

# Utility Energy Forum

Emerging  
Technologies  
Panel 2009



Short Term and  
Long Range  
Planning

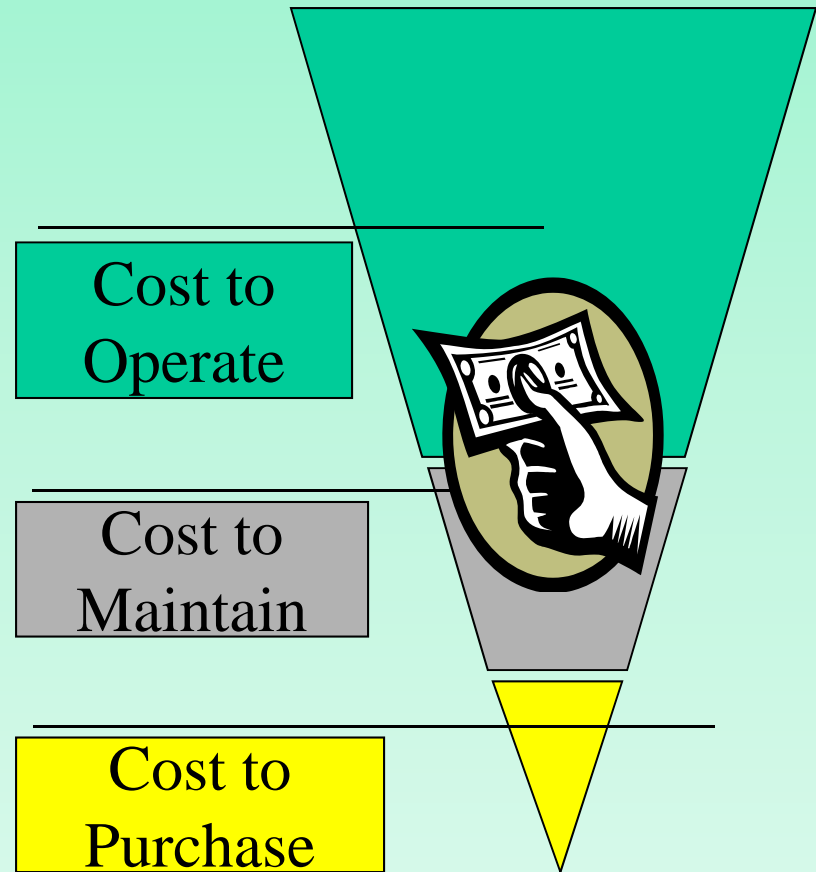
Where in the resource  
portfolio does a 65 year  
old technology fit???

# Impacts of Investment Decisions

Utility M&V programs will help quantify the impacts

“We have always dealt with hassles short term. What is valued now is looking at the long term hassle of the decisions we make with a short term attitude.”

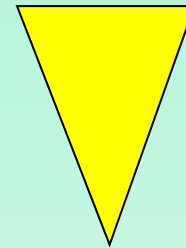
Brion McDonald, President, Universal Building Systems, Palo Alto, CA



# Cost to Purchase HVAC Systems

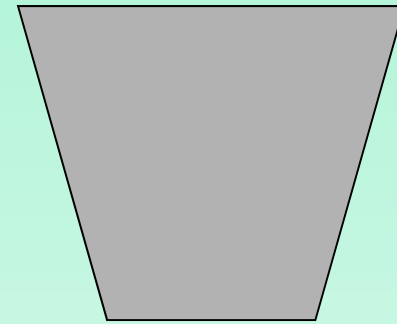
Conventional is  
cheaper than GHP

Higher SEER rated  
equipment tend to  
be higher priced



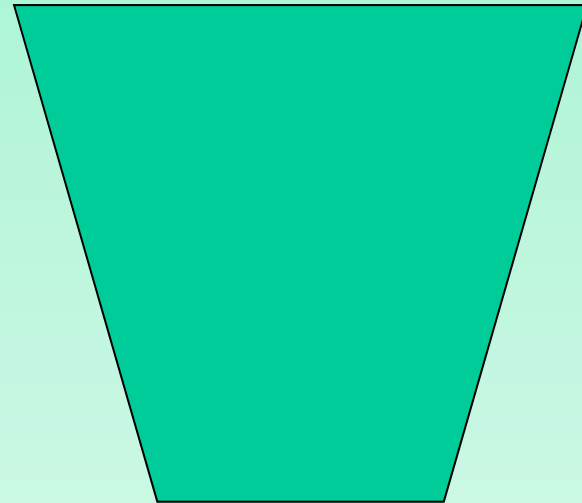
# HVAC Maintenance Costs

Exposed equipment  
needs more  
maintenance and  
has more  
vulnerability than  
equipment internal  
to the building or in  
the ground

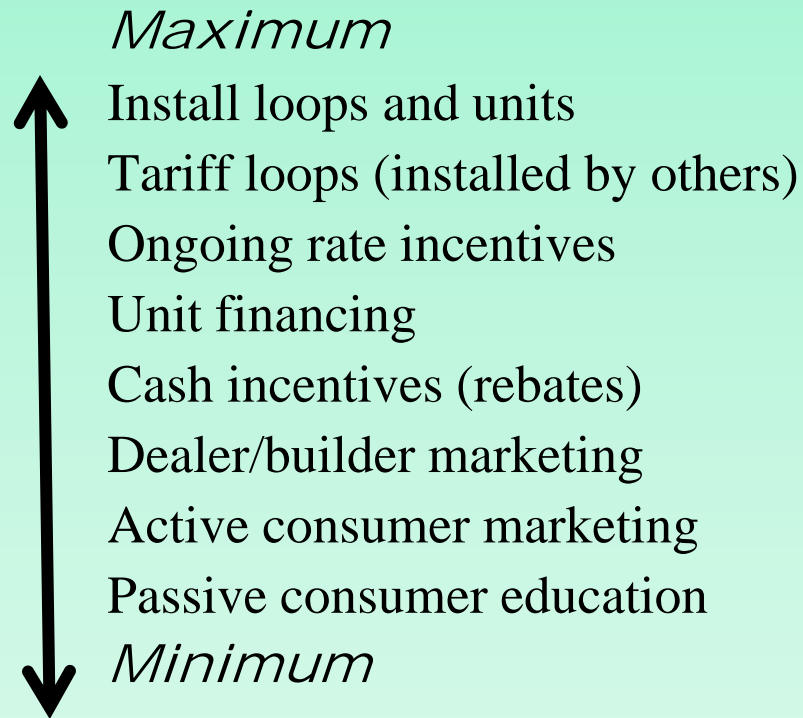


# HVAC Operating Costs

- Energy prices
- Chemical and other commodity use
- Carbon footprint
- Other externalities
  - Noise
  - Comfort
  - Productivity



# Levels of Utility Participation in GHP Programs



# Utility Led Mass Market GHP

**Transformation** CAUTION: Some utilities may need to strap on leadership skills and courage

- Establishing incentive levels and ancillary services for a pilot program,
- Assessing, maintaining and enhancing installer skill levels,
- Selecting sites,
- Installing GHP systems (and other cost-effective energy efficient measures),
- Commissioning installations,
- Evaluating performance, and
- Revising the program design and launching full scale, dedicated programs.



Why Utilities – because  
somebody has to carry the load





# Report ORNL/TM-2008/232

- Sponsor
  - DOE Geothermal Technologies Program
- Question posed
  - Have policymakers mistakenly overlooked GHPs as a component of national energy/climate strategy?
- Where can I get report?  
[www.zebralliance.com](http://www.zebralliance.com)

OAK RIDGE  
NATIONAL LABORATORY  
MANAGED BY UT-BATTELLE  
FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2008/232

Geothermal (Ground-Source) Heat Pumps:  
Market Status, Barriers to Adoption, and Actions to  
Overcome Barriers

December 2008

Prepared by  
Patrick J. Hughes  
Energy and Transportation Science Division

Sponsored by  
EERE Geothermal Technologies Program  
U.S. Department of Energy

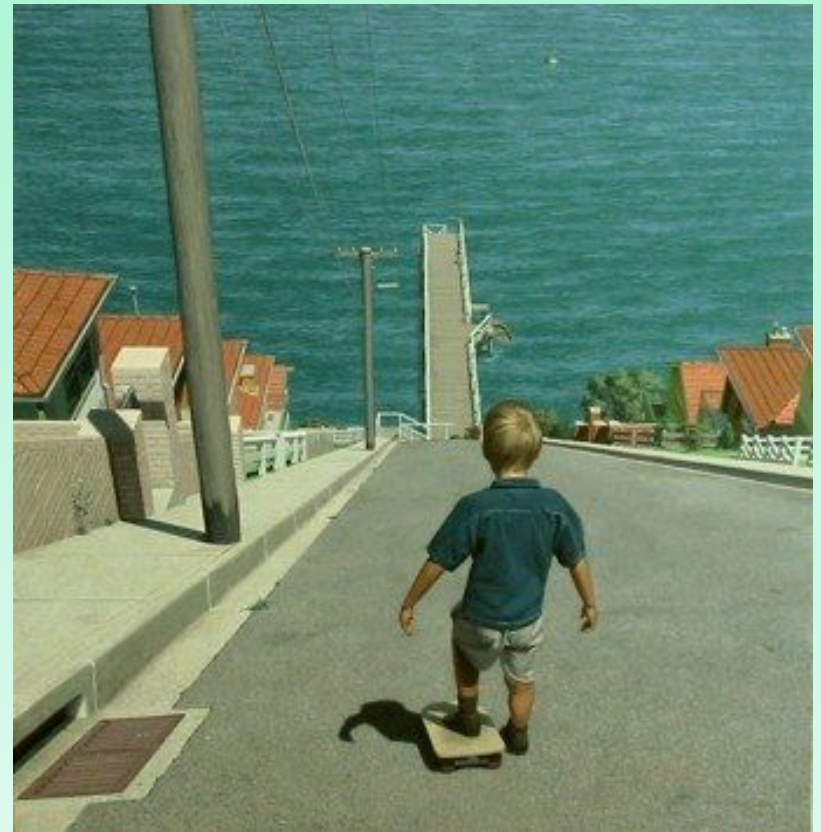
UT-BATTELLE  
ORNL-27 (A-00)

# Utility Risk Considerations

High first-cost of GHP systems

Lack of:

1. Customer and regulator knowledge and/or trust in benefits
2. GHP design and business model infrastructure
3. GHP installation infrastructure
4. New technologies and methods to improve system cost/performance



# The Loop Tariff

Proven energy service that provides  
geothermal heat pump loops to utility  
customers

**At an affordable price**

**The energy savings is greater than the  
monthly loop payment\***

\* After loan amount reduced by rebates, tax credits and other  
incentives



# The Loop Tariff

- Eliminates the first cost barrier (new construction) and reduces it for retrofit applications.
- Adds winter kWh load while reducing summer peak demand.
- Provides two utility revenue streams and provides customers with a lower total energy cost than they had before.



