



An Energy Efficiency Workshop & Exposition

Palm Springs, California

# **GEOHERMAL CASE STUDY AT ABERDEEN PROVING GROUND**

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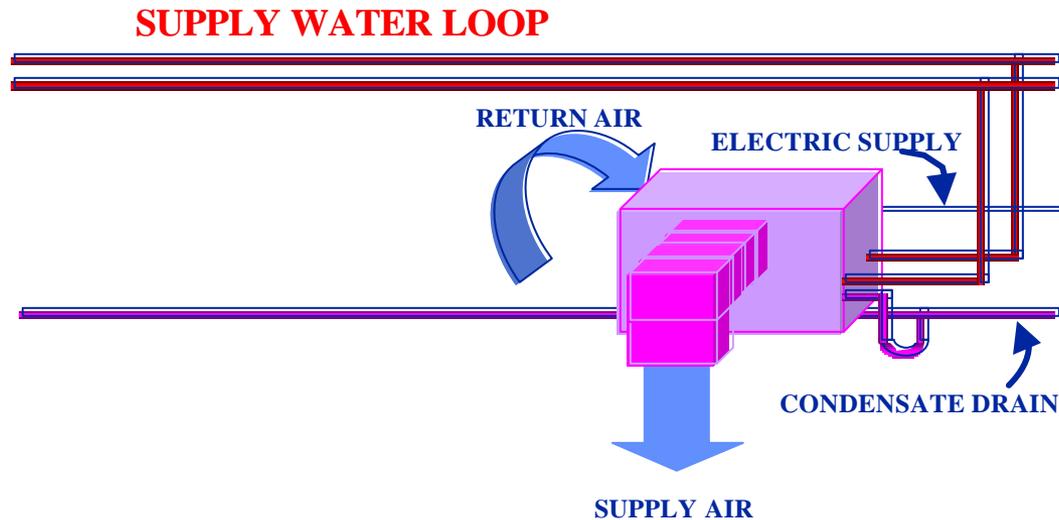
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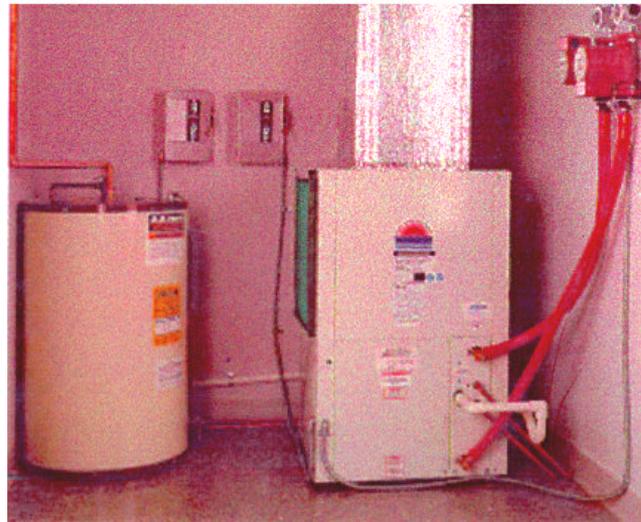
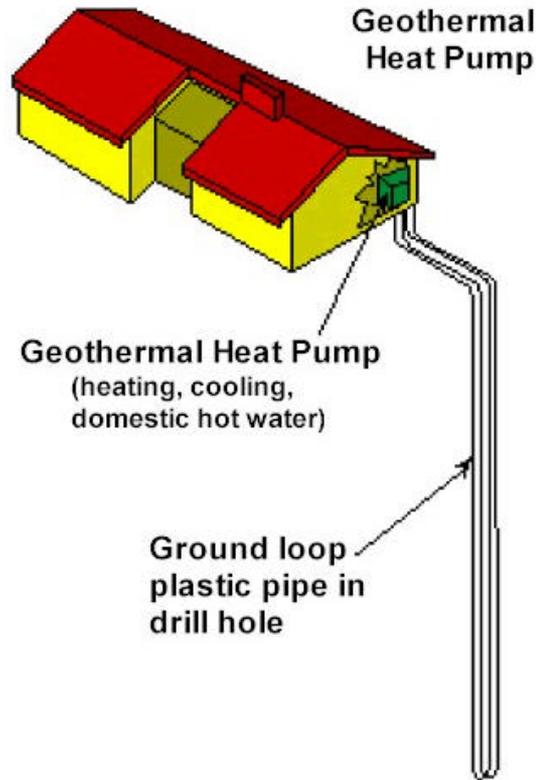


# What is a GHP?



A Heating & Cooling System that takes advantage of the earth's relatively constant temperature by using the ground as a heat sink for cooling and heat source for heating.







# *CESource Video*





## *The Problem*



- 643 Military Family Housing Units
  - Marginal ATAHP's originally installed
  - High failure rate, end of useful life
- APG needed replacements
- No Funding Budgeted for this need!



