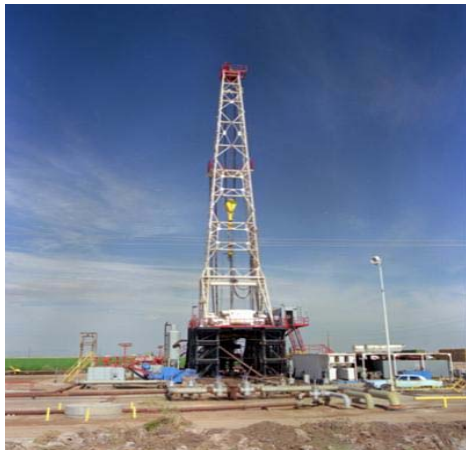


- Geothermal Energy -

State Policy Recommendations For GeoPowering Texas – An Example For States To Consider In Developing Their Geothermal Energy Resource On Non-Federal Acreage

R.J. Erdlac, Jr.
Energy America Geothermal
Midland, Texas



** Which well is for natural gas? **
** Which well is for geothermal? **
And...
** Which well can give you both? **



Acknowledgements

- ◆ Texas State Energy Conservation Office grant of \$40,000 to help develop a state-wide geothermal program (CM540).
- ◆ DOC/EDA grant of \$115,000 + matching to study geothermal, wind, and solar energy strategies in West Texas (08-06-04006).

This presentation is based on work conducted primarily for the State Energy Conservation Office (SECO) in Austin, TX. A complete copy of this report resides at the SECO office.

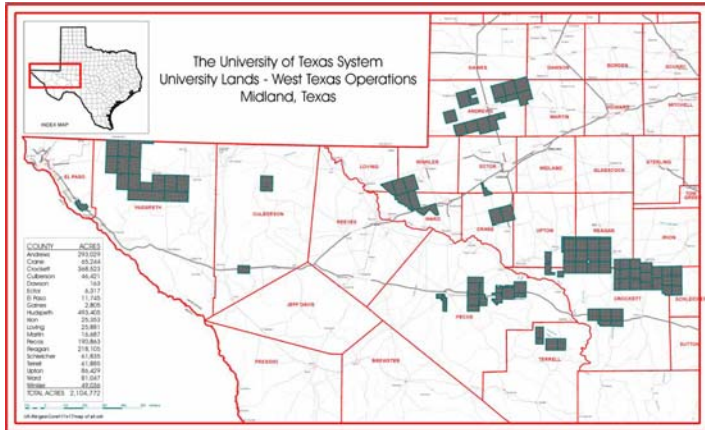
Presentation Overview

- ◆ **Texas Land Situation**
- ◆ **Texas Geothermal Overview**
- ◆ **Policy Recommendations**
- ◆ **Conclusions**

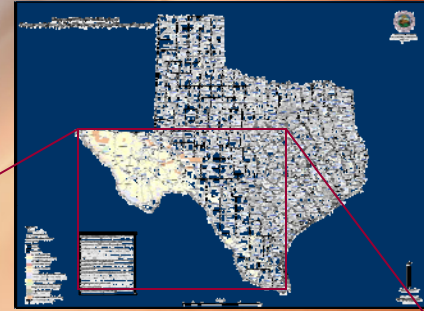
Texas Lands Are State Or Privately Owned

