pump

Ground level

CLAD Concept
Closed Loop Piping going to the building

Supply well (Typ.)

CLAD unit (Typ.)

Ground Level

30-40% Return (Typical & Optional)

Groundwater piping

Groundwater intake

Groundwater movement through pores/cracks/fissures

Ground formation

Groundwater supply

Cracking pressure device (Typ.)

Return Well or Diffusion well (Typ.)
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)

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<tr>
<th>Standard Efficiency</th>
<th>Model</th>
<th>Ton</th>
<th>Cooling</th>
<th>Heating</th>
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The capacities and entering water temperatures are based on a nominal ground temperature of 56 °F.
Site Survey Tools
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
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)
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
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
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!