## *APG Options*



- Do Nothing
  - Tenant complaints high, Increasing APG Man-hours, inefficient equipment costly
- Utility Energy Services Agreement
  - Limited to 10 year financing
  - Stipulated savings
- Energy Savings Performance Contract
  - Financing up to 25 years
  - Performance Guarantee, M&V
  - Includes Maint, R&R, Emergency Response



## *Solution*



- DOE's FEMP Super ESPC
  - National Geothermal Heat Pump Super ESPC
  - GHP equipment and Performance Period Costs paid through energy savings
    - No Capital Required !
  - Established Contract Vehicle
    - DOE, DESC, ORNL supported
  - Existing relationship with CESource



## *APG Constraints on GHP - ESPC*

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- \$0 Buydown
- Financing not to exceed 20 years



## *APG - GHP Scope of Work*



- Engineer, Design & Construct 643 GHP Systems to replace ATAHP's
  - Install de-super heater to existing HWH's as applicable
- 20 year Full Service Contract
- M&V of GHP Unit Efficiencies over 20 year performance period
- Savings to exceed all costs over 20 years



## *Keys to Successful Award*



- ❑ **Innovation, Diligence and Persistence by DOE, DESC**
- ❑ **Good & Trusting Relationship between APG & ESCO**
- ❑ **Being VERY Conservative with Savings Estimate**
- ❑ **Risk/Cost Mitigation efforts between parties**



## *Risk / Cost Mitigation Efforts*



- Development of mutually acceptable termination and prepayment language
- Utilization of construction period savings to “buydown” principal
- M&V for performance guarantee of unit efficiencies



## *Risk / Cost Mitigation Efforts (con't)*



- Title Conveyed to APG after acceptance
- Structured P&I payments to effect a positive cash flow each year
- Additional savings over annual payment to be reserved for unknown conditions during construction



## *Construction Findings*



- Existing deficiencies with ATAHP's
  - Many units had little to no refrigerant
  - Clogged filters
  - Corroded resistive heating elements
  - Inadequate duct work in some units
- Deficiencies found with HWH's
  - Corroded heating elements
  - Excessive sediment buildup
- Correction of these deficiencies results in additional savings to APG



## *APG – GHP Award*



- **\$5.7M Contract**
  - \$0 Buydown
  - 12 Month Construction
- **20 Year Performance Period**
  - \$4M over 20 years
  - Includes M&V
  - Maintenance & Repair
  - 24/7 Emergency Response



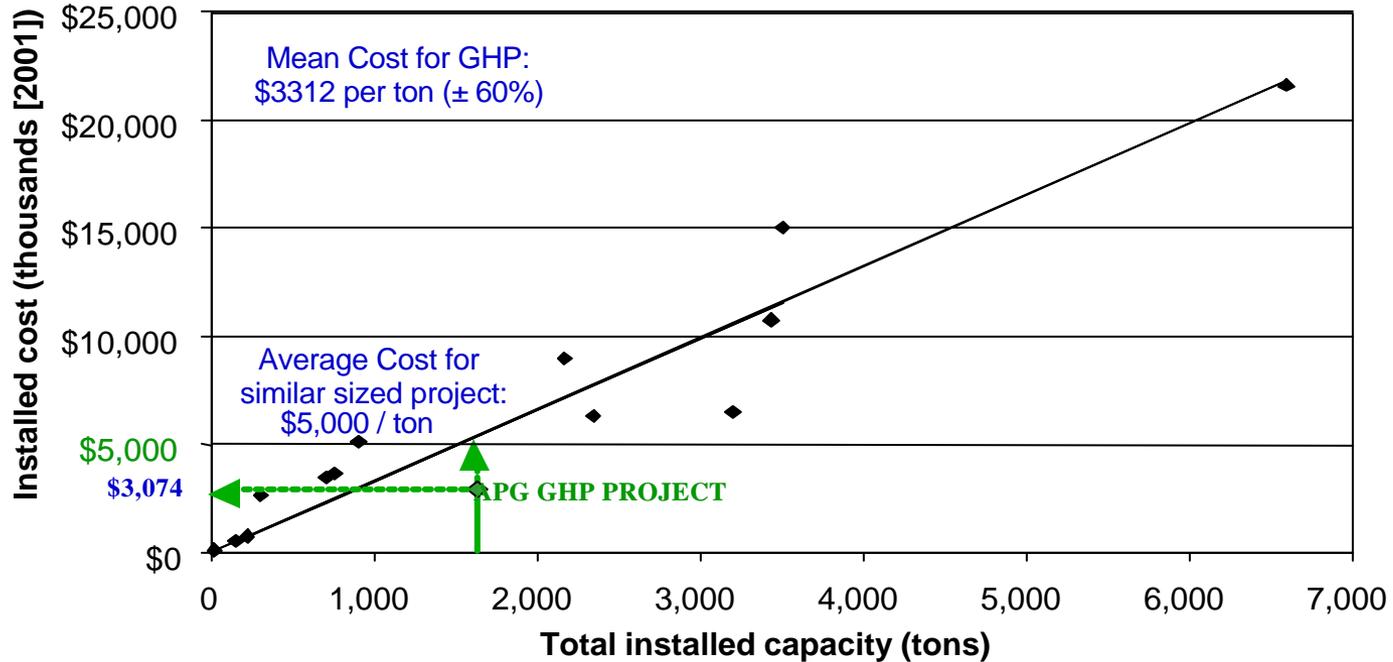
## *Results*



- \$600K Annual Savings
- 8,600,000kWh saved per year
- Reduced Emissions
  - Equivalent to 785,000 gallons of gasoline saved per year, 2500 acres of trees planted per year, or over 1200 vehicles removed from the road
- Assist APG's energy reduction, reduced emissions and renewable energy goals



### Installed Cost of Multi-Home Residential Vertical Bore GHP Retrofit Projects



NOTE: ASHRAE will be adopting this Database for GHP Projects



# DISCUSSION