

INTRODUCTION TO GEOTHERMAL CONFERENCE

David D. Blackwell

Geothermal Laboratory

Southern Methodist University

Dallas, Texas

Oil & Gas Geothermal Meeting

November 3&4, 2009

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clean energy ahead

TURBODEN

A PRATT & WHITNEY POWER SYSTEMS COMPANY



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Roy M. Huffington
Department of Earth Sciences
Dallas, Texas

The World is Energized by Your Technology.

Thank you!—SMU Geothermal Lab

• *November 3 - 4, 2009* •

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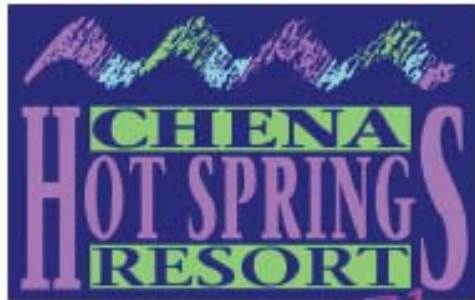
DEANS & LYONS

A PROVEN TEAM OF COMPLEX LITIGATION ATTORNEYS

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Linear Power

IN-KIND Contributors

Texas Alliance of Energy Producers

Geothermal Energy Association (GEA)

Geothermal Resource Council (GRC)

Dallas Regional Chamber of Commerce

2006

The Future of Geothermal Energy

Impact of Enhanced Geothermal
Systems (EGS) on the United States
in the 21st Century

THE EGS SYSTEM
Introduction of water into
rock of limited
permeability (either tight
sediment or basement) in
a controlled fracture
setting so that this water
can be withdrawn in other
wells for heat extraction,
i.e. heat mining

Google.org/egs

Geothermal
Resource:
Temperature
at depth:
7.5 km

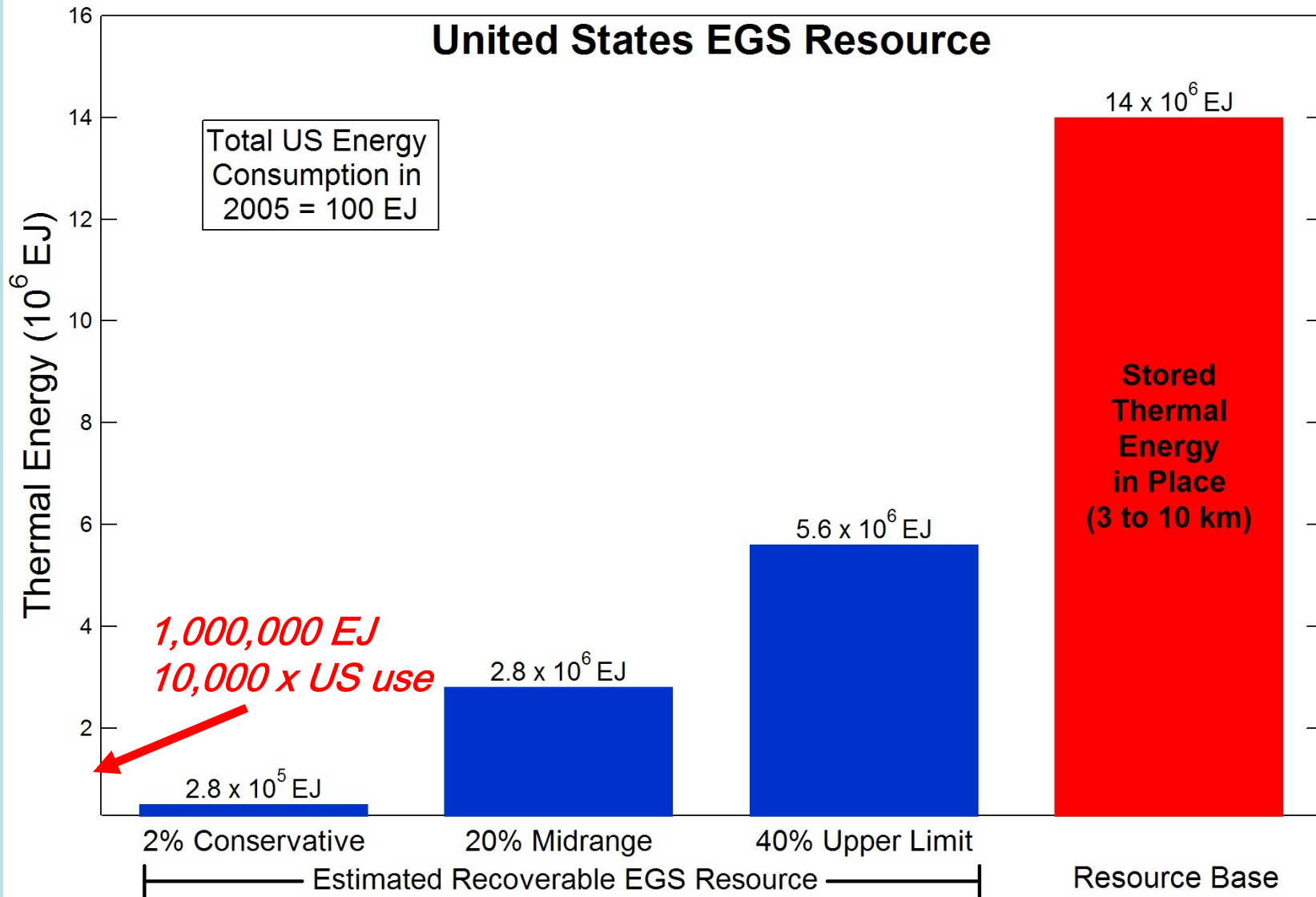


All Geothermal is SITE specific!!!