University Lands

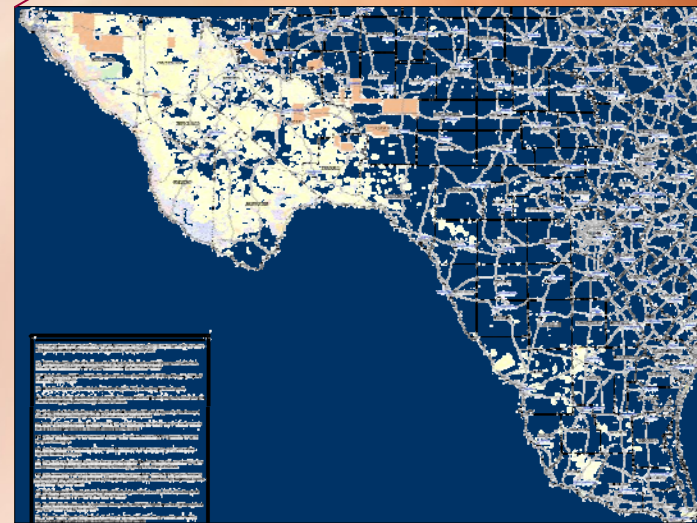
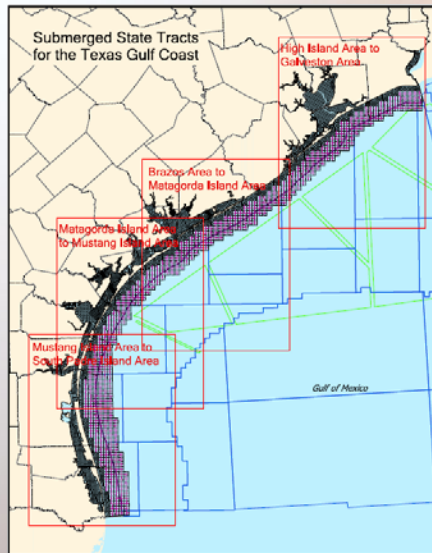
2,104,772 acres in West Texas



County	Acre	County	Acre	County	Acre
Andrews	293,029	Crane	65,244	Crockett	368,523
Culberson	46,421	Dawson	163	Ector	6,317
El Paso	11,745	Gaines	2,805	Hudspeth	493,405
Irion	25,353	Loving	25,881	Martin	16,687
Pecos	190,863	Reagan	218,105	Schleicher	61,835
Terrell	61,885	Upton	86,429	Winkler	49,036
Ward	81,047	Total Acres: 2,104,772			

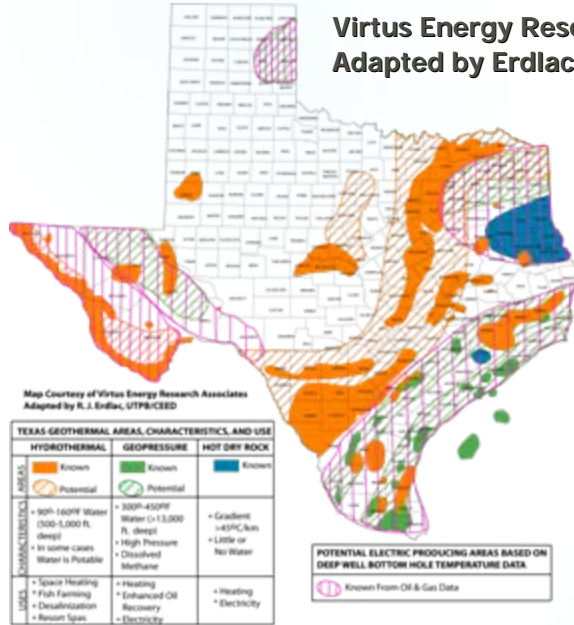


Texas General Land Office
20.3 million acres in West Texas, the Gulf Coast extending 10.3 miles from shoreline, state agency acreage & timber lands in East Texas



