

# Geothermal Resources Council

What's new in Geothermal Technologies?

- GRC Educational Series
- Utility Geothermal Working Group
- GRC Annual Meeting

[www.geothermal.org](http://www.geothermal.org)



**Geothermal Resources Council**

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# GRC Educational Series

## Sponsors



**National Rural Electric  
Cooperative Association**

© A Touchstone Energy<sup>®</sup> Cooperative



# 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

# 2008 Webcasts and Workshops

Role of Renewables in Consumer-Owned Utility Supply Portfolios – Feb. 13, 2008

REC Tracking and Marketing Systems – April 9, 2008

Public Participation – May 14, 2008

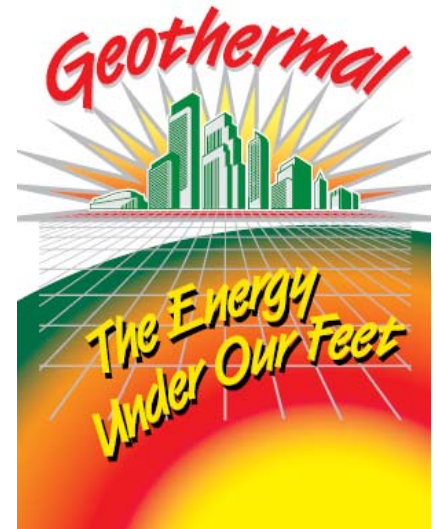
Geothermal Technologies Workshops

March 17-18 Redwood Falls, MN

March 20-21 Sioux Falls, SD

June 9-10 Denver, CO

August 10-11 Everett, WA



For further information, go to [www.repartners.org](http://www.repartners.org)

# **2009 - 10 Webcasts and Workshops**

RE Project Financing and REC Webinar – Jan 27

Geo Heat Pump Webinar – Mar 31

Geo Tech Workshop – April 29-30 Salt Lake City, UT

Enhanced Geothermal Systems Webinar – July 15

Utility Geothermal Development Strategies Webinar – Dec 9

Geo Tech Workshop – Jan 26, 2009 Dallas, TX

For further information, go to [www.geothermal.org](http://www.geothermal.org)

# **What is the Utility Geothermal Working Group?**

The UGWG is a group of utilities and ancillary associations formed under the US Department of Energy's (DOE) Geothermal Technologies Program (GTP)

# Utility Geothermal Working Group Sponsors



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**National Rural Electric  
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# About DOE's Geothermal Technologies Program

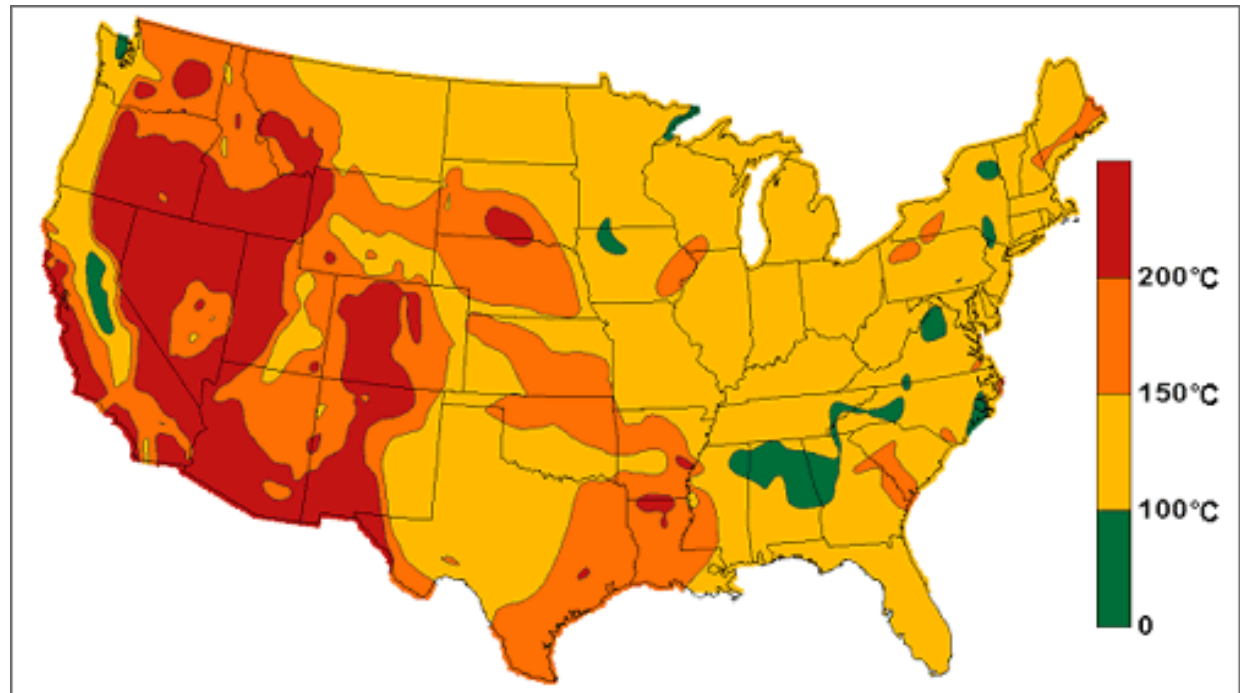
- GTP works in partnership with industry, academia, and DOE's national laboratories to establish geothermal energy as an economically competitive contributor to the U.S. energy supply.
- GTP will conduct research, development and demonstration projects to establish Enhanced Geothermal Systems (EGS) as a major contributor for electricity generation.
- For more information, see:  
<http://www1.eere.energy.gov/geothermal/>



# UGWG Mission

To accelerate the appropriate integration of three geothermal technologies into mainstream applications