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United States EGS Resource

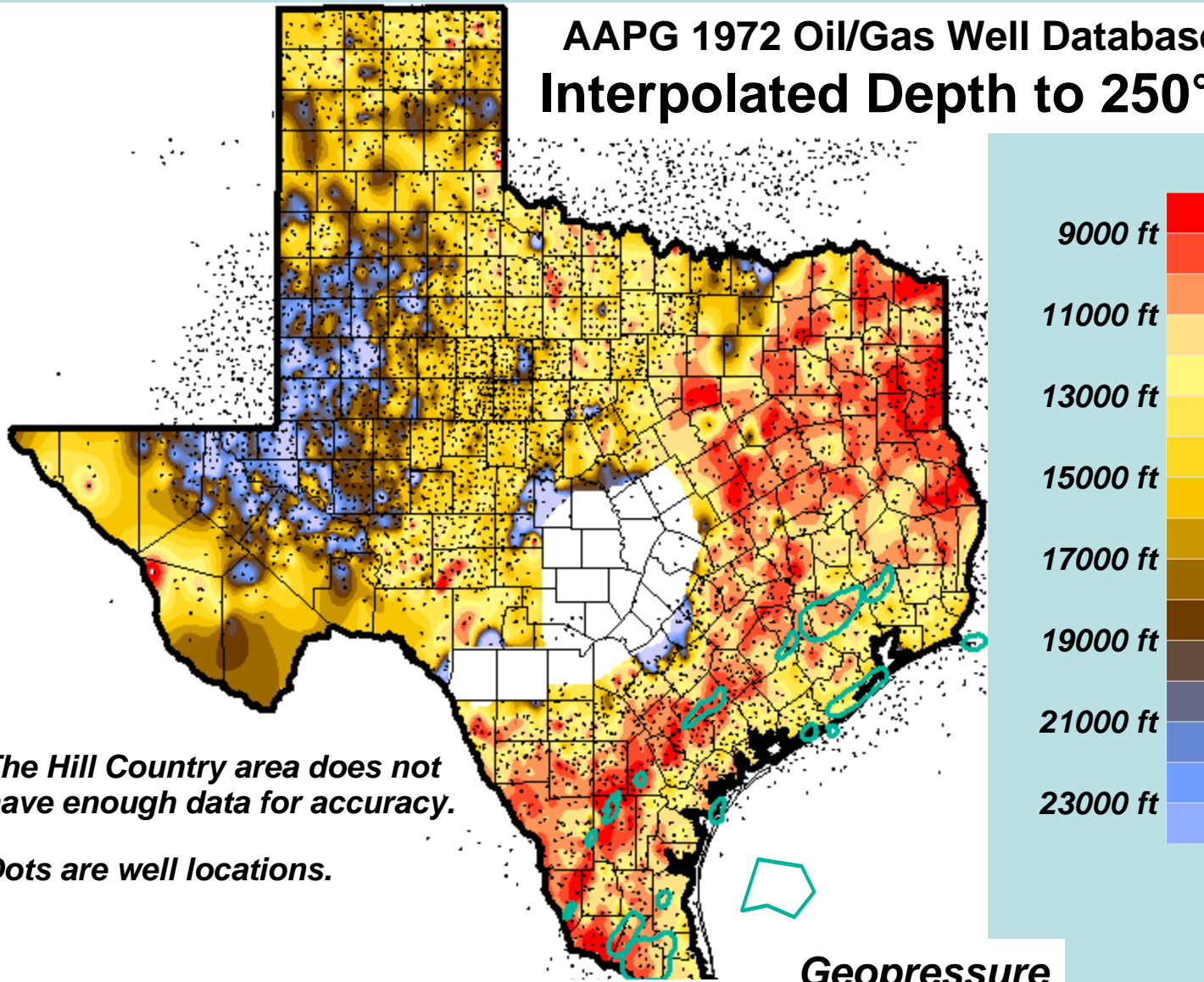


Estimated total geothermal resource base and recoverable resource given in EJ or 10^{+18} Joules (Future of Geothermal Energy, 2006) .

Types of Unconventional Geothermal Resources

- **Basement EGS**
- **Hydrothermal Margin EGS**
- **Sedimentary EGS-Tight gas sands-gas shales**
- **Geopressure-Gulf Coast/East Texas**
- **Coproduced-Low Temperature**

AAPG 1972 Oil/Gas Well Database Interpolated Depth to 250°F



The Hill Country area does not have enough data for accuracy.