# Findings From National Focus Groups:

25-30% of participants said they would participate in a utility GHP financing program! (Higher acceptance than anti-lock brakes received when originally tested)

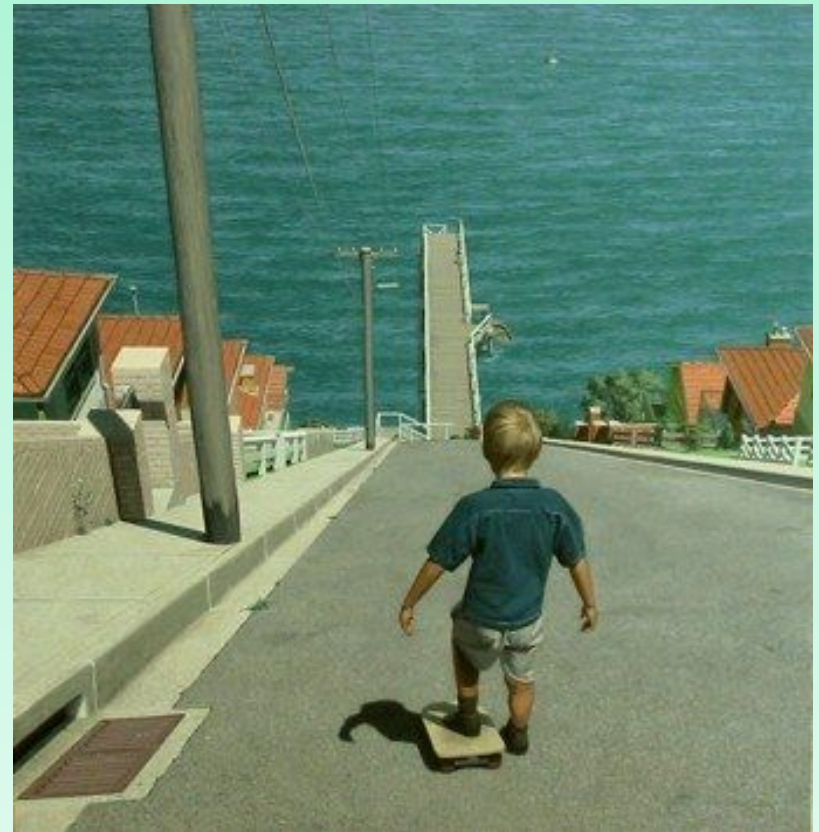


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# *The Customer Response*

Sample Customer Survey Results (Summer 2003)

Aware Of What A GHP System Is?



*Increase from 35%  
awareness in the 1991  
survey*

*Of those aware of what a  
Geo-Exchange system is,  
80% say its a good HVAC  
system*

# A Tale of Two Buildings

Oklahoma City, OK

## ***PROJECT RESULTS FROM:***

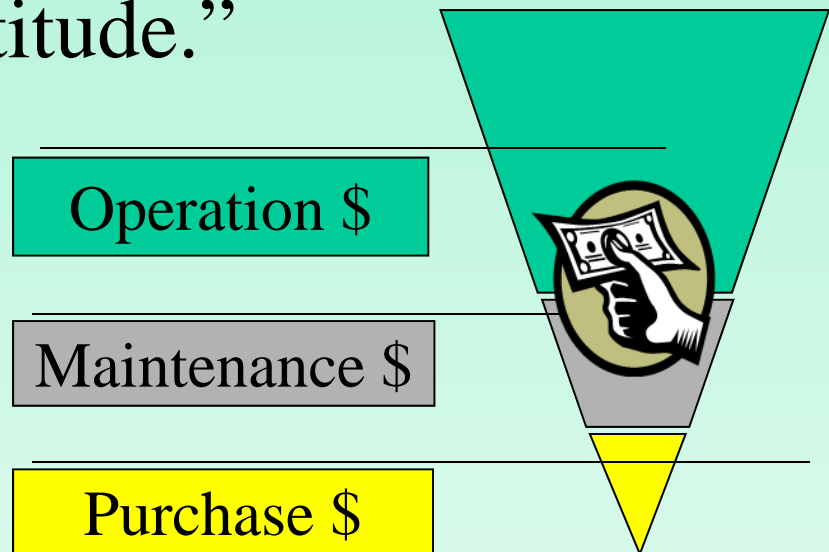
*A “side by side” Comparison of a  
Ground Source Heat Pump System  
vs. Conventional HVAC System  
between two “identical” buildings.*



# Testimony of a Building Owner

“We have always dealt with hassles short term. What is valued now is looking at the long term hassle of the decisions we make with a short term attitude.”