- Power Generation
- Direct Use
- Geothermal Heat Pumps



# Some UGWG Members

Arizona Public Service

State Working Groups

Sandia National Lab

Idaho National Lab

South San Joaquin ID

Salt River Project

Seattle City Light

Bonneville PA

GRC

Western

Ormat, Int'l

Palo Alto Utilities

Redding Electric

Springfield UB

# Major Finding (Affirmation)

Cost Effective Energy Efficiency is the first choice



# Duct Loss and Testing

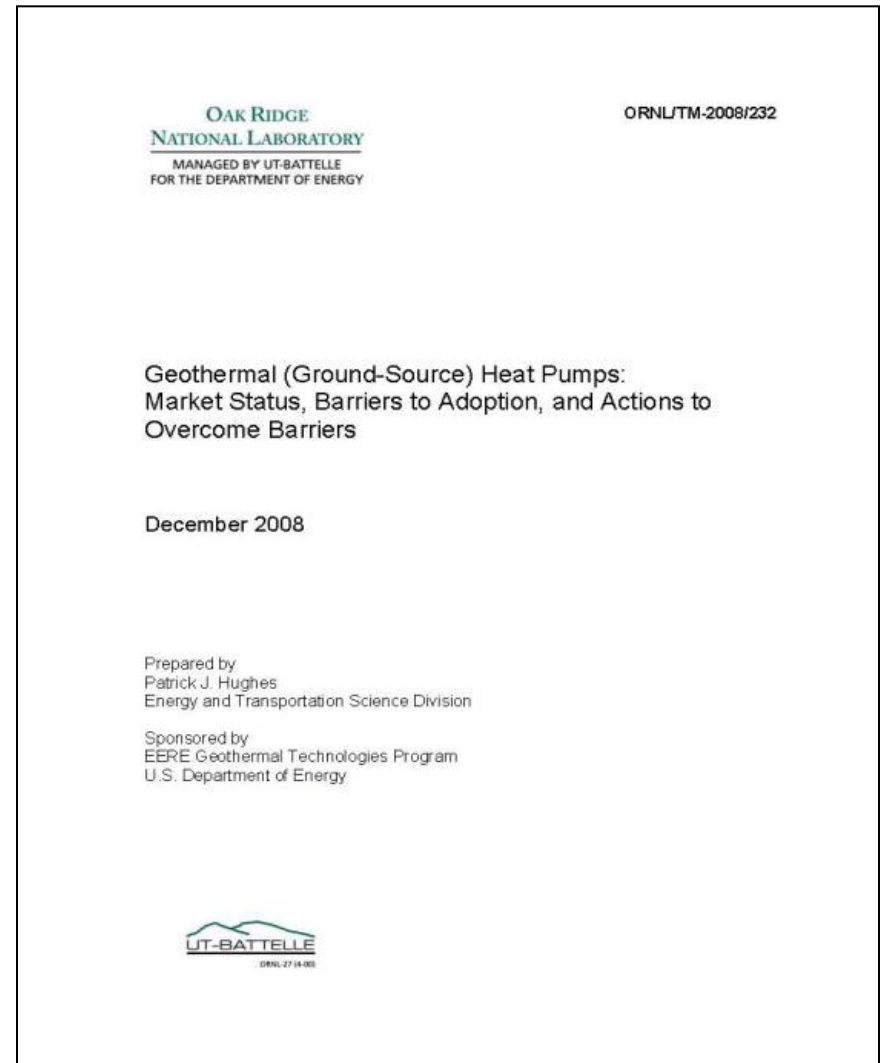


# Geothermal Power Plant Costs (dollars per kilowatt hour)

1. Exploration & Resource Assessment	400
12 Month time frame	
2. Well Field Drilling and Development	1000
12 Month time frame after completion of item 1	
3. Power Plant, Surface Facilities, & Transmission	2000
18 Month time frame with overlap of item 2	
4. Other costs:	600
○ Commitment fees	
○ Legal & Accounting fees	
○ Consultants,	
○ Interest during construction, and	
○ Debt service and operating reserve	
○ Construction contingencies and Developers fee	
12 Month time frame beginning after completion of item 1	
5. TOTAL <i>FINANCED</i> COST	~ \$ <u>4000/kW</u>

# 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)



# Key Barriers to Rapid Deployment of GHPs<sup>†</sup>

- Tier 1
  - High first-cost of GHP systems to consumers
- Tier 2
  - Lack of consumer knowledge and/or trust in benefits
  - Lack of policymaker/regulator knowledge and/or trust in benefits
  - GHP design and business model infrastructure limitations
  - GHP installation infrastructure limitations
- Tier 3
  - Lack of new technologies and techniques to improve GHP system cost/performance