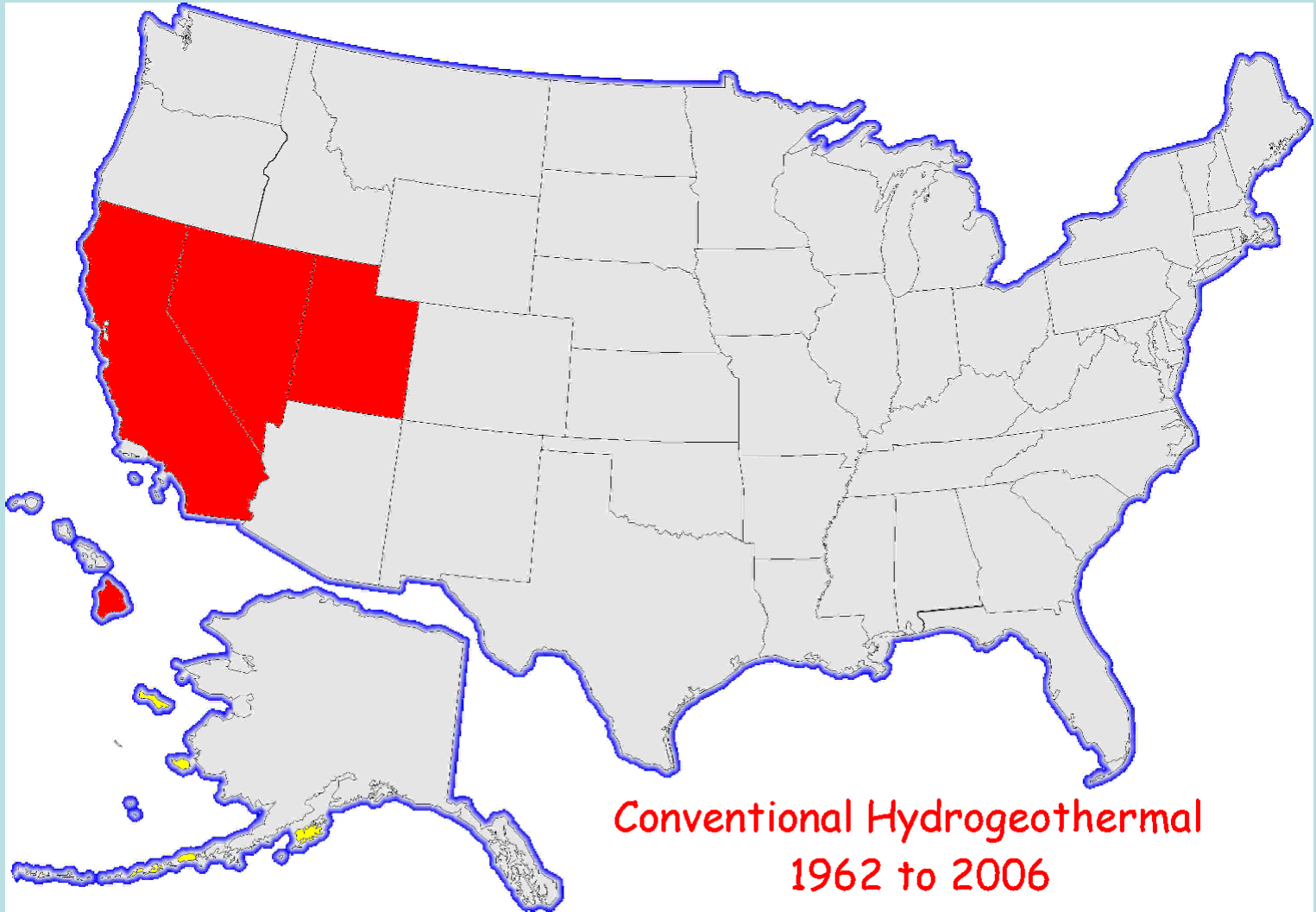
Dots are well locations.