Brion McDonald, President  
Universal Building Systems



# Oklahoma City Buildings

Conventional 15,000 sq ft

GHP 20,000 sq ft

Conventional Roof Top VAV Building Built in  
1987

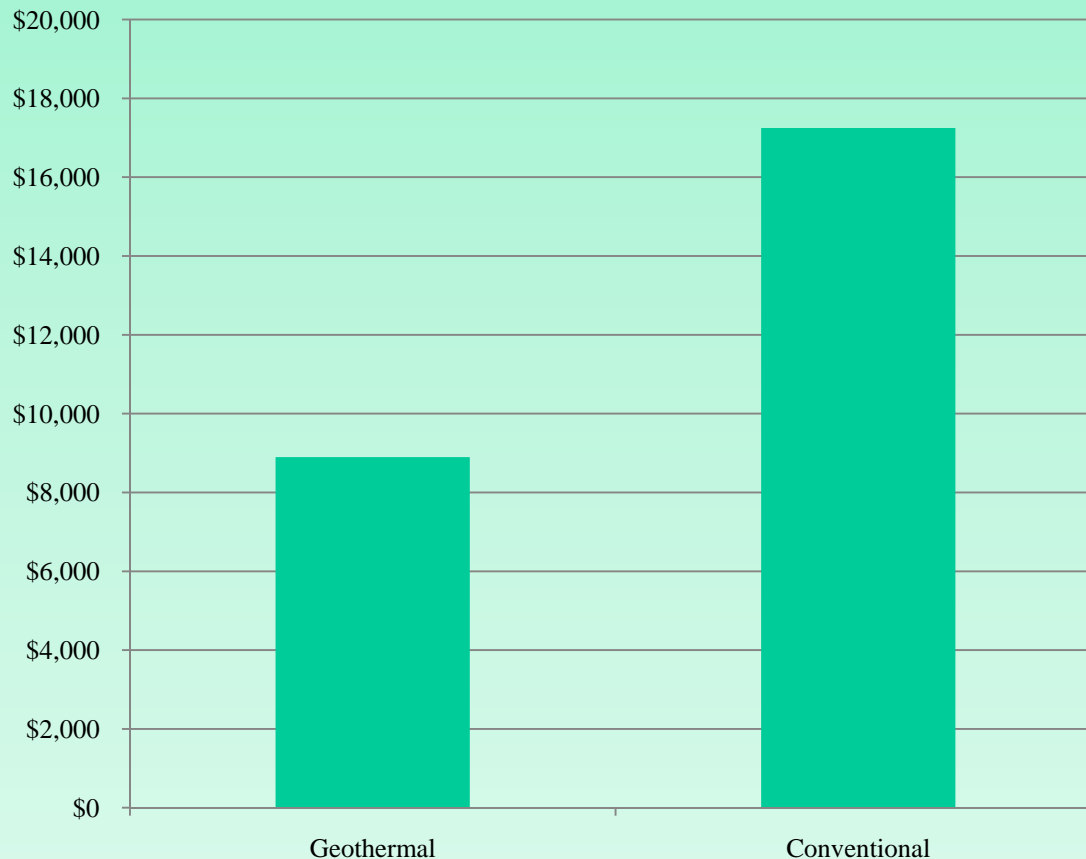
GHP Building Built in 1997

40 boreholes drilled 250 feet deep on 20 foot centers  
and 3/4 inch PE pipe

16 Ceiling Mounted Units

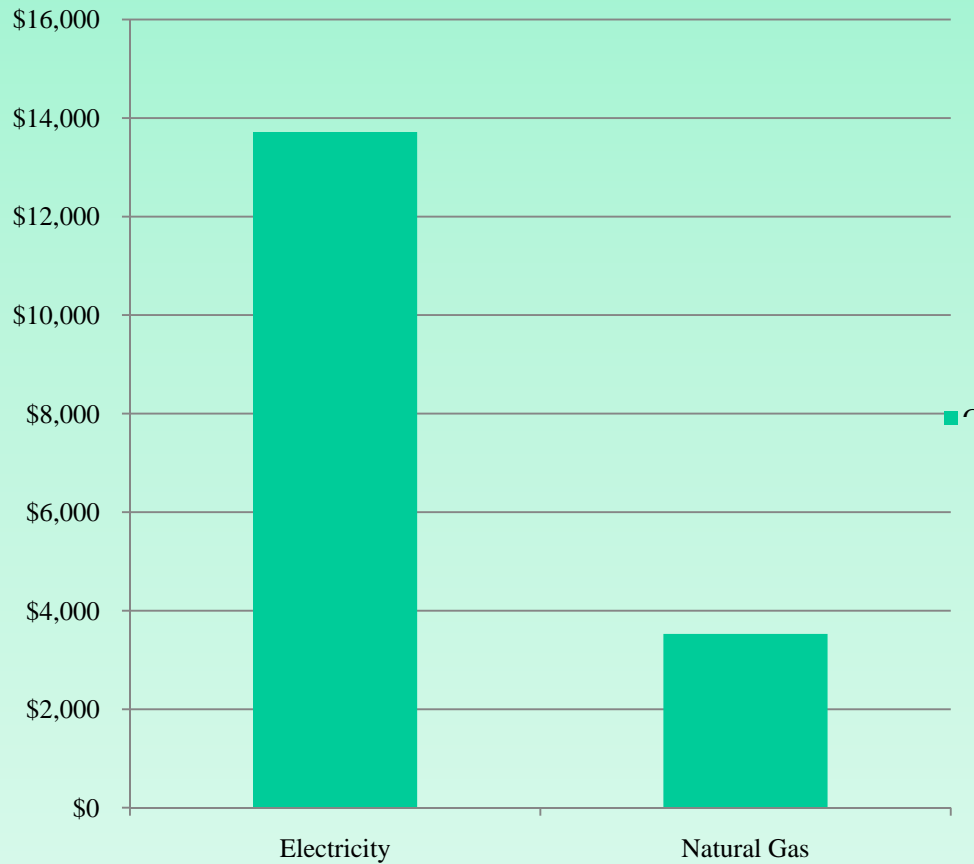
# Oklahoma City Buildings

**Average Annual HVAC Energy Costs**

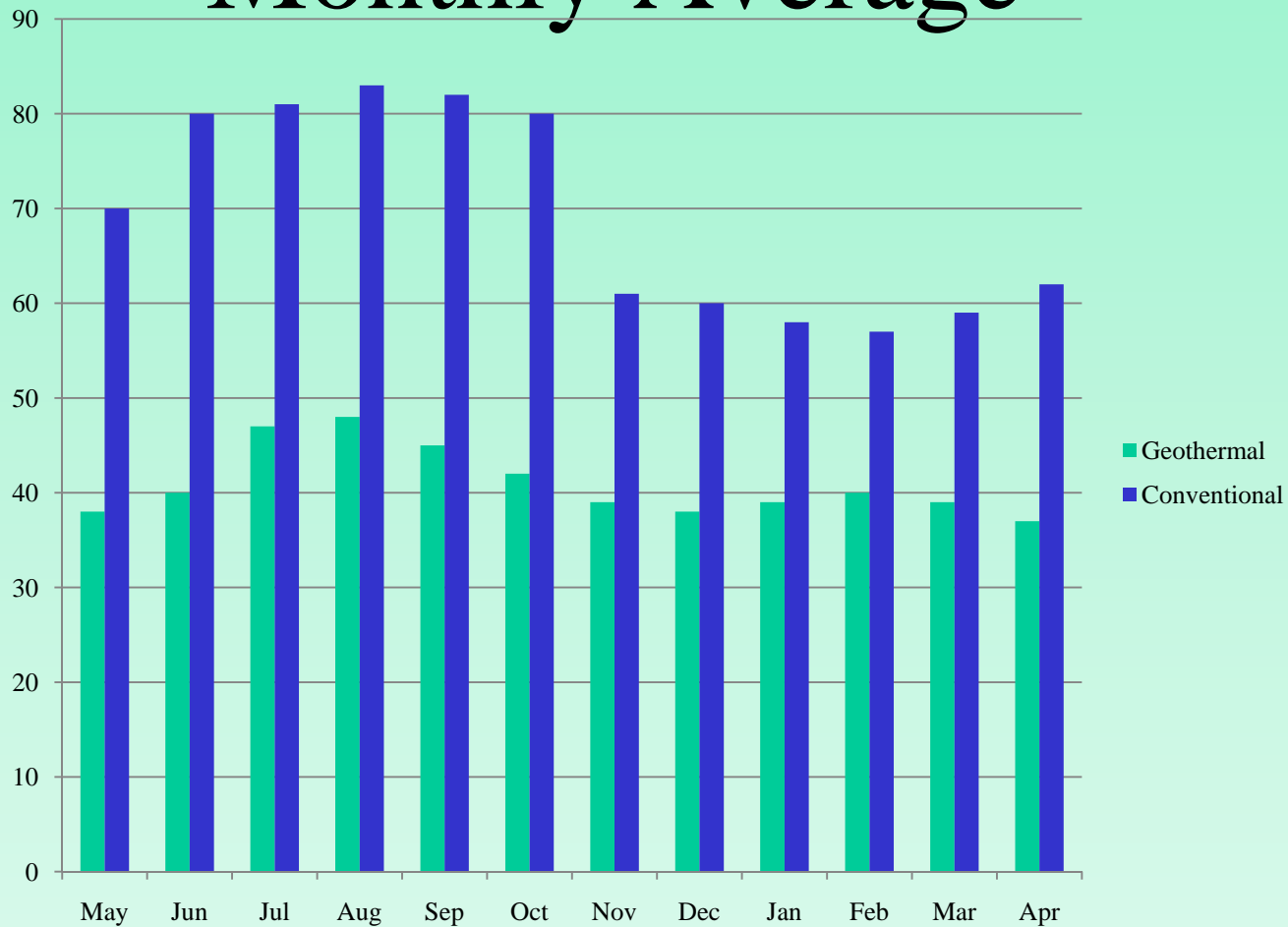


# Conventional Building

**Average Annual HVAC Energy Costs**



# kW Demand – Four Year Monthly Average



# Hope Crossing Project Oklahoma City, OK

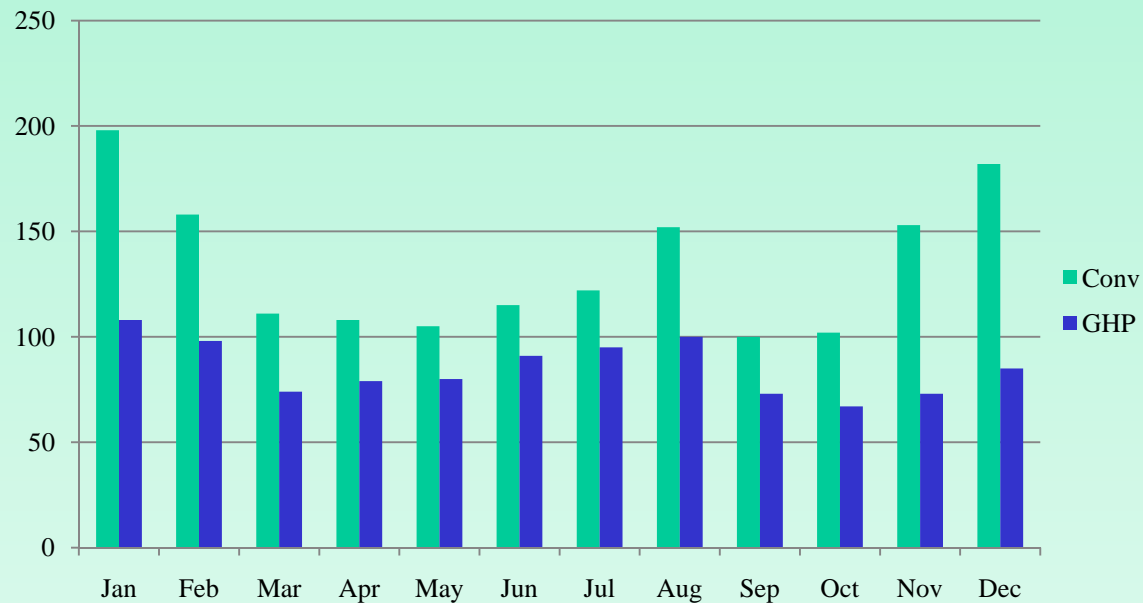
- Administered by Habitat for Humanity, Int'l
- Construction Started in 2004 1100 sq ft detached
- GHP home construction began in 2006
- Goal of an additional 240 homes with GHP
- Goal is important to demonstrate cost savings on a mass market scale

# Hope Crossing GHP Program Design

- Break the GHP first cost barrier
- Install one 400 ft loop under the foundation
- Achieve the greatest cost-effective energy efficiency level
- Track energy use to establish baselines
- Use the program for publicity purposes to:
  - Make it the “default” case in future HFHI projects
  - Attract more donations to HFHI to create more projects