Texas Geothermal Energy As: Geoexchange – Direct Use – Electrical

Virtus Energy Research Associates, 1995
Adapted by Erdlac, 2006



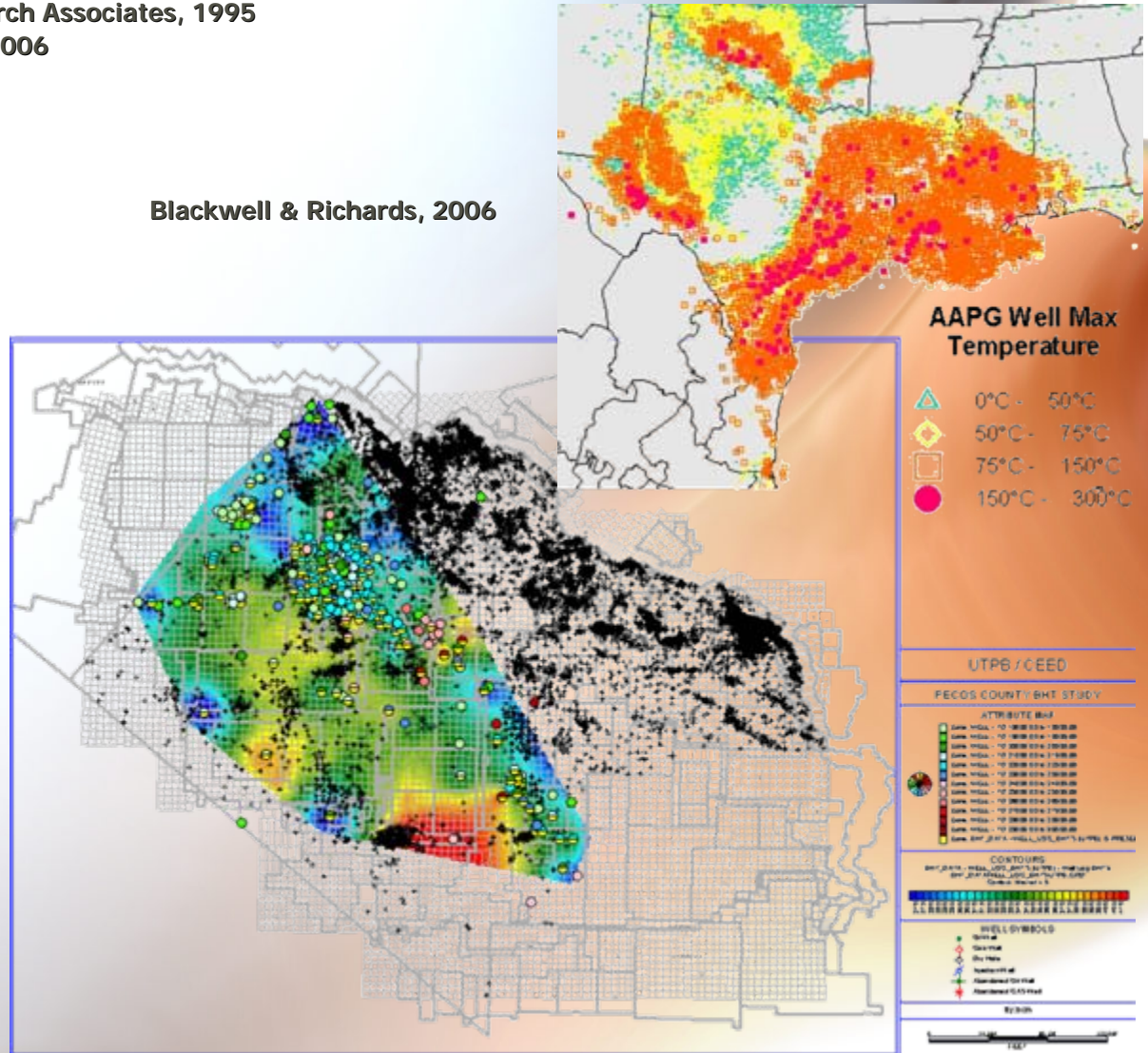
Erdlac & others, 2006

Well symbol color intervals every 1000 ft:
18,000 – 30,000 ft

Lower yellow half circle indicates BHT
data available.