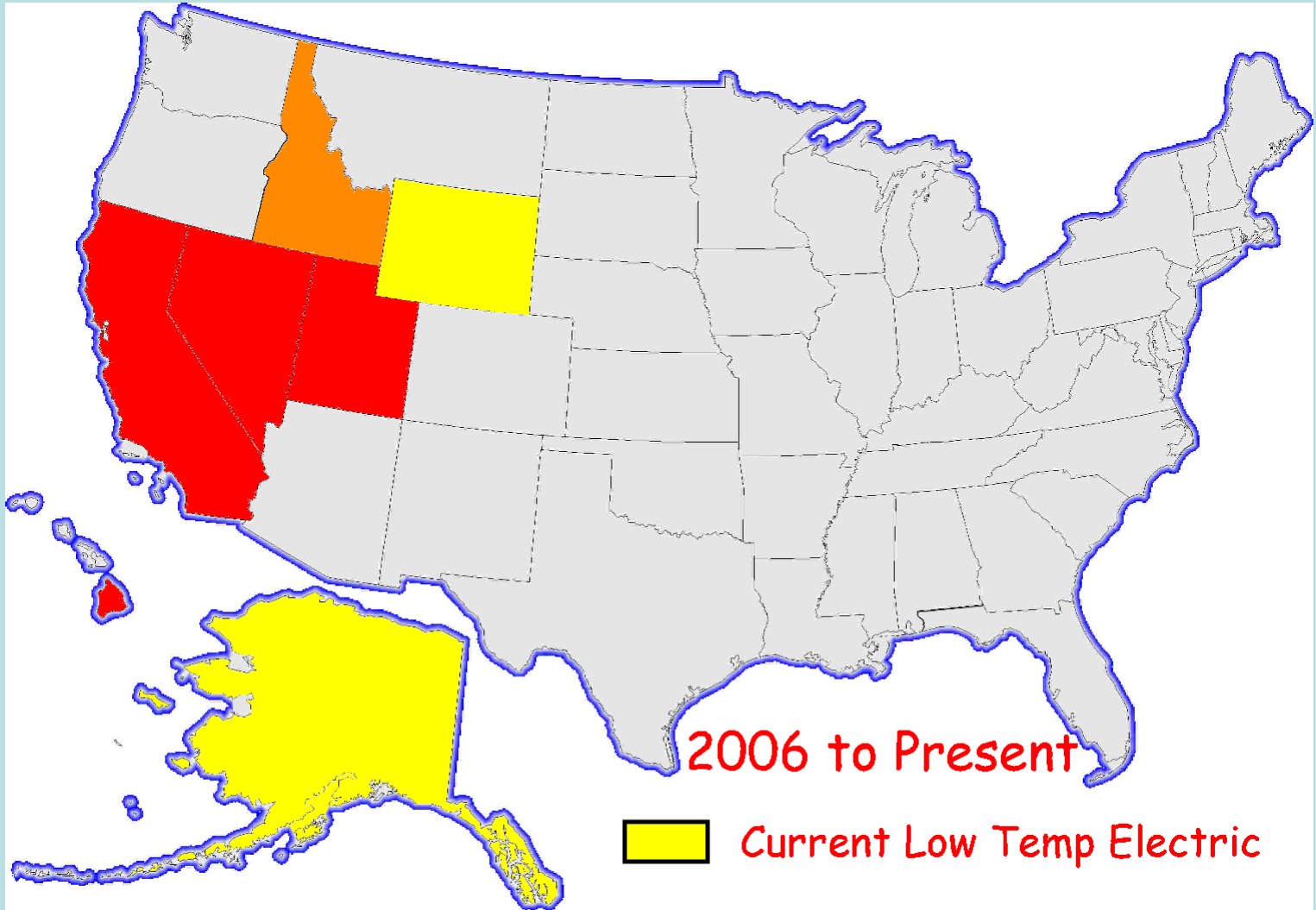
Location of Texas Geothermal Resources

**Geopressure
Fairways**

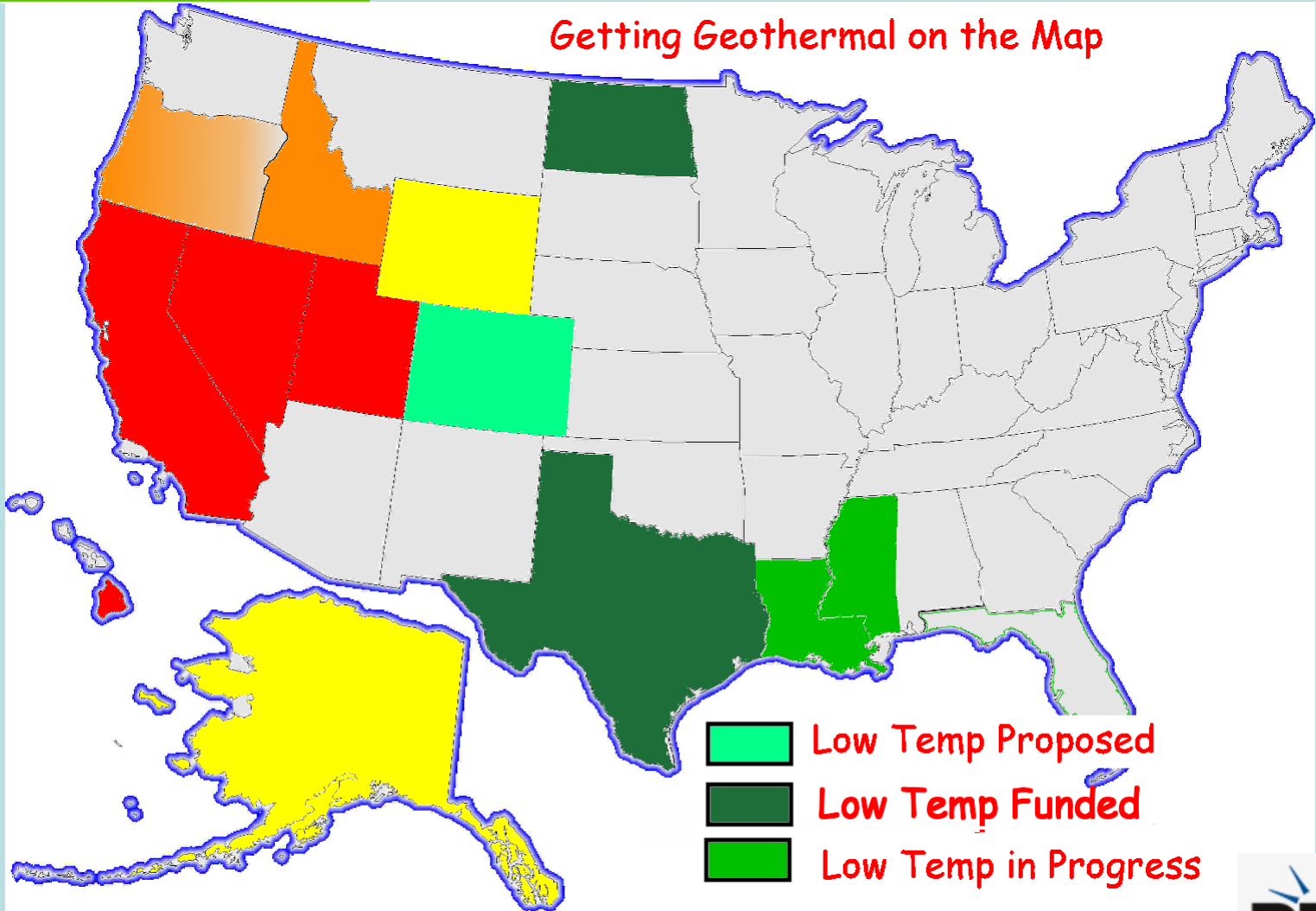
Table 1. Estimates of Total Geopressured Resource, onshore/offshore the Texas-Louisiana Gulf Coast, in Quads *One quad equals 10^{15} Btu or one trillion cu gas.

Source	Thermal	Mechanical	Gas	Total
Brown—Hudson	—	—	60,000 100,000	60,000 100,000
Dorfman—Texas	—	—	5,735	5,735
Hawkins—LSU (Louisiana only),*	19.5	1.2	13.6	34.3
Jones—LSU (sands & shales)	—	—	100,000	100,000
(sands only)	—	—	49,000	49,000
Papadopoulos—U.S.G.S. Circ. 726 (sands & shales assessed onshore only)	43,331	198.0	23,927	67,456
(unassessed only)	<i>One and one-half to two and one-half times the assessed quantities</i>			
Wallace—U.S.G.S. Circ. 790 (assessed onshore sandstone only)	5,800	—	3,220	9,100
(assessed offshore sandstone only)	5,200	—	2,800	8,000
* Recoverable amounts only calculated				





Getting Geothermal on the Map



DOE Funding Announced October 28, 2009

2) Coproduced, Geopressured, and Low Temperature Projects

Universal GeoPower LLC	\$1,499,288	Liberty County	TX	Universal GeoPower LLC will utilize a modular low temperature binary unit to produce power from oil and gas wells in Liberty County, Texas.
University of North Dakota	\$1,733,864	Williston Basin, (Bowman County)	ND	The University of North Dakota will utilize a low temperature binary unit to produce power from oil and gas wells in Bowman County, North Dakota.
Louisiana Tank, Inc.	\$5,000,000	Cameron Parish	LA	Louisiana Tank, Inc. will demonstrate the feasibility of a geopressured power plant in Cameron Parish, Louisiana.
University of North Dakota	\$1,733,864	Williston Basin, (Bowman County)	ND	The University of North Dakota will construct a low temperature power plant in Bowman County, ND.