*<sup>†</sup>Based on the sense of a group of GHP industry experts.*

# A Tale of Two Buildings

- Palo Alto, CA
- 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

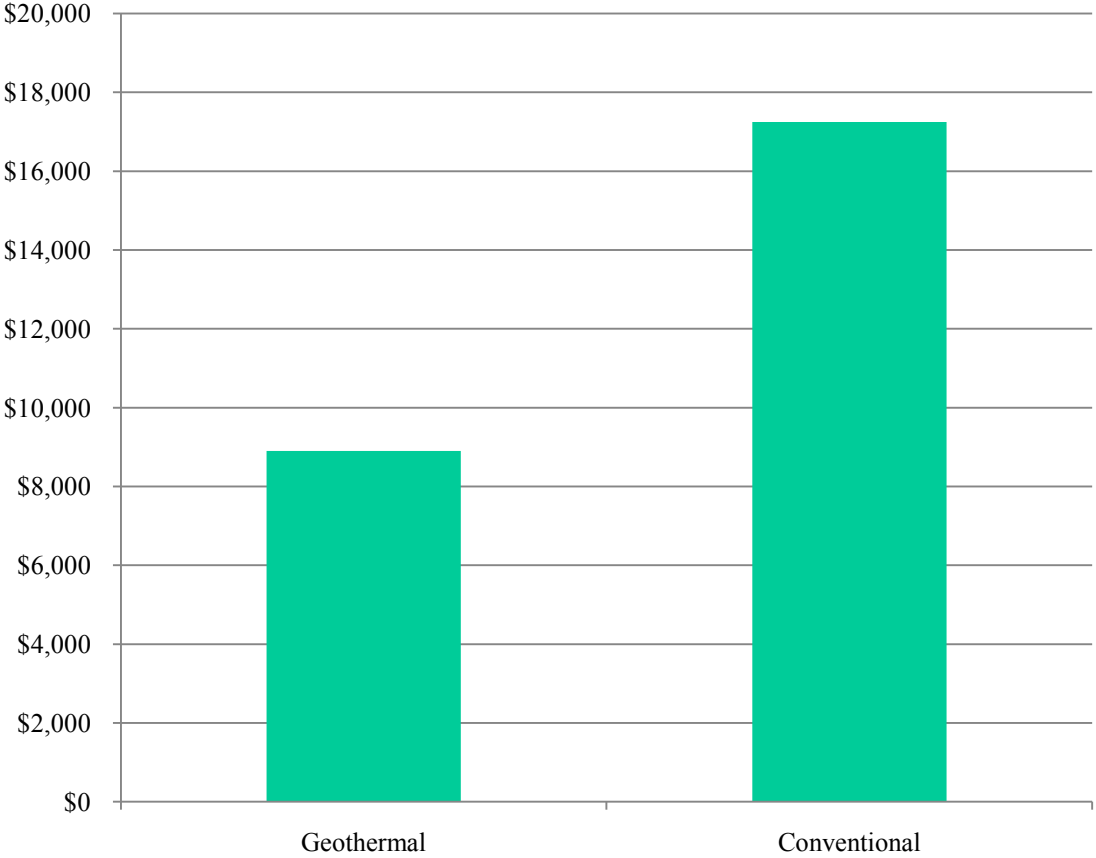
GHP Building Built in 1997

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

16 Ceiling Mounted Units

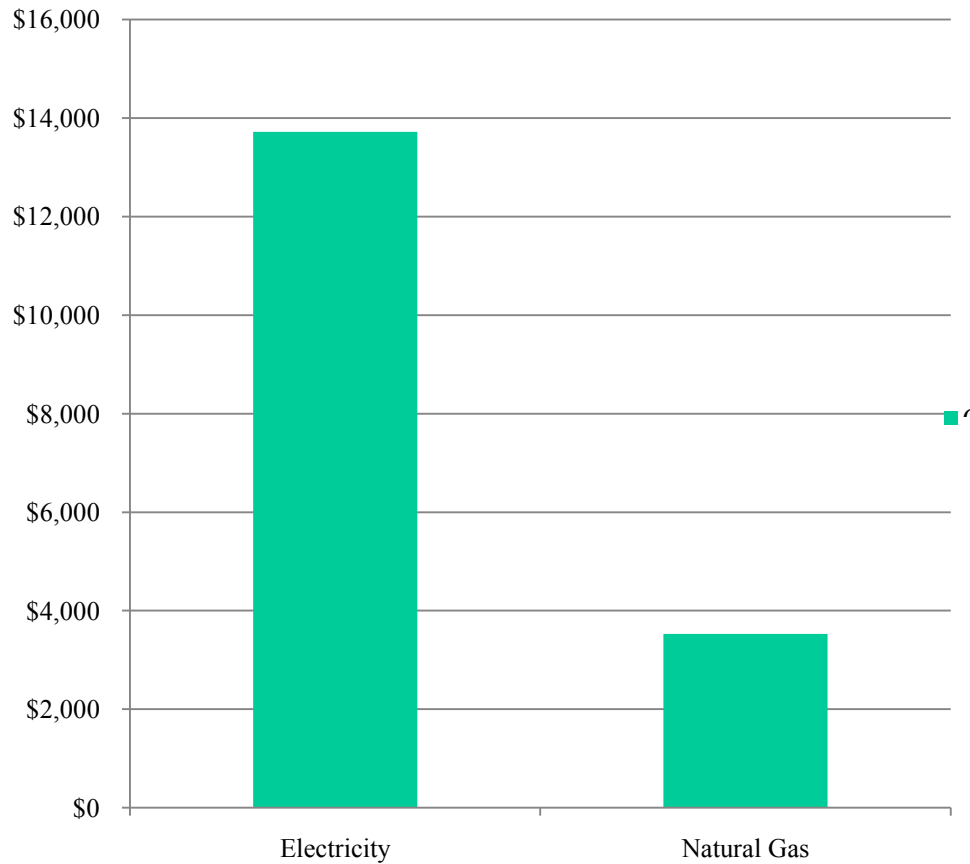