# Hope Crossing Ave Metered Energy Costs (\$)

Energy Savings = \$1606 - \$1023 = \$583/yr



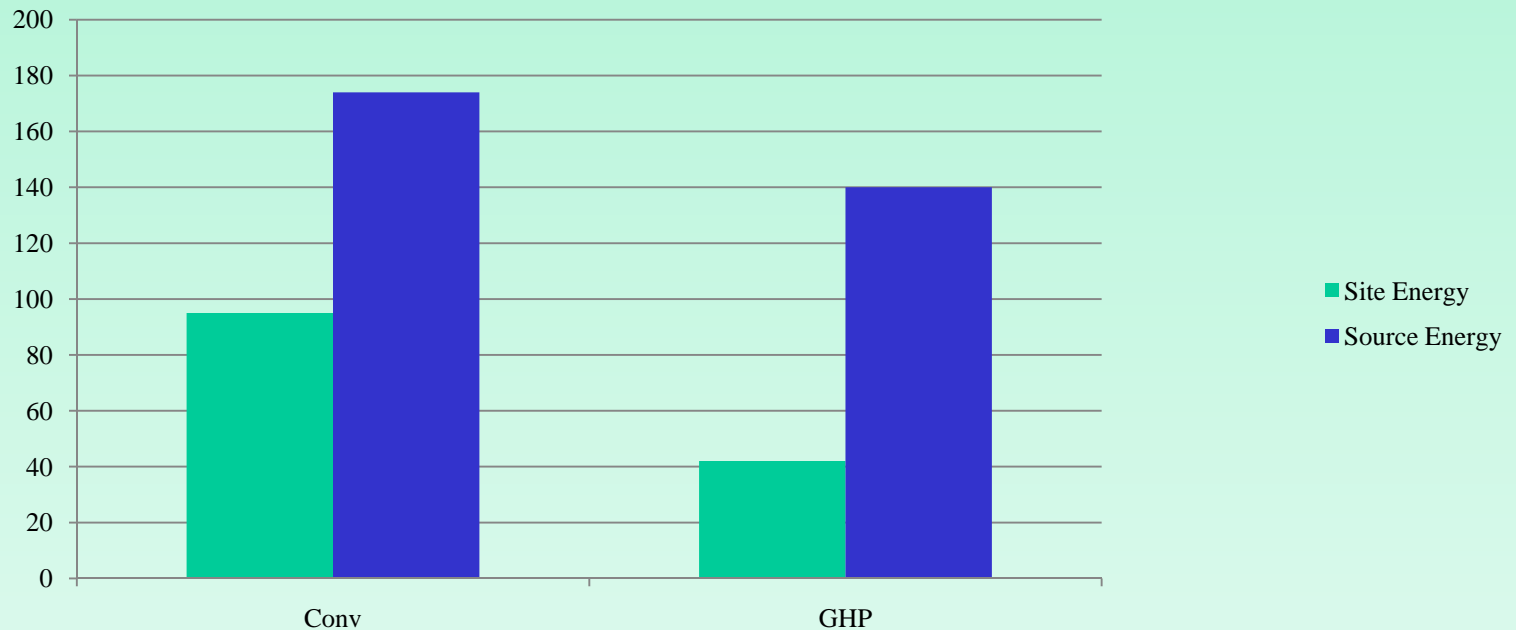


# Hope Crossing Site and Source Energy Consumption (MM Btu/ton

## Source Energy Benefits of GHP

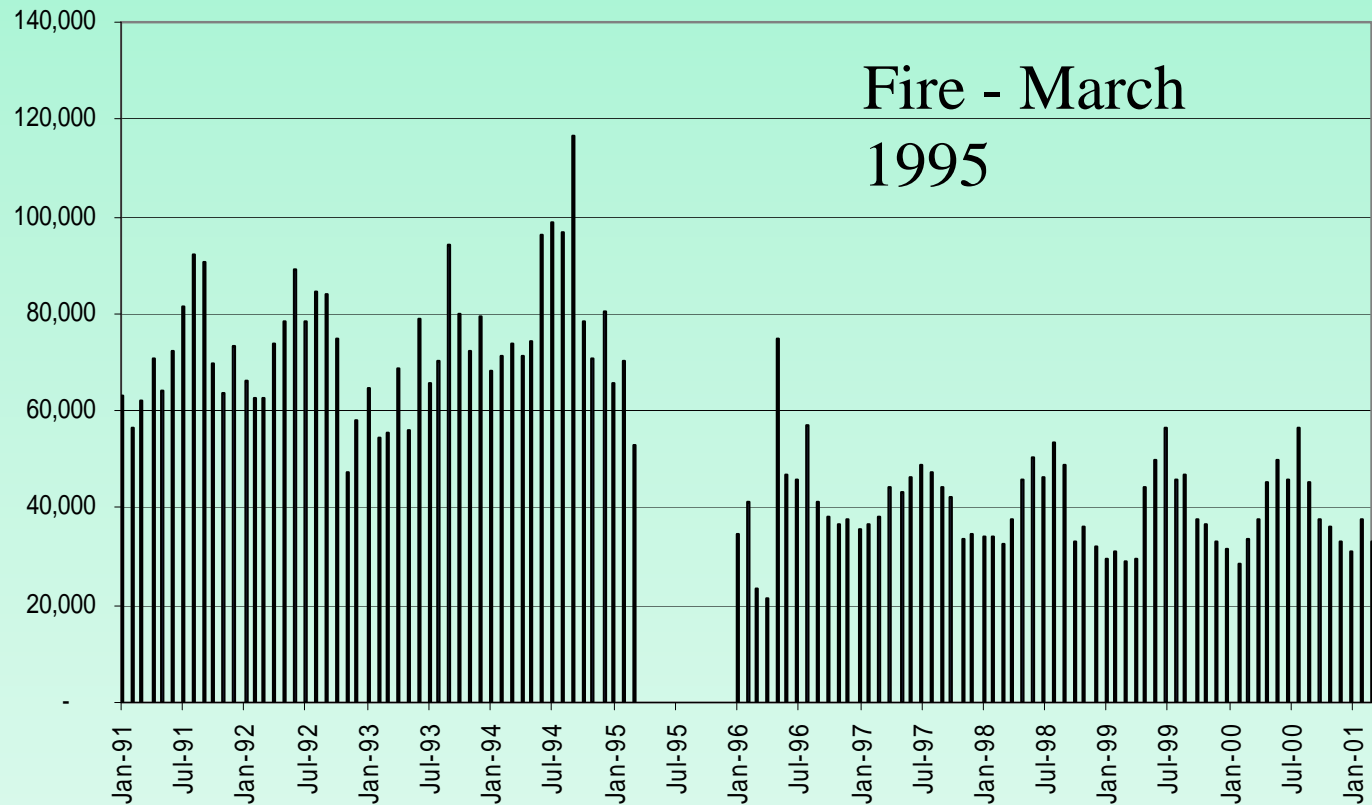
34 MM Btu /yr lower for GHP = 17 MM Btu per Ton

1 ton of CO<sub>2</sub>/yr reduction per ton of GHP

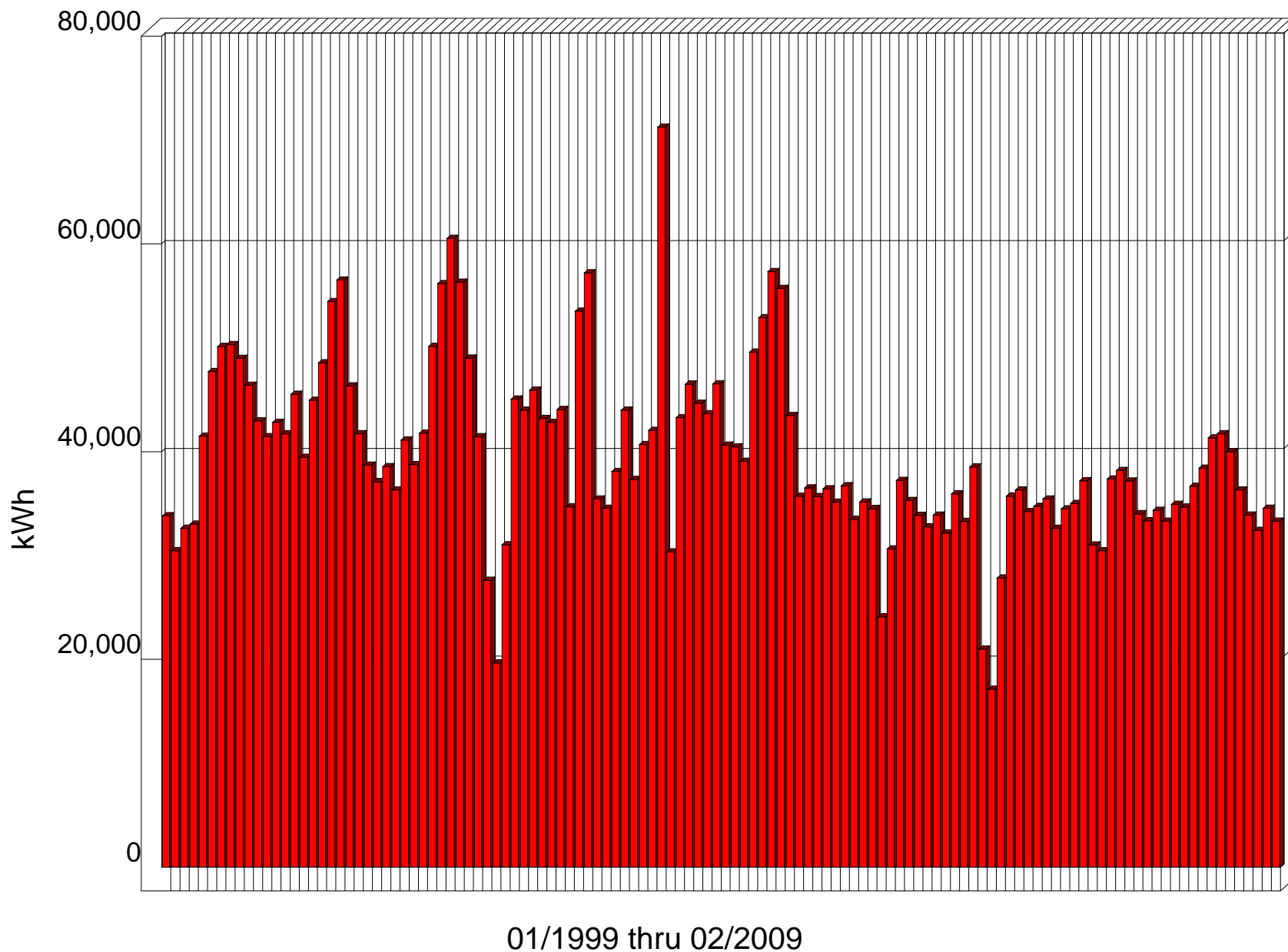


# A Fire isn't all Bad News

Oquirrh Elementary (Kwh) History



# Monthly Electricity Use for West Jordan Elementary



# GHP Capacity Benefits (to the utility)

Assumption – 1/2 kW per home peak capacity savings from a 3 ton GHP system

Wholesale Capacity Cost - \$ 10 per kW month

20 year system life

Net Present Value (NPV) ???????????