CI for BHT data every 5°F: 270 – 410°F

Blackwell & Richards, 2006



Texas State Recommendations On Geothermal Energy Development

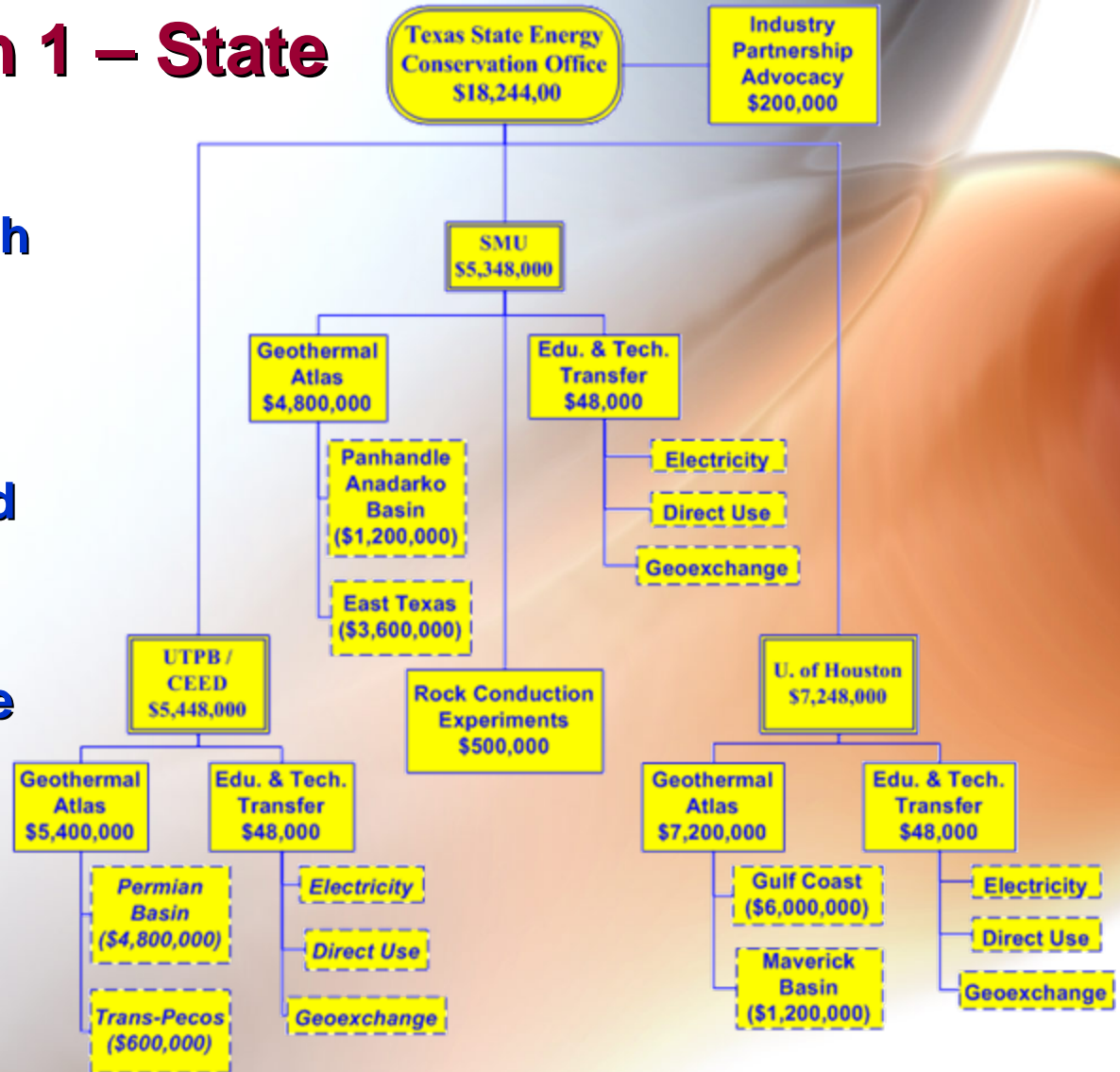
Recommendations Are In Four Categories:

- ◆ **Technical Assistance**
- ◆ **Industrial / Economic Development**
- ◆ **Advocacy**
- ◆ **Policy / Legal Action**

Recommendations: Technical

Recommendation 1 – State Funding

- ◆ 4 Years State Research Support
- ◆ Develop “Texas Geothermal Atlas”
- ◆ >=\$18 Million Targeted To 3 Universities
- ◆ Develop Industry Support Infrastructure Beyond 4 Years