# Oklahoma City Buildings

**Average Annual HVAC Energy Costs**

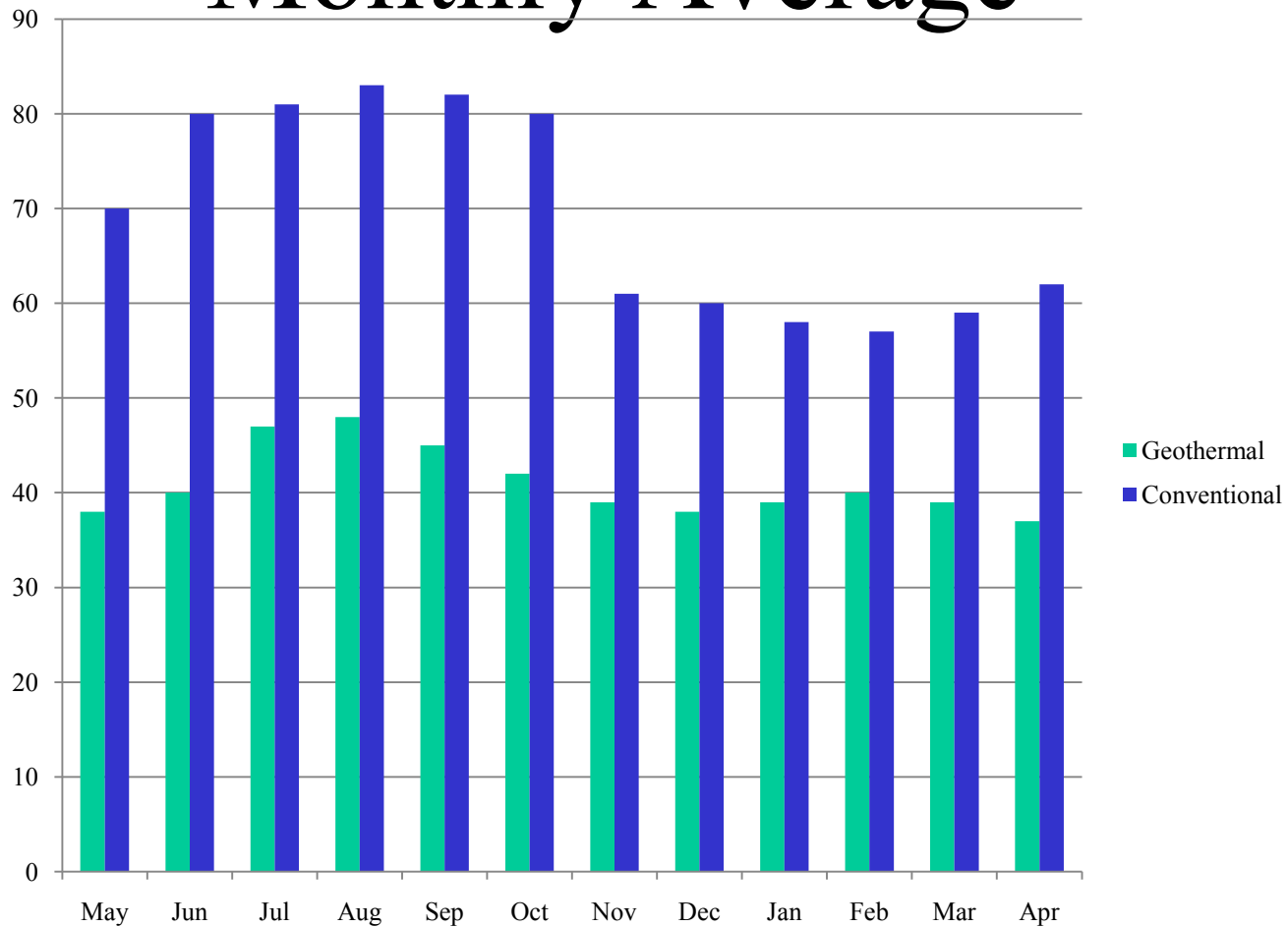


# Conventional Building

**Average Annual HVAC Energy Costs**



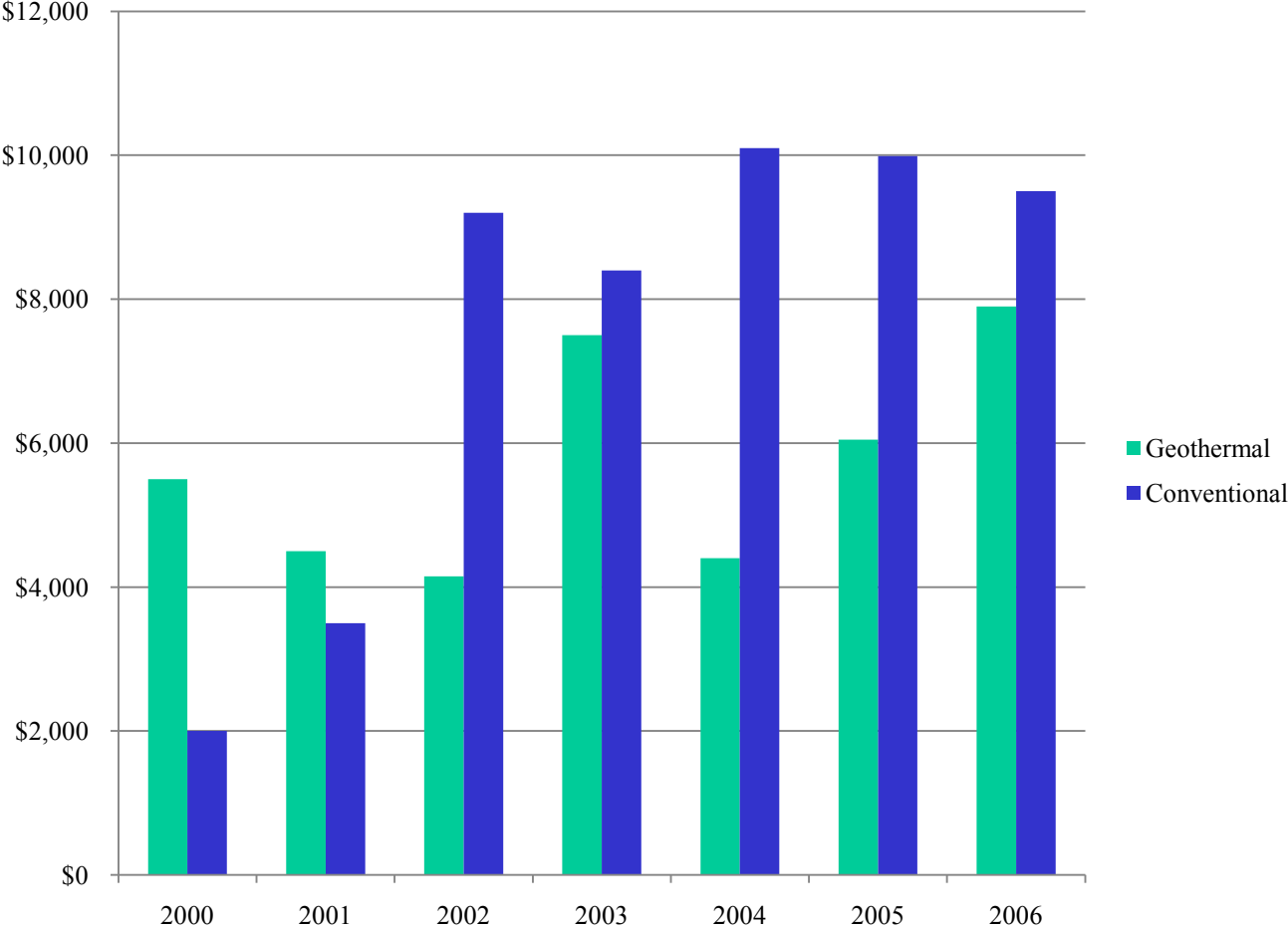
# kW Demand – Four Year Monthly Average



# 2183 and 2185 Park Blvd Buildings (Palo Alto)

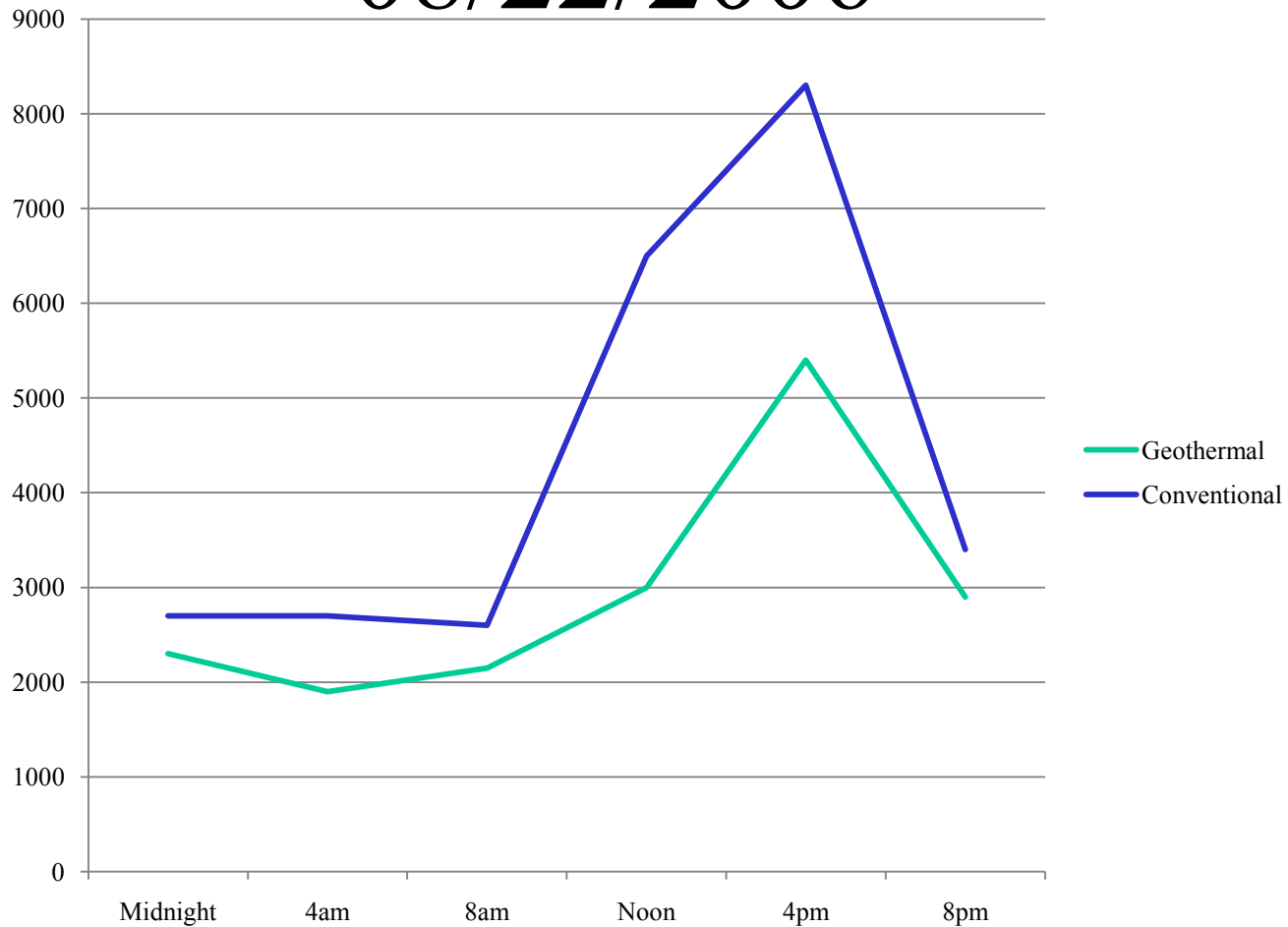
- Two Stories
- 10,000 sq ft each
- Built in the 1960s