Texas wind power is blowing in the bucks

The economic downturn has had a bit of a silver lining for Texas' wind energy business.

Under the **American Recovery and Reinvestment Act** Texas wind projects have received nearly **\$400 million in funding** meant to stimulate the economy and create green jobs. That's 40 percent of the \$1 billion given out so far.



Wind turbines near Sterling City, Texas.(AP Photo/LM Otero, File).

\$114,071,646

Oddly enough the **massive power line projects** designed to take West Texas' surplus wind power to the large cities in Texas that can use it seem to be **turning down the federal loan guarantees**.

At a Public Utility Commission meeting last month developers indicated the strings that come attached to the \$750 million in federal loan backing are too onerous for them.

"Cost increases arising from this Buy American [rule] could quickly overcome the savings created by the lower cost of capital," Richard Roloff, vice president of finance at LS Power,

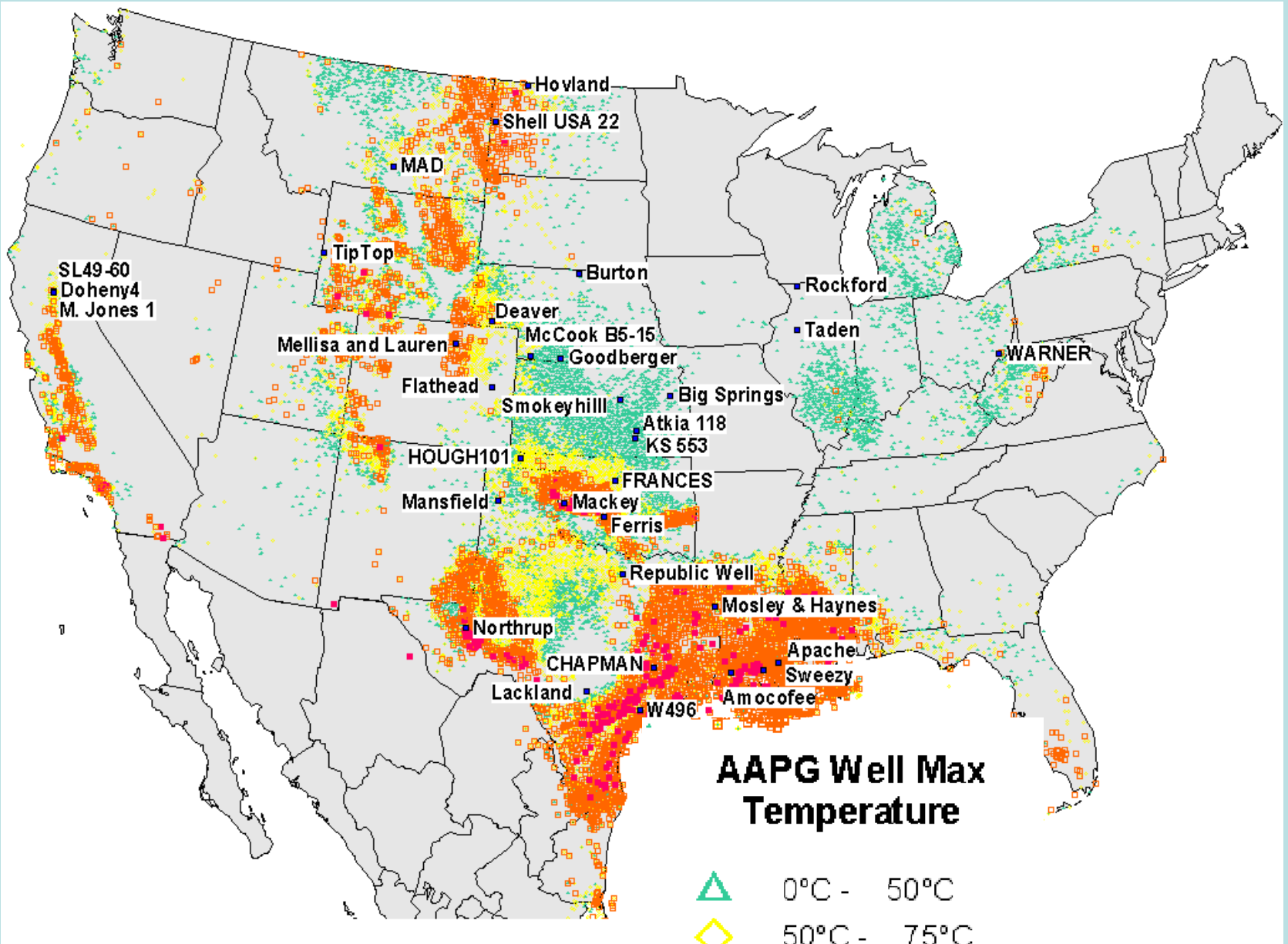
The **recipients include:**

- **Barton Chapel Wind Farm** Jacksboro, TX
\$72,573,627
- **Bull Creek Wind LLC**
O'Donnell, TX \$91,390,497
- **Pyron Wind Farm, LLC**
Roscoe, TX \$121,903,306
- **Penascal Wind Energy**
Near Corpus Christi, TX

- **Barton Chapel:**
– \$72,573,627
- **Bull Creek:**
– \$91,390,497
- **Pyron Farm:**
– \$121,903,906
- **Penascal:**
– \$114,071,646

Total: ~\$400,000,000

**+ \$5 Billion for
Powerlines to
Service 18 MW!**



AAPG Well Max Temperature

- ▲ 0°C - 50°C
- ◆ 50°C - 75°C
- ◻ 75°C - 150°C
- 150°C - 300°C

NAPE struts new technology, too

From Old Stripper to Power Producer

By LOUISE S. DURHAM
EXPLORER Correspondent

How very appropriate that Houston is home to Summer NAPE.