# GHP Capacity Benefits NPV

@ \$5 per month/ton and three discount rates

- 5% - \$ 748
- 3% - \$ 893
- 7% - \$ 635

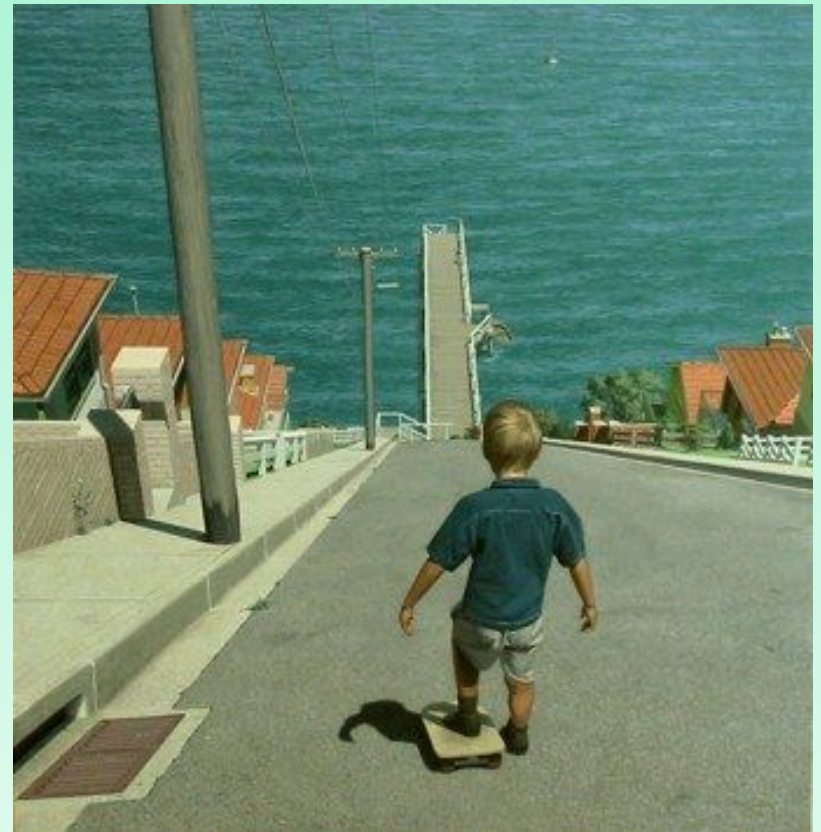


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# GRC Educational Series to promote GHP businesses and infrastructure



# **Other GRC Educational Series Sponsors\***

ClimateMaster

National Renewable Energy Laboratory

Southern Methodist University

University of Nevada Reno

University of Utah

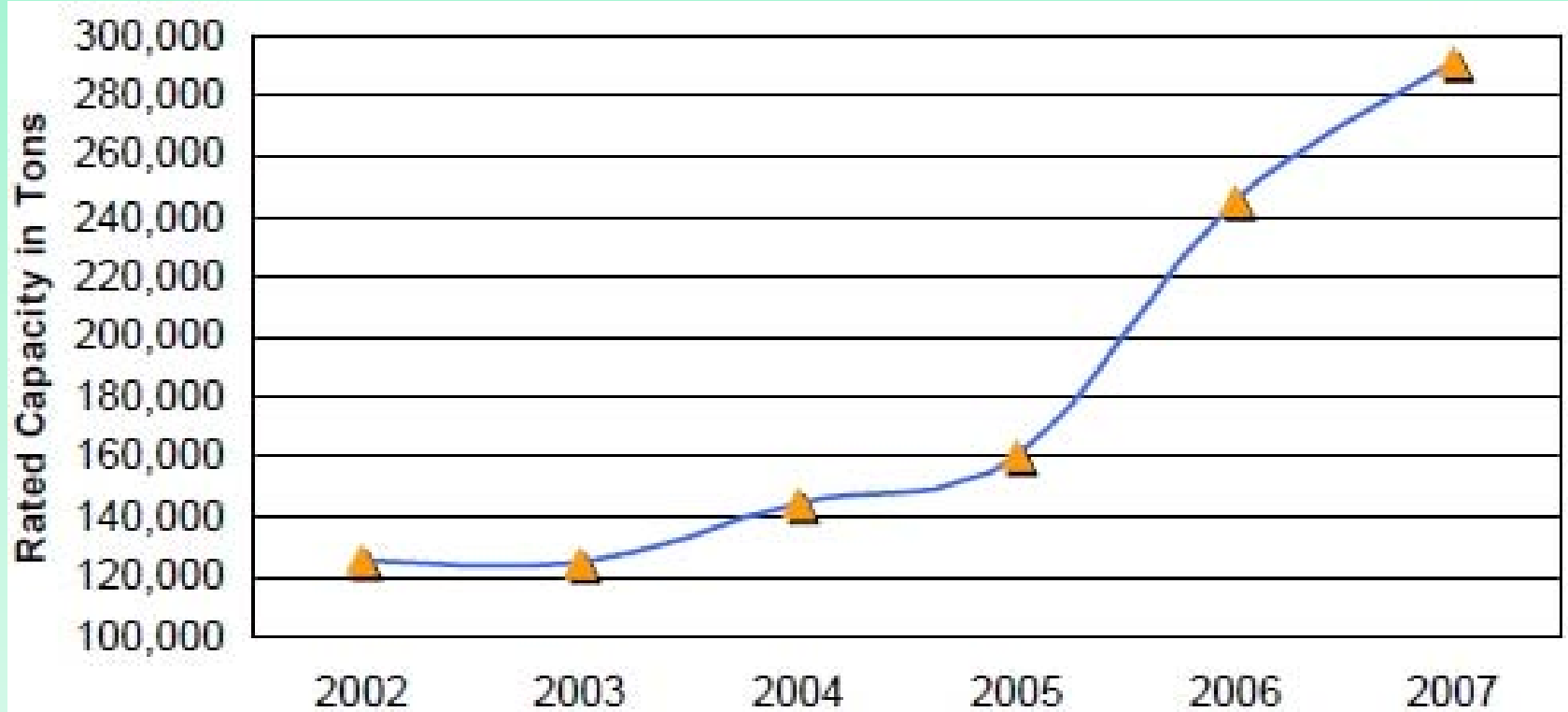
US DOE Geothermal Tech' Program

\* The series also covers geothermal power production, other resource options, and utility planning issues