Recommendations: Industrial / Economic Development

Historic West Texas Economic Dependence

Jan-Mar 1997 Business Statistics For Midland & Ector Counties		
Business Type	Number Businesses	Number People Employed
Bus. Excluding Petroleum ^	9,923	78,345
Bus. Excluding Petroleum & Agriculture ^	9,784	77,851
Petroleum ^	1,795	
Exploration & Prod Co. *	228	

^ From D&B Market Place

* SW Bell Yellow Pages

Jan-Mar 1997 Business Statistics For Midland & Ector Counties	
Business Type	Sales
All Businesses ^	\$7,408,100,000
Agriculture & Related ^	\$91,600,000
Petroleum & Related ^	\$2,573,600,000
Remaining Businesses ^	\$4,742,900,000

^ From D&B Market Place

Renewable Energy Jobs

Texas Wind Resource	
# Tech / 10 MW*	# Tech / 2898 MW installed
1	300

Geothermal (Ormat^)	
# Tech for 20 MW plant	# Tech for 50 MW plant
12 - 14	40 - 50

* Randy Sowell, personal communication

^ Personal communication (field trip)

If Texas had 2898 MW of installed geothermal, employment might run from 6 – 10 jobs for every 10 MW, or 1,738 to 2,898 employees.

Recommendations: Industrial / Economic Development

Recommendation 2 – Leasing Definition And Clarification

Legislative Intent:

NATURAL RESOURCES CODE
TITLE 5. GEOTHERMAL ENERGY AND ASSOCIATED RESOURCES
CHAPTER 141. GEOTHERMAL RESOURCES
SUBCHAPTER A. GENERAL PROVISIONS
“(Texas) Geothermal Resources Act of 1975”

Sec. 141.002. DECLARATION OF POLICY. It is declared to be the policy of the State of Texas that: (1) the rapid and orderly development of geothermal energy and associated resources located within the State of Texas is in the interest of the people of the State of Texas;

Sec. 141.002(4) since geopressured geothermal resources in Texas are an energy resource system, and since an integrated development of components of the resources, including recovery of the energy of the geopressured water without waste, is required for best conservation of these natural resources of the state, all of the resource system components, as defined in this chapter, shall be treated and produced as mineral resources;

Sec. 141.012(b)(2) prevention of waste of natural resources, including geothermal energy and associated resources, in connection with the exploration, development, and production of geothermal energy and associated resources

Recommendations: Industrial / Economic Development

Recommendation 2 – Leasing Definition And Clarification

The typical O&G lease does not directly include geothermal in the agreement with the mineral owner...or do they?

If the word 'geothermal' is not used does this type of wording also include heat?

And if not, does the injection of hot brine constitute a breach of law under the Geothermal Resources Act whereby the heat is being wasted?

Paid Up TX Form

OIL AND GAS LEASE

THIS LEASE AGREEMENT is made as of the _____ day of _____, 2005, between

as Lessor (whether one or more), whose address is: _____
and _____, as Lessee, whose address is _____

All printed portions of this lease were prepared by Lessee, but all other provisions (including the completion of blank spaces) were prepared jointly by Lessor and Lessee.

1. Grant and Description. In consideration of an adequate cash bonus in hand paid and the covenants herein contained, Lessor hereby grants, leases and lets exclusively to Lessee the following described land, hereinafter called leased premises:

in the County of _____, State of **TEXAS**, containing _____ gross acres, more or less (including any interests therein which Lessor may hereafter acquire by reversion, prescription or otherwise), for the purpose of exploring for, developing, producing and marketing oil and gas, along with all hydrocarbon and nonhydrocarbon substances produced in association therewith. The term "gas" as used herein includes helium, carbon dioxide and other commercial gases, as well as hydrocarbon gases. In addition to the above-described land, this lease and the term "leased premises" also covers accretions and any small strips or parcels of land, or any vacancies or excess acreage, now or hereafter owned by Lessor, or which Lessor may have a preferential right to acquire, which are contiguous or adjacent to the above-described land, and, in consideration of the aforementioned cash bonus, Lessor agrees to execute at Lessee's request any additional or supplemental instruments for a more complete or accurate description of the land so covered. For the purpose of determining the amount of any shut-in royalties hereunder, the number of gross acres above specified shall be deemed correct, whether actually more or less.