The enormous demand for air-conditioning required to make life bearable in this Gulf Coast city's environment of excessive summer heat and humidity is apt testimony to the nation's need for dependable energy sources – particularly time-proven, efficient oil and natural gas.

Summer NAPE is the annual prospect and property exhibition, offered by AAPG and the American Association of



Summer NAPE crowds gathered to see the Linear Driver Free-Piston engine.

Professional Landmen – a companion to the NAPE event held earlier in the year. Both events have become "must attend" events for geologists, geoscientists and investors.

The delightfully chilled George R. Brown Convention Center enabled the recent NAPE viewers to roam in comfort as they perused the expected smorgasbord of oil and gas drilling prospects.

Of course, they also came across vendor booths where the unexpected was on display.

Included among the surprise

encounters this year was Long Beach, Mississippi-based Linear Power Ltd., which was displaying the Linear Driver Free-Piston Engine it developed to turn watered-out wells into long-life electrical power producers.

"Natural gas wells that produce gas, or geo-pressured brine/gas wells that produce mainly high pressure brine, or low pressure gas wells with a high water cut are all wells capable of generating kinetic energy," said Bob Hunt, founder and chief technology officer at Linear Power. "This energy in turn is able to produce valuable amounts of electricity.

"A highly productive well is capable of producing several megawatts of electricity per hour," Hunt said. "A megawatt (MW) per hour of electricity will sell in a range of \$75 to \$120 per hour, resulting in revenues of up to \$86,000 per month.

"The economics of individual well locations will vary depending on selling price and other factors," he emphasized.

The electricity produced can either be used on site or sold into a local electrical distribution grid.

"Our application is attractive to oil and gas producers who spend significant amounts of money on electricity for production purposes," Hunt noted.

Step by Step

Linear Power has performed short-term testing of its equipment on wells in



The engine that turns watered-out wells into long-life electrical power producers.

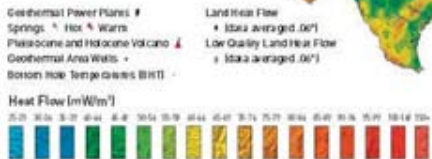
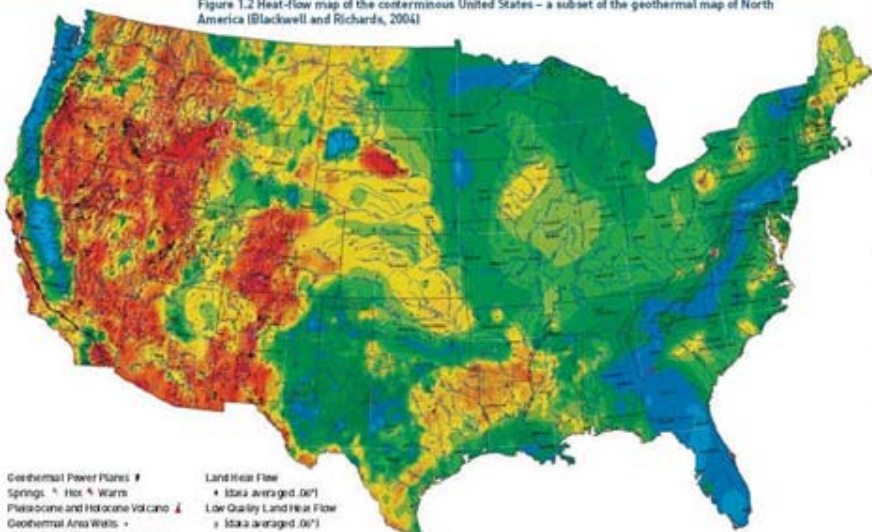


Andrés Ruzo

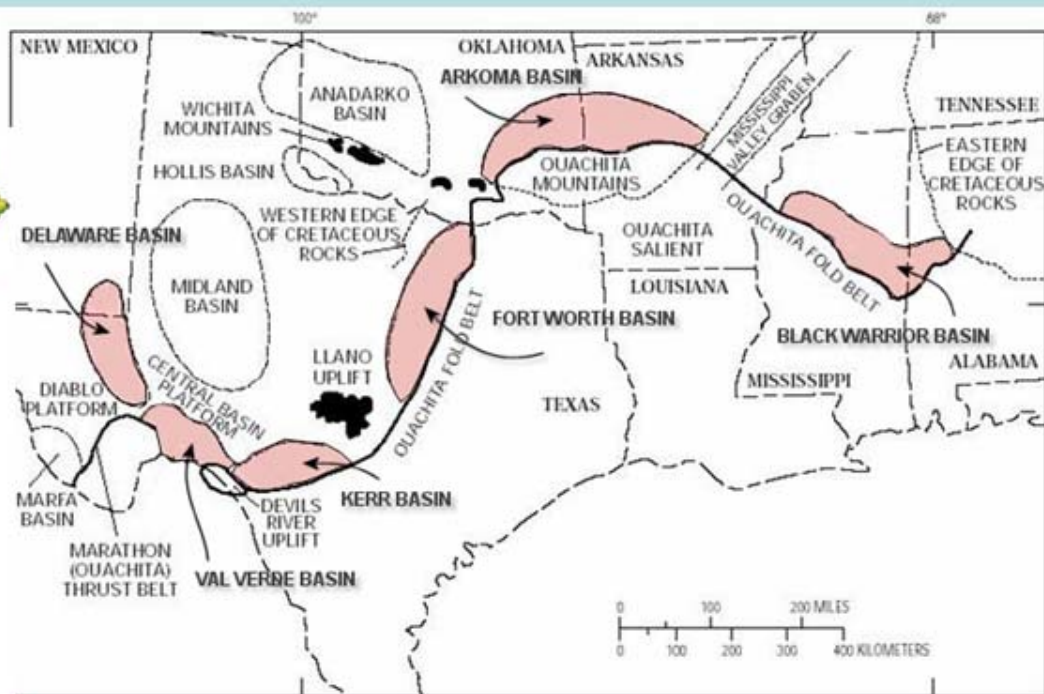
SMU Geothermal Project Big Ideas Grant Proposal