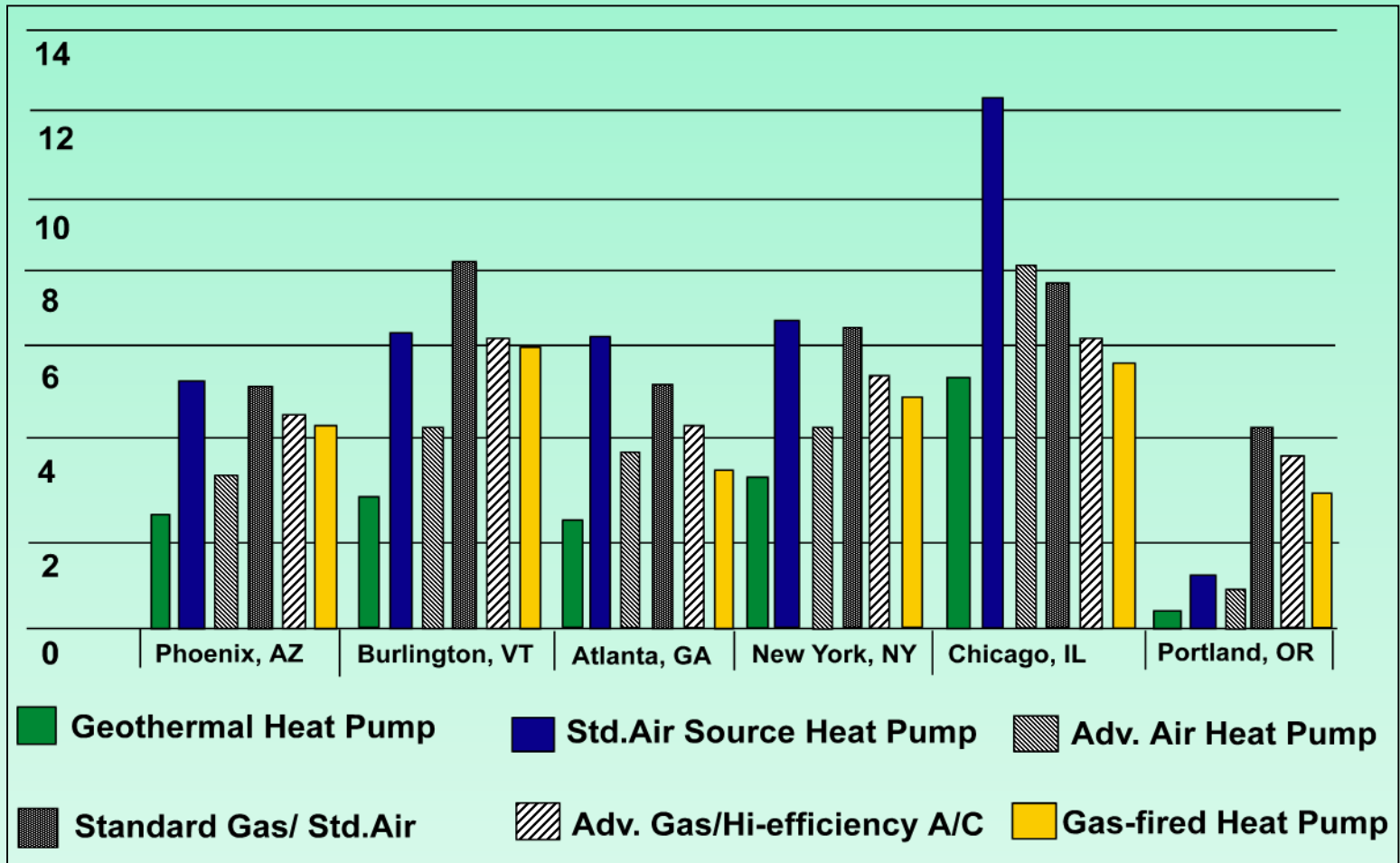


# GHP Market World Wide



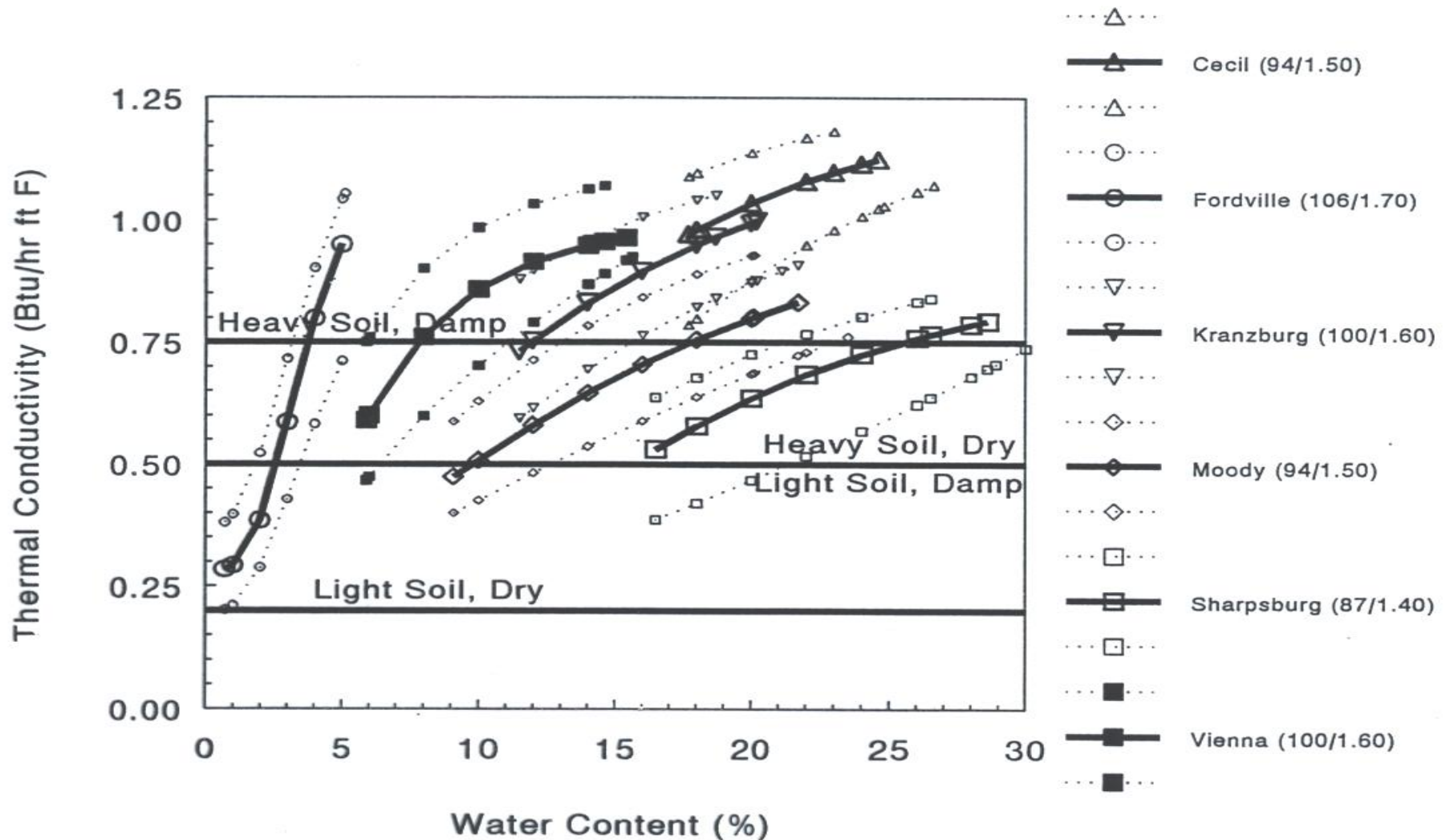
# Environment

## Annual Carbon Dioxide Emissions from Space Conditioning Equipment by Region



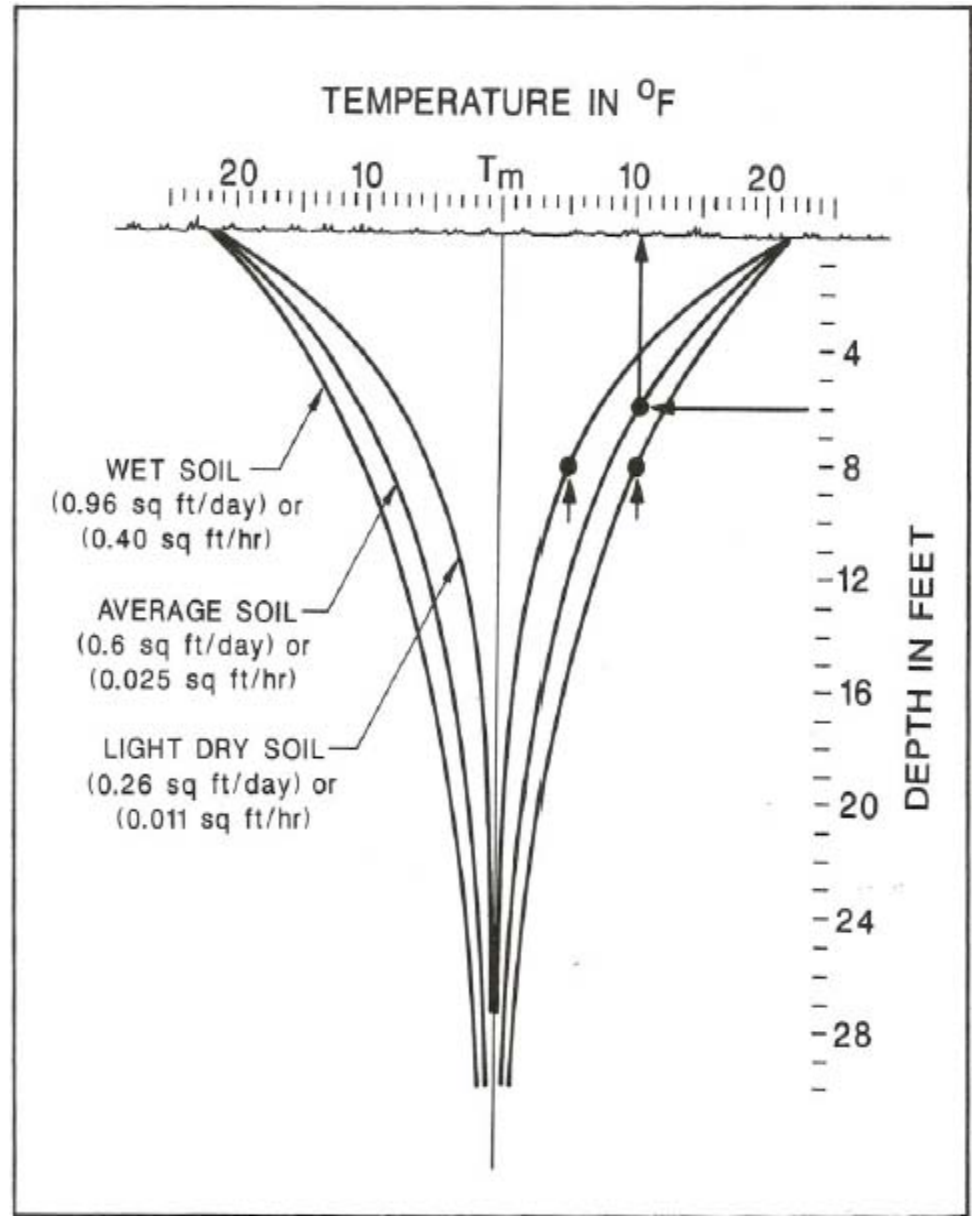
(In thousands of kilograms per year)

# Moisture content is very important:



# Soil Temperature

- Soil temperature is variable to about 26 feet.
- At ~26 feet the temperature is +/- 2° F of the mean surface air temperature.
- Generally, below ~26' to approximately 1,000', the earth temperature will remain constant.
- Geologic anomalies (faults, thermal intrusions, etc.) may change this rule of thumb.



# Training not just on GHP

## Cost Effective Energy Efficiency





# Duct Loss and Testing

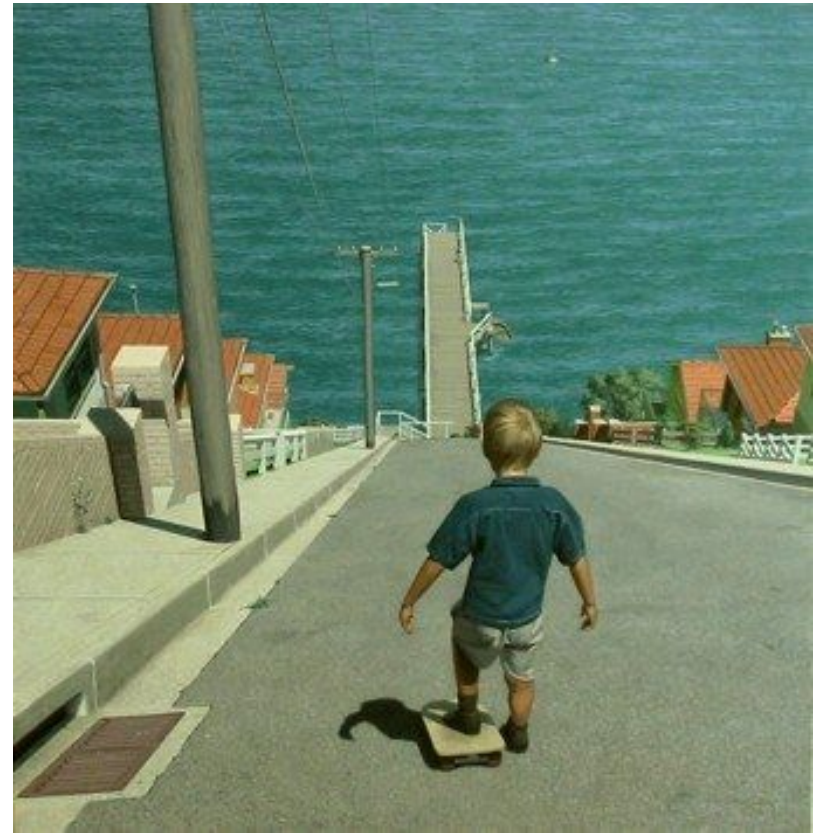


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# Installing GHP Loops

New and retrofit installations use a small foot print, light weight drilling rig and excavation equipment to enter onto the property and drill a series of holes and trenches, typically in either the front or back yard. The rig is designed to fit through a section of fence.