# Palo Alto Buildings Energy Costs



# Hourly Load Curve Sample

## 08/22/2006





# Hope Crossing Project Oklahoma City, OK

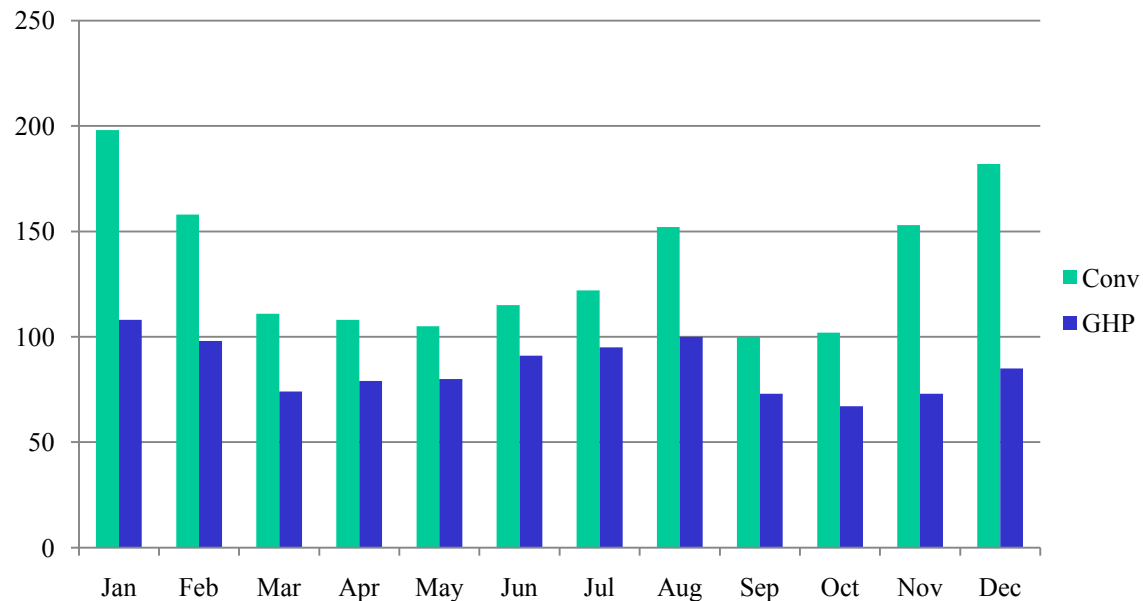
- Administered by Habitat for Humanity, Int'l
- Construction Started in 2004 1100 sq ft detached
- GHP home construction began in 2006
- Goal of an additional 240 homes with GHP
- Goal is important to demonstrate cost savings on a mass market scale

# 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

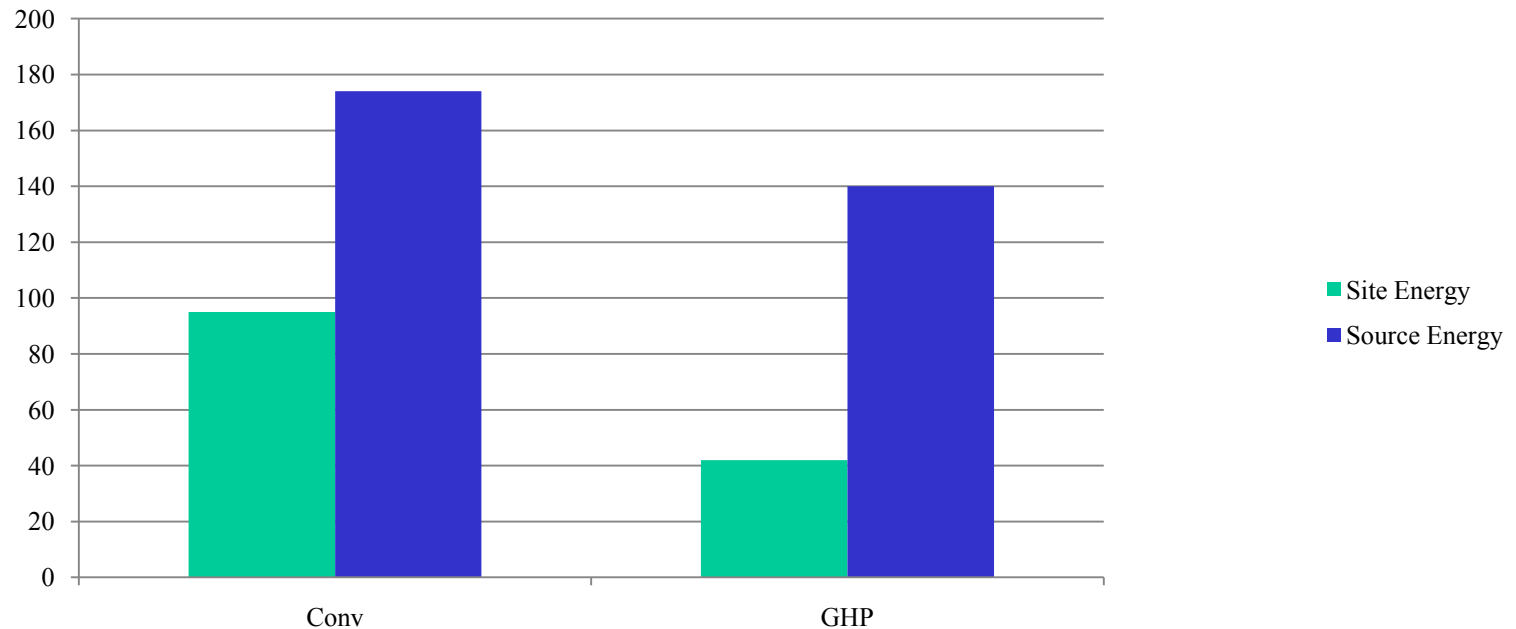


# Hope Crossing Site and Source Energy Consumption (MM Btu/ton

## Source Energy Benefits of GHP

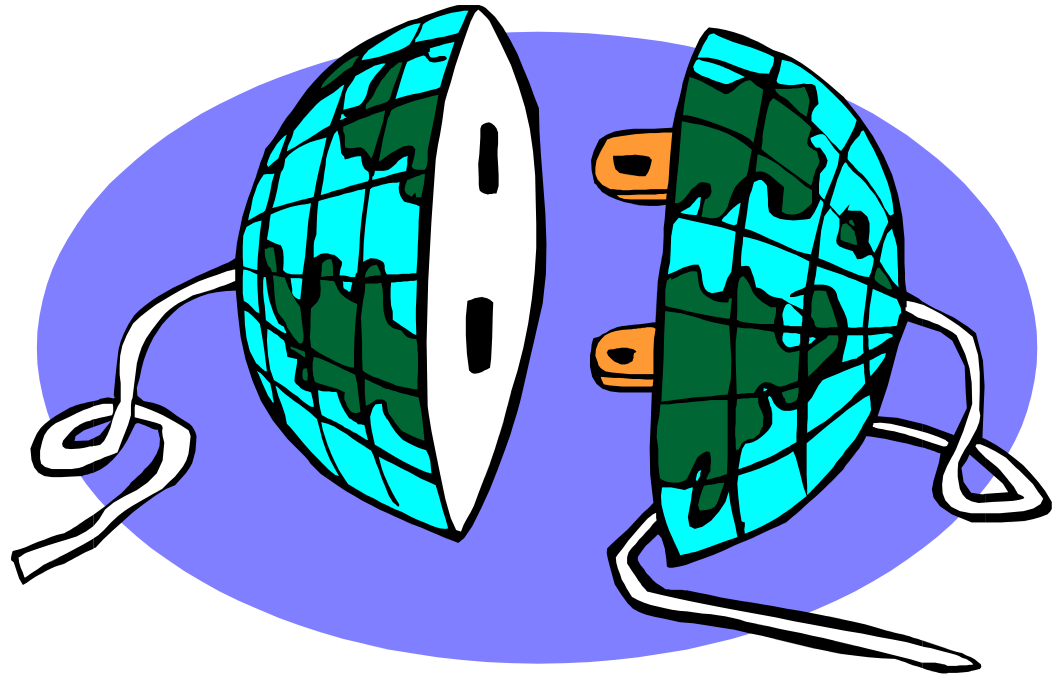
34 MM Btu /yr lower for GHP = 17 MM Btu per Ton