For Texas, the United States, & the World

Figure 1.2 Heat-flow map of the conterminous United States - a subset of the geothermal map of North America (Blackwell and Richards, 2004)



SMU Geothermal Lab, Geothermal Map of United States, 2004



LOCAL

DEPENDABLE

SUSTAINABLE

BASE-LOAD

GREEN

ZERO-EMISSION



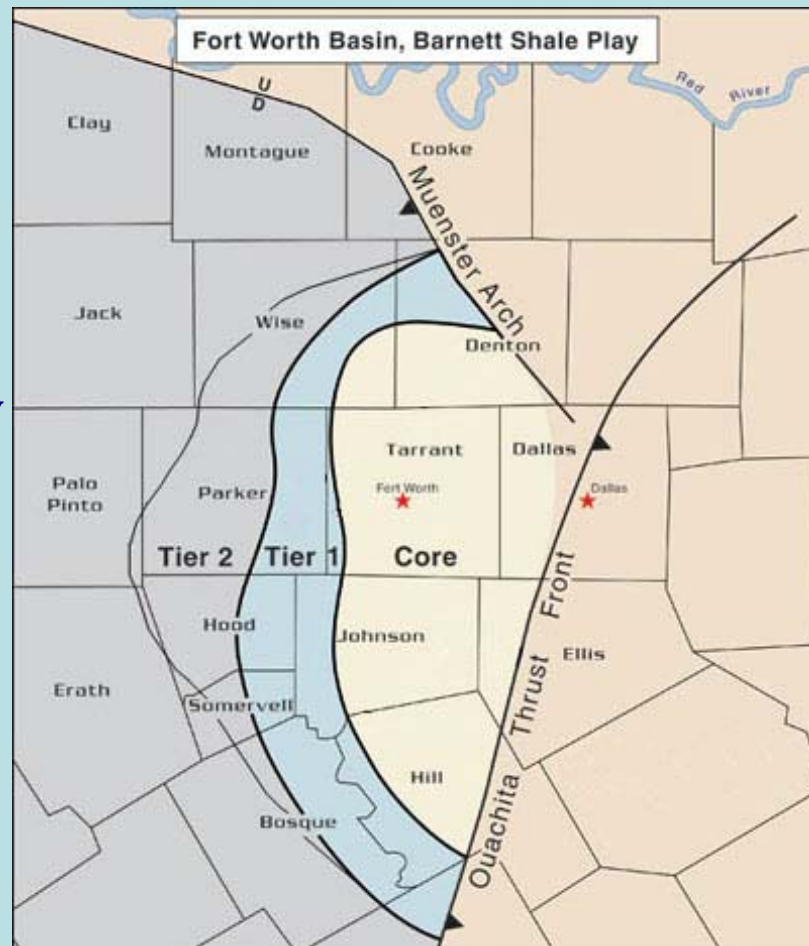
For SMU and the Dallas Area



- Base-load clean energy
- Unique geologic information
- Potential research facility
- Commitment to sustainability
- Bragging rights