# Wider Choices & Higher Efficiencies



COPs up to 6.0

Sizes 1/2 - 50 Tons

R410 Ready

EER >40 @ 1<sup>st</sup> Stage and >30 @ 2<sup>nd</sup> Stage

# GRC 2009 Annual Meeting

Reno, NV Peppermill October 3-7, 2009

- Pre and Post Meeting Workshops
- Field Trips
- Exhibits
- Technical Papers

Updates and other info at  
[www.geothermal.org](http://www.geothermal.org)



# Is This a Great Time to be in the Utility Business . . . Or What???

- State Energy Program Formula Grants
- Energy Efficiency Block Grants
- Greening of the Planet

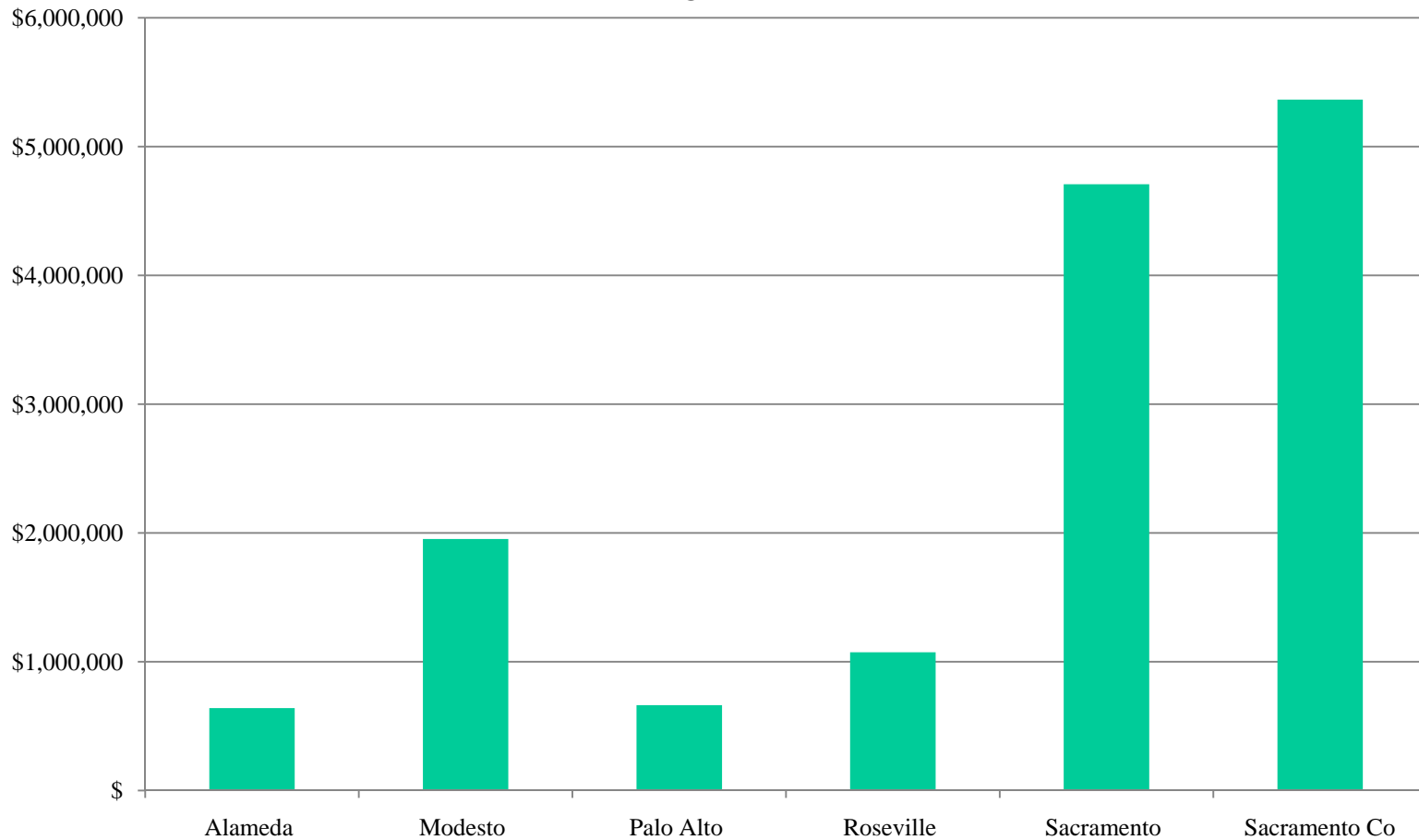


# ARRA State Energy Program Formula Grant Performance Metrics

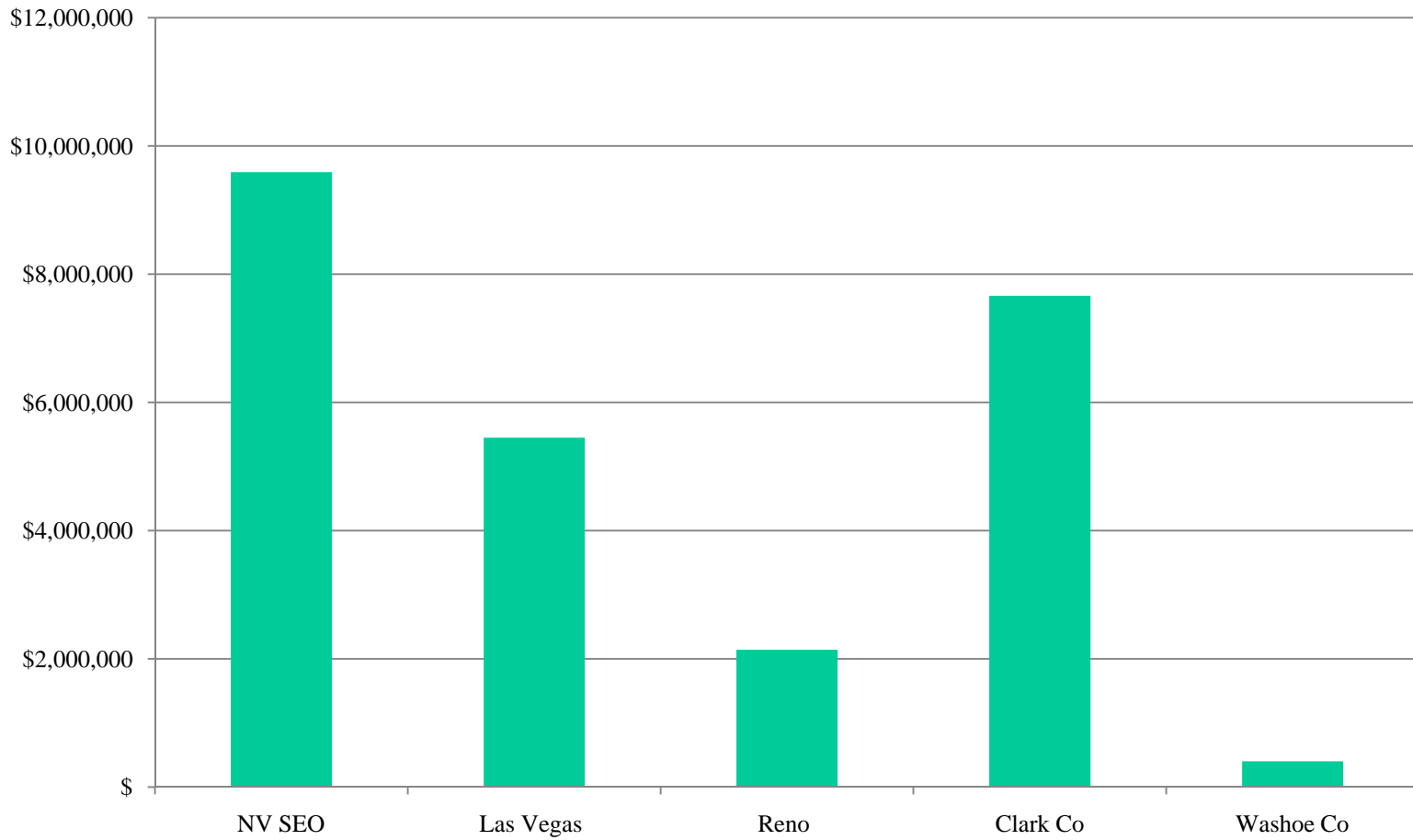
- Jobs created
- Energy saved
- RE installed and energy generated
- GHG emissions reduced
- Energy cost savings
- Funds leveraged