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



# GHP Non-Energy Benefits

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



# 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) ????????????



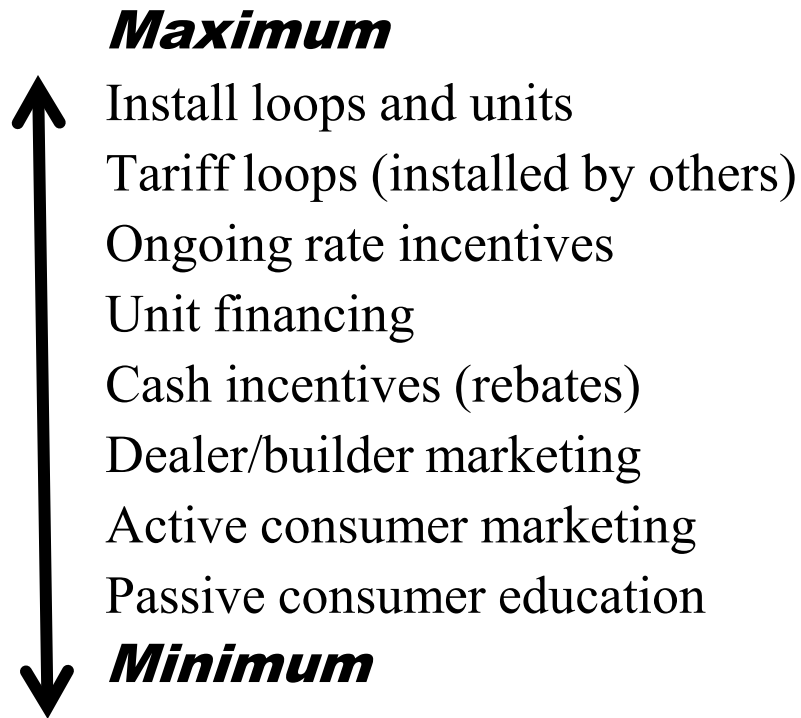
# GHP Capacity Benefits NPV

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

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



# Levels of Utility Participation in GHP Programs





Why Utilities – because  
somebody has to carry the load

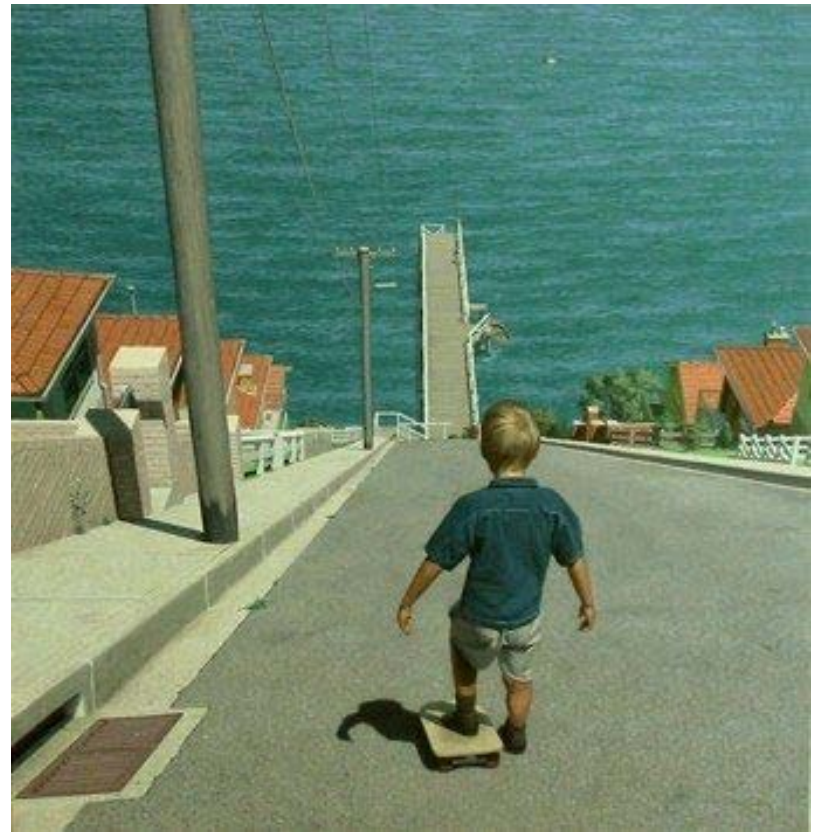


# Utility Risk Considerations

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



# Utility Led Mass Market GHP

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

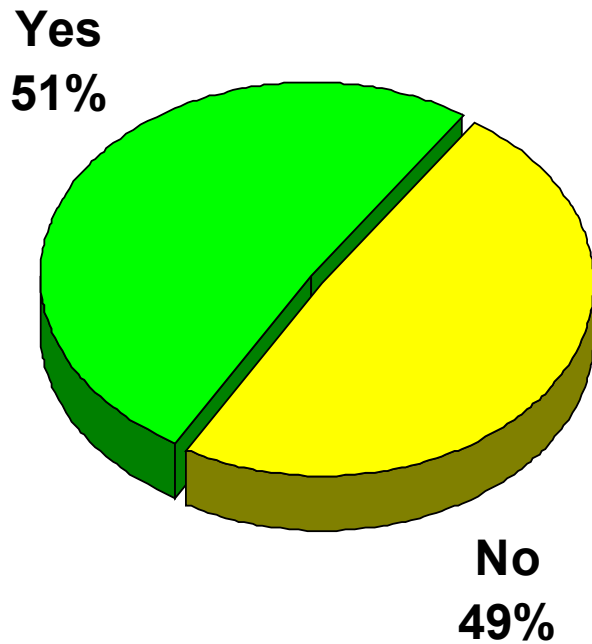
- Establishing incentive levels and ancillary services for a pilot program,
- Assessing, maintaining and enhancing installer skill levels,
- Selecting sites,
- Installing GHP systems (and other cost-effective energy efficient measures),
- Commissioning installations,
- Evaluating performance, and
- Revising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