Recommendations: Industrial / Economic Development

Recommendation 3 – Lease Expansion

Allow oil and gas companies with existing O&G leases on lands under state jurisdiction to grandfather into existing leases the right to develop geothermal energy along with the oil and gas that may already be in production.

- ◆ **Maintain integrity of O&G and / or geothermal reservoir.**
- ◆ **Minimize legal battle over which energy resource takes precedence.**
- ◆ **Alleviate two separate companies from wanting O&G and geothermal from the same lease and the same reservoir.**

Recommendations: Advocacy

Recommendation 4 – Financial Forums

- ◆ Renewable energy finance forums that include geothermal.
- ◆ Separate geothermal finance forum due to uniqueness of resource – long lead time in establishment.
- ◆ Location of forums be in different locations throughout the state.

Recommendation 5 – Nesting

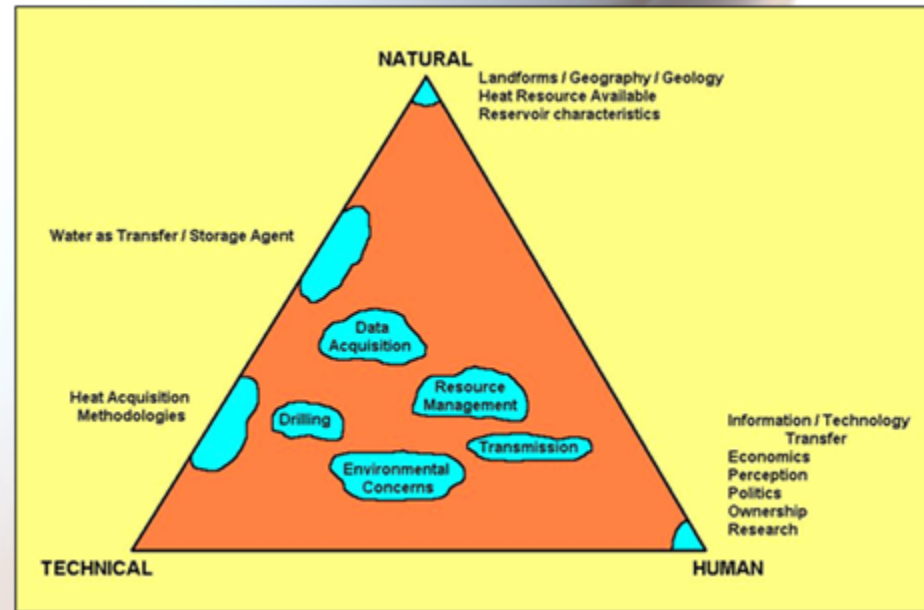
- ◆ The planned development of two or more (renewable) resources in concert with each other in the same geographic area for the purpose of:
 - Offsetting a weakness of one resource by the strength of another.
 - Guaranteeing that a minimum amount of electrical power is available for baseload use at all times.



Recommendations: Policy / Legal Action

Constraints on geothermal development.

CONSTRAINTS TO GEOTHERMAL DEVELOPMENT			
Natural (Geological/Geographical)		Technical	Human
Surface	Subsurface		
Landforms/Geography/ Geology	Heat Resource Available	Drilling (techniques- horizontal, radial patterns)	Economics (cost vs. profit) (drilling costs)
	Reservoir Characteristics	Heat Acquisition Methodologies	Perception
	Water as Transfer/Stora ge Agent	Environmental Concerns (toxic & nontoxic minerals)	Transmission
		Data acquisition	Information/Technology Transfer
			Politics (gov., people [advocacy groups])
			Ownership
			Resource Management
			Research



Ternary Constraint Diagram
Erdlac, 2005

While Natural and Technical constraints may be hard to overcome, the Human constraints can be more directly addressed. Constraints that are 'manmade' can be 'unmade'.