- North Texas skill set
- Turns liabilities into assets



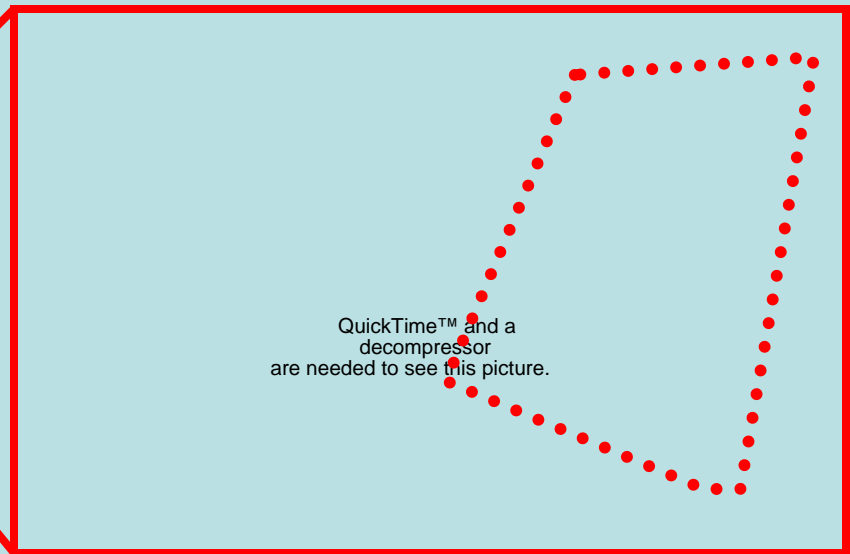
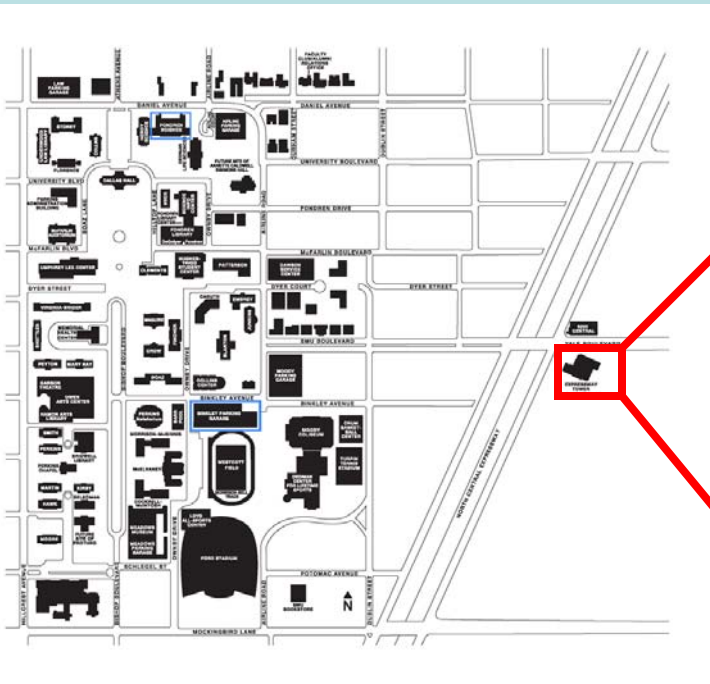


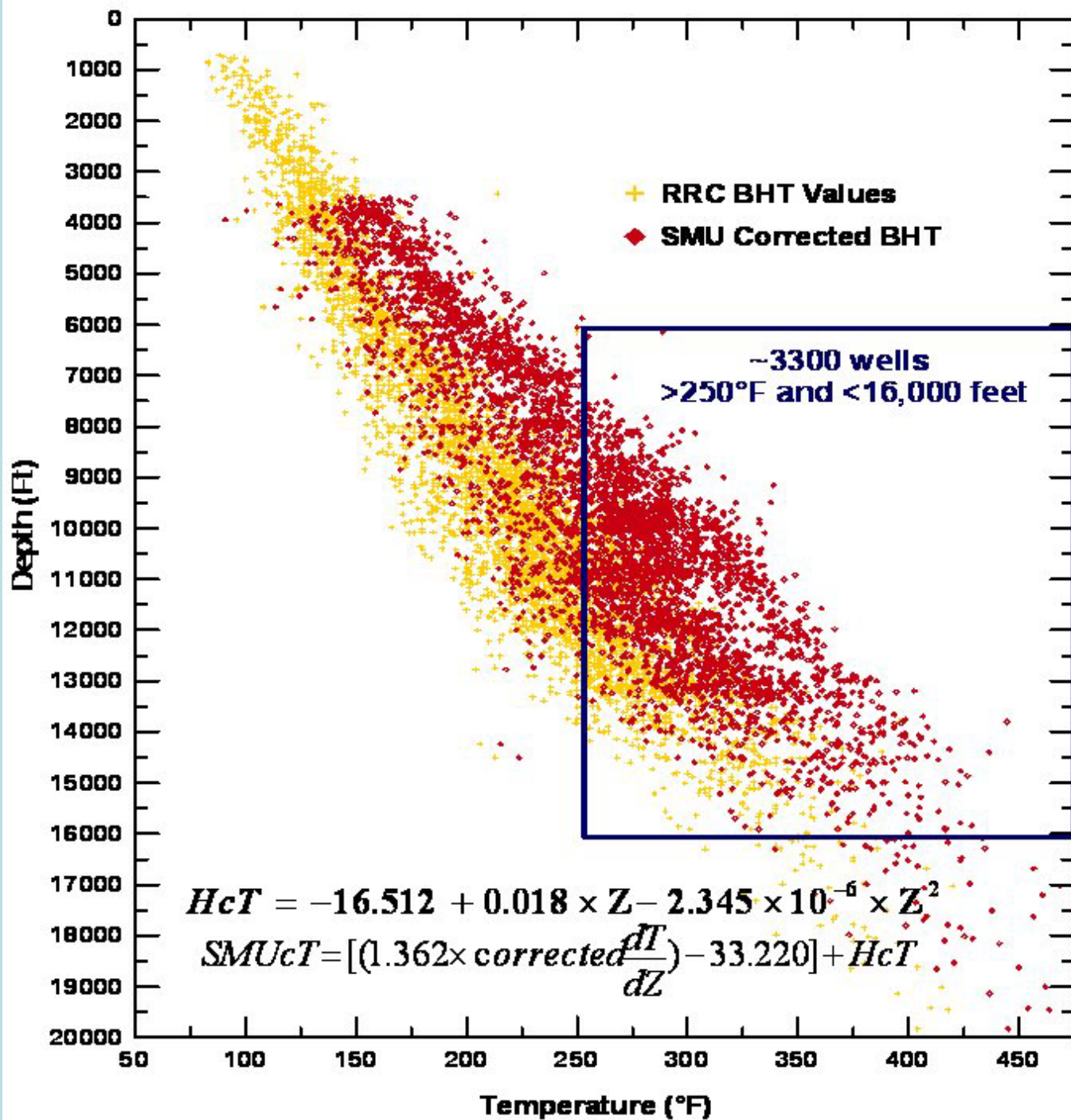
The next step...

Permission of pursuit → US Department of Energy Development Grant

→ Test well → Plant Development →

**SMU Geothermal Plant
&
Energy Research Center**







The Beginning