# *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*

# 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.



# 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)



# The Loop Tariff

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

**At an affordable price**

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





# The Loop Tariff

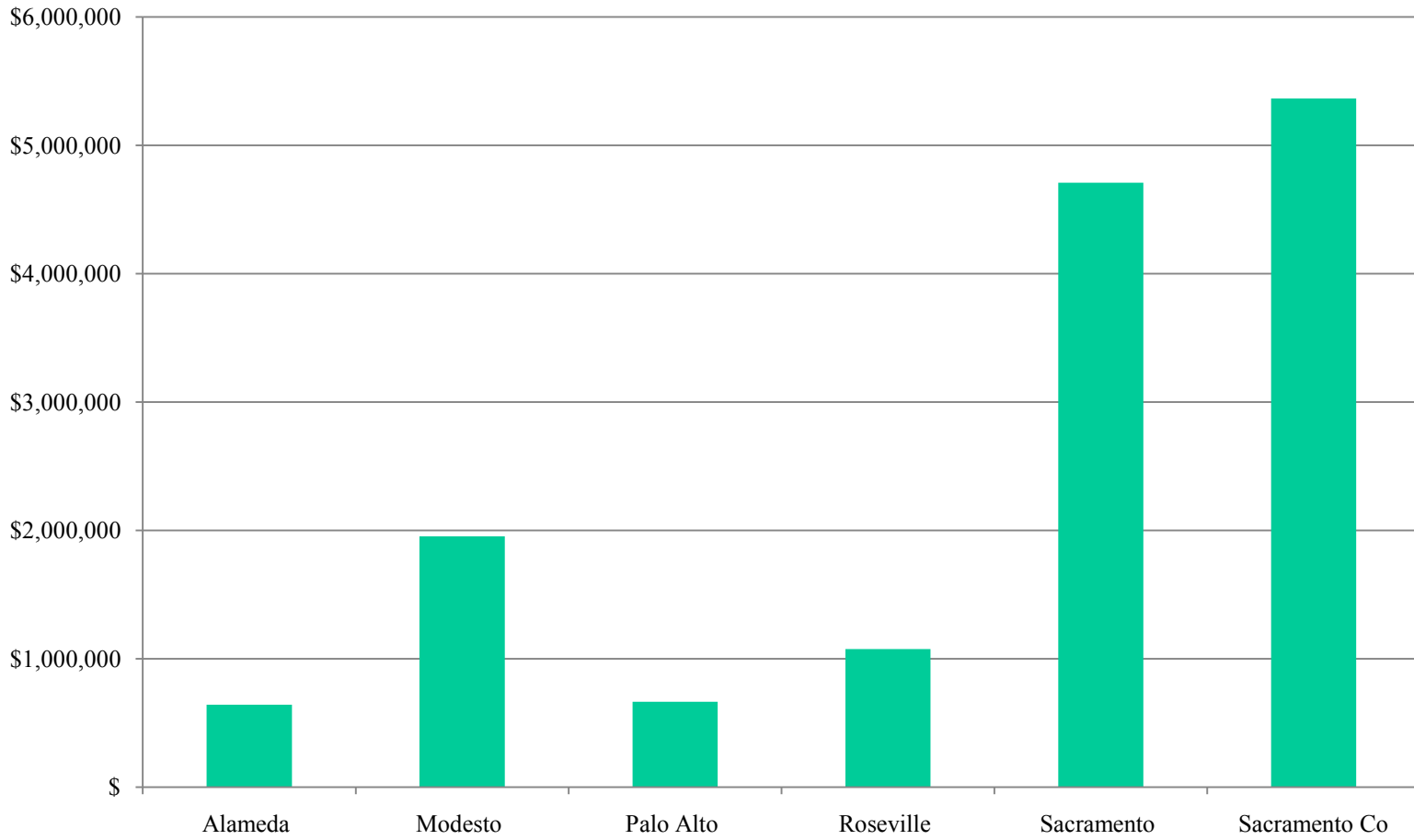
- Eliminates the first cost barrier (new construction) and reduces it for retrofit applications.
- Adds winter kWh load while reducing summer peak demand.
- **Provides two utility revenue streams** and provides customers with a lower total energy cost than they had before.