Recommendations: Policy / Legal Action

Recommendation 6 – Retrofit State Buildings Energy Policy Act Of 2005

STATE ENERGY EFFICIENCY GOALS

SEC. 364. Each State energy conservation plan with respect to which assistance is made available under this part on or after the date of enactment of the Energy Policy Act of 2005--

- (1) shall contain a goal, consisting of an improvement of 25 percent or more in the efficiency of use of energy in the State concerned in calendar year 2012 as compared to calendar year 1992; and*
- (2) may contain interim goals.*

- ◆ **Texas should embark upon a plan that requires all state buildings and state supported facilities to retrofit these facilities with geexchange HVAC systems.**
- ◆ **Lubbock Christian University (a private institution) has already experienced a 40 to 50% drop in heating and cooling costs by using geexchange HVAC.**

Recommendations: Policy / Legal Action

Recommendation 7 – Incentives

- ◆ **Federal incentives have included Business Energy Tax Credits and Renewable Electricity Production Tax Credits through December 31, 2007.**
- ◆ **Texas has incentives for non geothermal resources:**
 - **Renewable Energy Systems Property Tax Exemption**
 - **Solar Energy Device Franchise Tax Deduction**
 - **Solar Energy Business Franchise Tax Exemption**
- ◆ **These incentives should be extended to include geothermal energy.**

Suggestion for a new incentive:

NEW RENEWABLE ENERGY PROJECTS SHOULD BE ENTIRELY TAX EXEMPT UNTIL THE INITIAL INVESTMENT COST HAS BEEN PAID FOR BY THE PRODUCT DEVELOPED BY THE RENEWABLE ENERGY PROJECT.

Recommendations: Policy / Legal Action

Recommendation 8 – Capacity Factor

Definition: Capacity factor measures the amount of real time during which a facility is used.

- ◆ Texas SB 20 uses words such as “generating capacity” and “cumulative installed renewable capacity” when discussing 5,880 renewable requirement by January 1, 2015.
- ◆ This is availability factor, not capacity factor.
- ◆ A successful transition from non-renewable to renewable resources must consider capacity factor for a steady stream of power production.
- ◆ Future legislation must include capacity factor in its wording.

Power Technology	Expected Capacity Factor (%)*
Nuclear	90
Geothermal	86 – 95
Biomass	83
Coal	71
Hydropower	30 – 35
Natural Gas Combustion Turbine	30 – 35
Wind	25 – 40
Solar	25 – 33 (~60 with heat storage capability)^

*Geothermal Energy Association, 2007

^Erdlac, 2006, rpt. to DOC/EDA

Recommendations: Policy / Legal Action

Recommendation 9 – Shallow Geothermal Use

- ◆ **Past Legislation defined geothermal as a mineral and energy resource, managed by the Texas Railroad Commission (Oberbeck, 1977) suggesting ownership by the mineral owner.**
- ◆ **Texas Oil And Gas Conservation Laws: Title 5: §141.003 Definitions: (4) “Geothermal energy and associated resources” means: (C) heat or other associated energy found in geothermal formations;**
- ◆ **What legislation, if any, covers the access to shallow heat use with geoexchange systems?**
- ◆ **What constitutes the legal definition of a “geothermal formation”?**
- ◆ **May need a revisit of terms by legislation to more clearly define the forms of geothermal, its ownership, and its use.**

Embrace A New Energy Future!

"Your system is perfectly designed to give you the results you're getting".

Supportive....

....or Restrictive

W. Edwards Deming

- ◆ **Geothermal is versatile in its use, for HVAC, direct industrial use, and for electric power generation.**
- ◆ **It has a high capacity factor, important when a focus is getting electrons on the grid.**
- ◆ **Geothermal power development can initiate through the oil and gas infrastructure, bringing new jobs to Texas and continuing to maintain existing jobs in the geoscience and engineering disciplines.**
- ◆ **Texas must take an active leadership role for geothermal development, demonstrating its forwarding thinking capability for the benefit of its citizens and for displaying fiscal responsibility.**

"The oil and gas and geothermal industries are linked. It is time for the two estranged brothers to work together towards a new and broader energy future"