# CA EE & Cons Block Grants

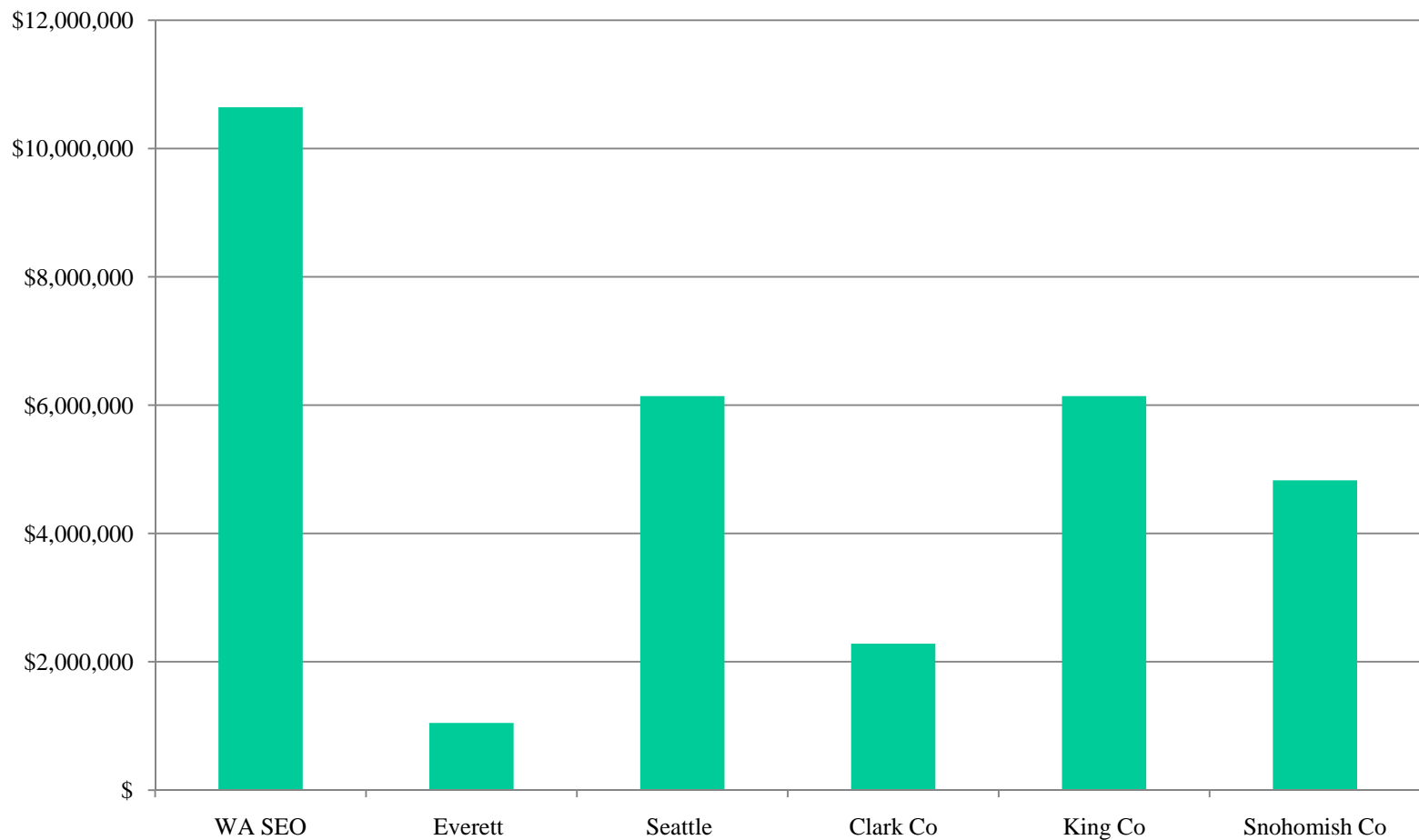
CEC gets \$ 50 million



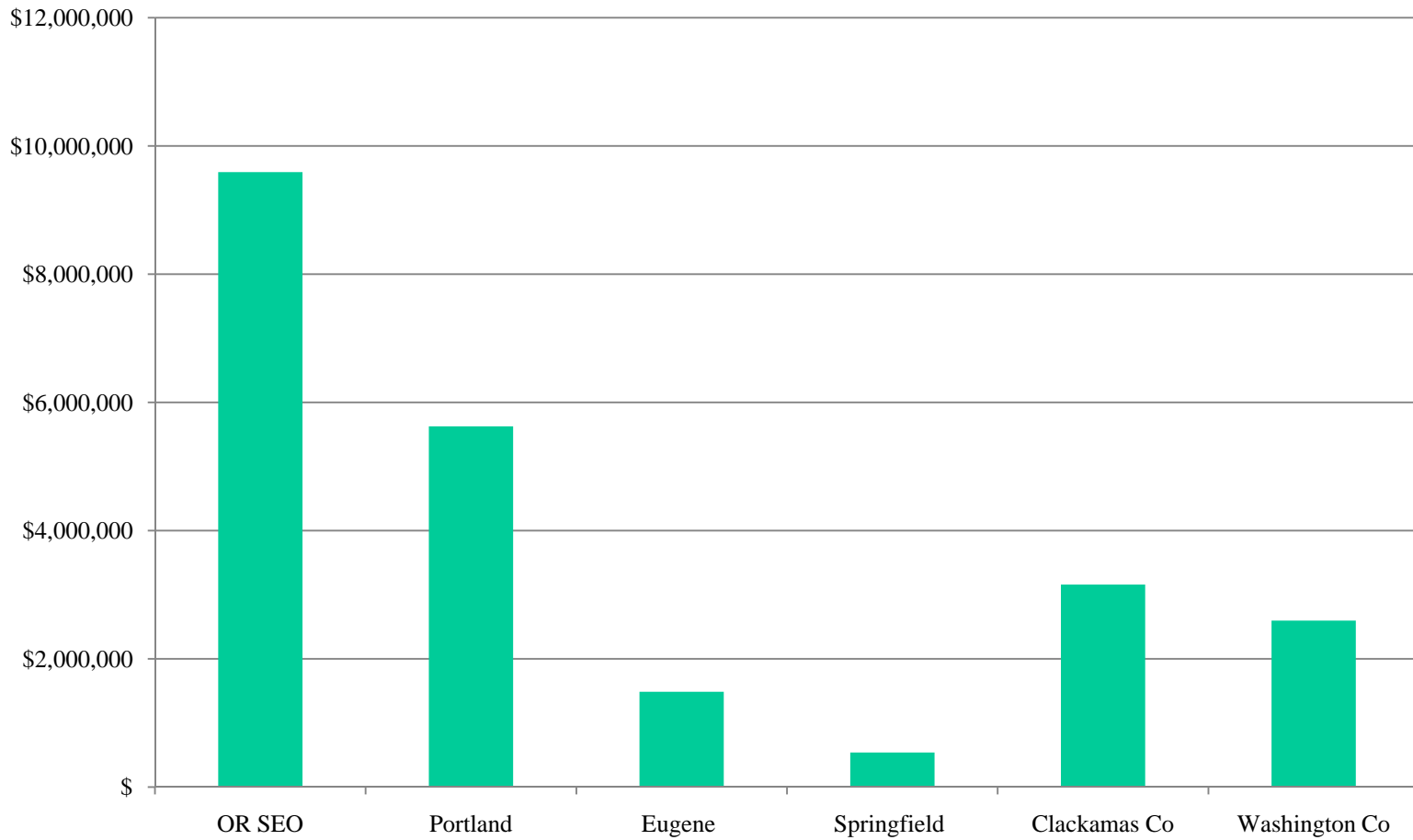
# NV EE & Cons Block Grants



# WA EE & Cons Block Grants



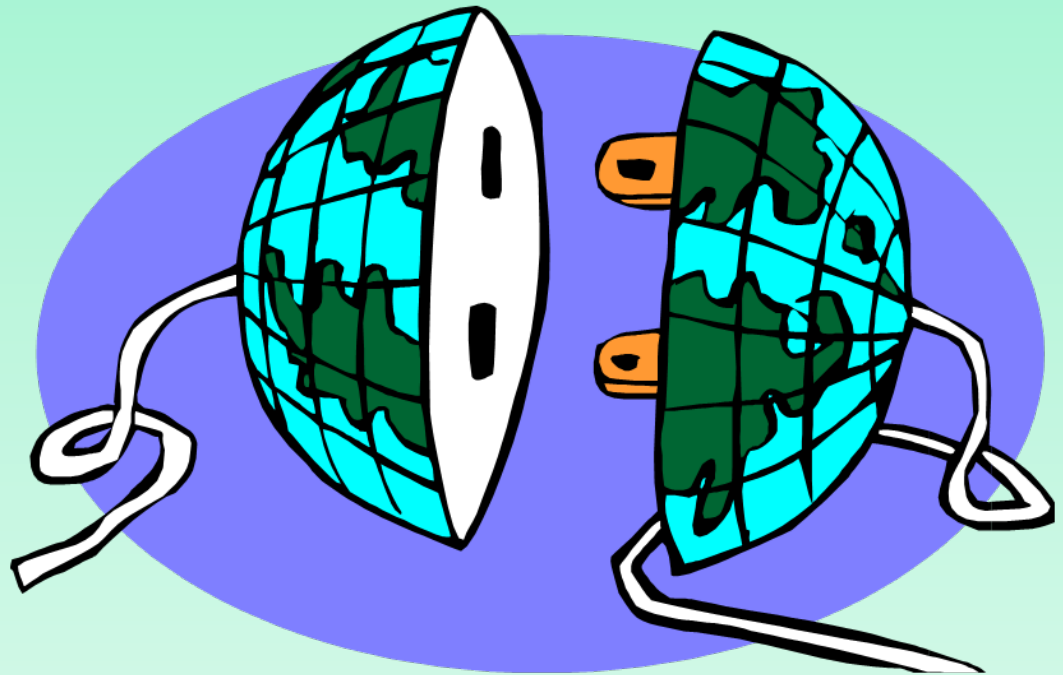
# OR EE & Cons Block Grants





# GHP Non-Energy Benefits

- **Space Requirements**
- **Noise**
- **Maintenance**
- **Ambient Conditions**
- **Vandalism**



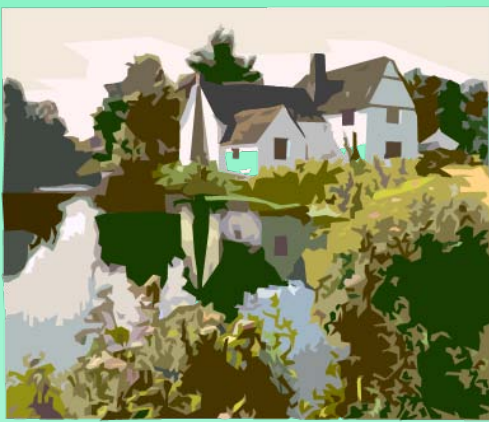
**Utility Driven GHP Programs can break thru the barriers and provide**

# **Meter Gateways**



- 2 way load control
- Can keep GHP systems “off peak” or on low speed
- Thus increase the value of the GHP system





# Mimic SERP



Utilities pooled refrigerator rebates and transformed the EE market for refrigerators with SERP.

With the lessons learned from SERP, Utilities can pool GHP rebates and add the leverage of ARRA funds (block and formula grants) to transform the EE market for HVAC systems with AAAHHH (affordable, available american home heatpump heros).

# Let's get Going



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Guy Nelson, Utility Geo Working Group [energyguy@utilityforum.com](mailto:energyguy@utilityforum.com)



**Geothermal Resources Council**

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