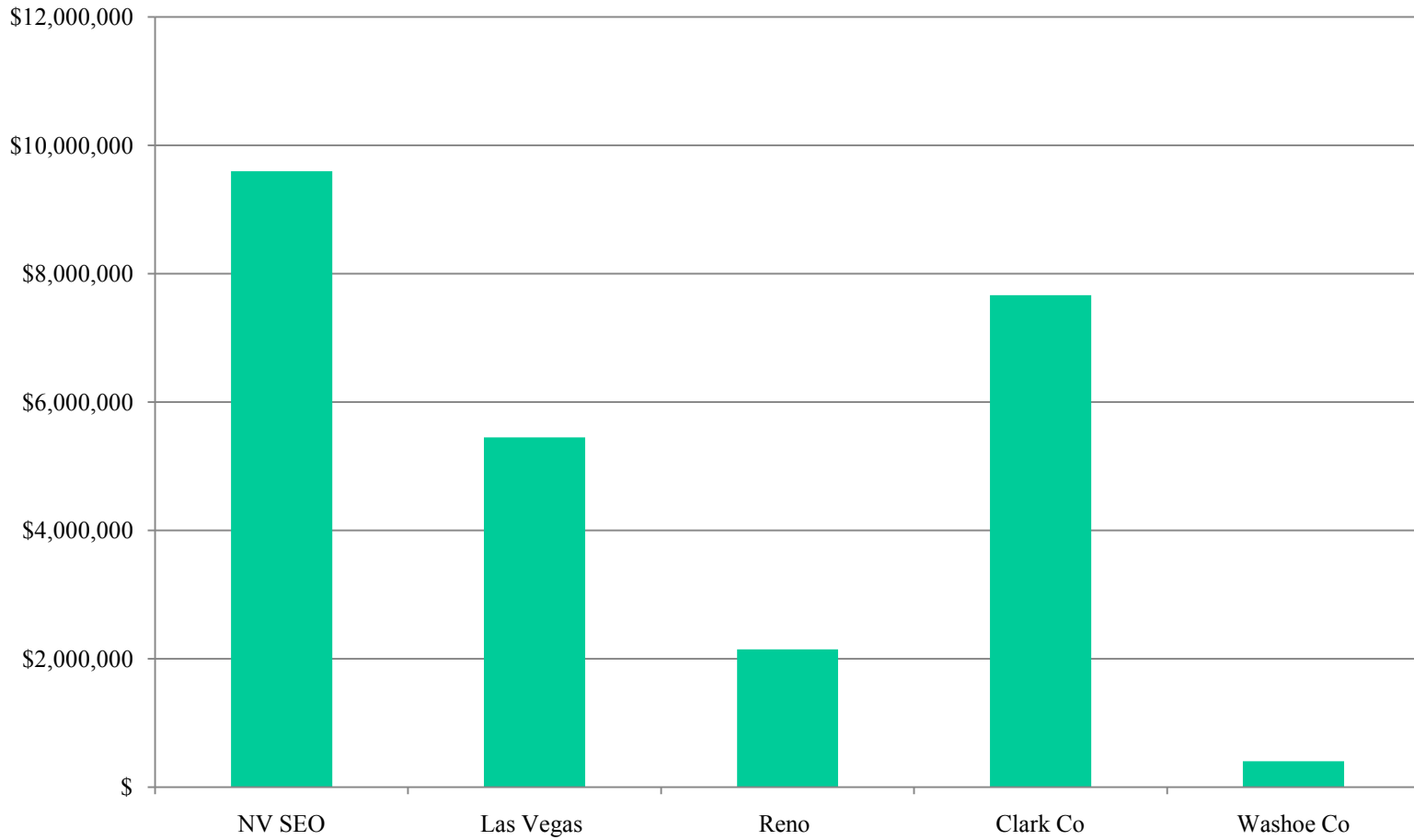


# CA EE & Cons Block Grants

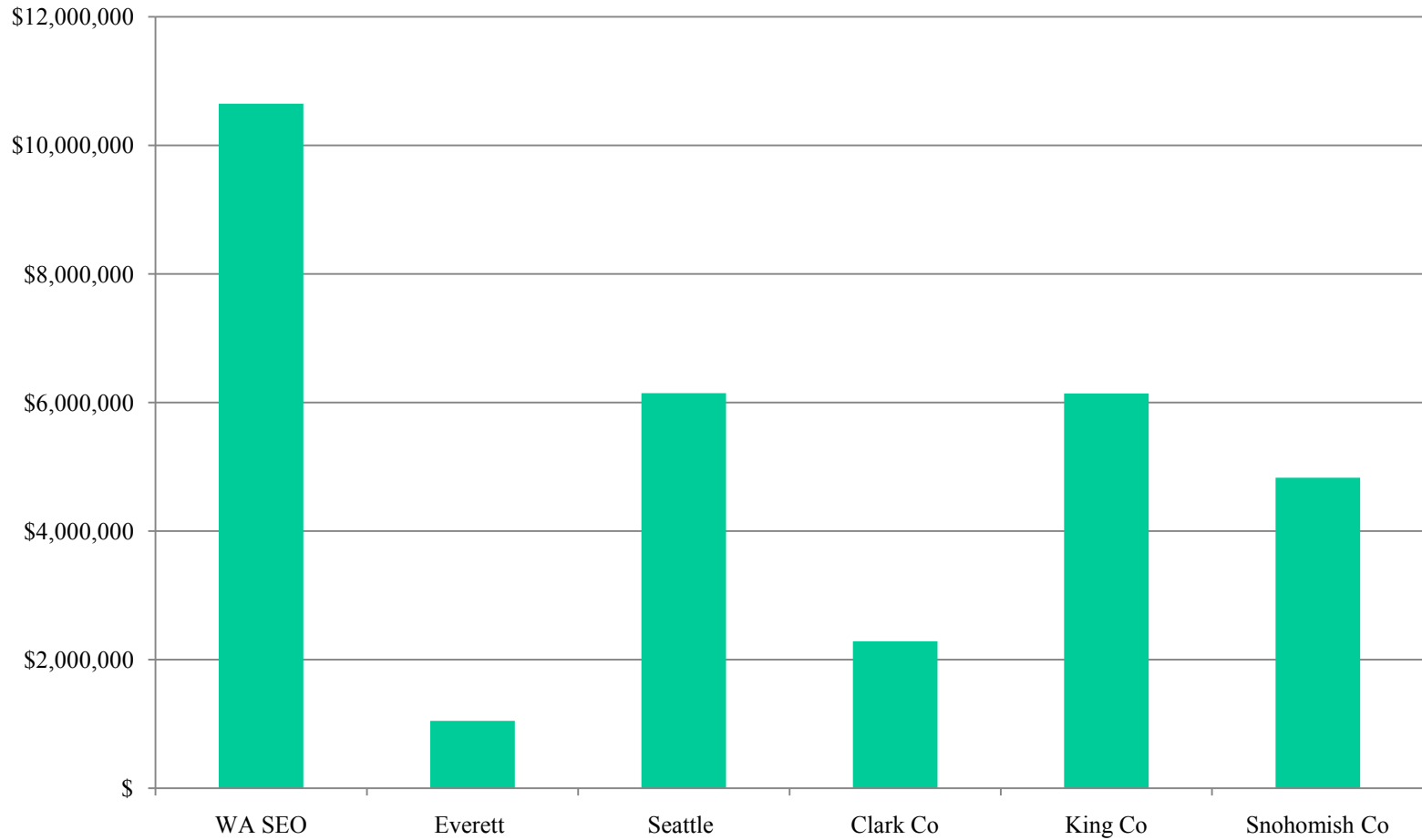
CEC gets \$ 50 million



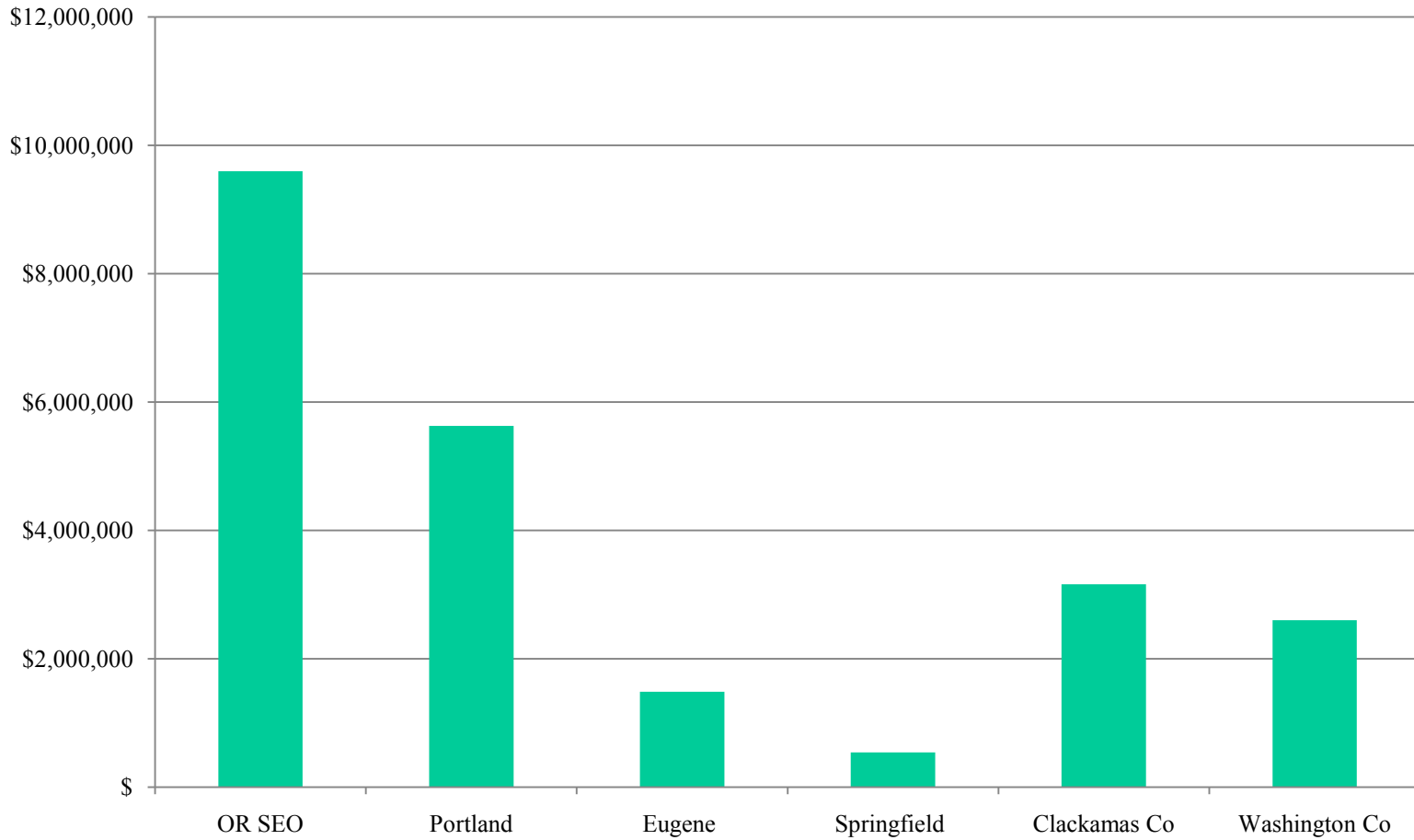
# NV EE & Cons Block Grants



# WA EE & Cons Block Grants



# OR EE & Cons Block Grants



**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



# 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)



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