Constraints And Best Use Practice:

The Importance Of Texas Geothermal Electrical Energy Production

“Like A Phoenix Rising From Its Ashes”

Richard J. Erdlac, Jr.
The University of Texas of the Permian Basin
Center for Energy & Economic Diversification

*Which well is for natural gas?*
*Which well is for geothermal?*
* DOE grant of $194,458 to study deep Permian Basin geothermal energy (part of an anticipated 3-year Congressional appropriation) (#DE-FG36-05GO85023).

* State Energy Conservation Office grant of $40,000 to help study deep Permian Basin geothermal energy and to develop a state-wide geothermal program (#CM540).

In Texas, peak oil and gas hit in 1972.

“Your system is perfectly designed to give you the results you’re getting”.

W. Edwards Deming
U.S. Energy Usage –– Up...and UP!

Automotives – 9 million Bbl/ day
Trucks, Heavy Machinery, Power Plants – 11 million Bbl/ day

1 Petroleum products supplied is used as an approximation for consumption.

2 Crude oil and natural gas plant liquids production
World Oil Supply & Demand Are Close

So what of the future... for the oil and gas industry?
Yes, Virginia, there is a...
# Geothermal Energy Industry Constraints

Only Three Variables Control All Constraints

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Many of these constraints do not exist in the Texas oil and gas industry.
Natural Variable

Surface – a non-issue; land very accessible.

Subsurface –
  ✓ Heat resource – known from O&G data.
  ✓ Reservoir characteristics – known from O&G data.
  ✓ Water availability – known from O&G data; total amount unknown as industry does not perforate wells for the purpose of producing water.

This knowledge greatly reduces risk for geothermal development as well as total cost.
Drilling – involved with pioneering oil/gas drilling techniques; nothing new needed for geothermal.

Pinnate drainage pattern horizontal drilling system pioneered by CDX Gas LLC for coal-bed methane extraction.

Joint venture between the DOE, NovaTek Engineering, and Grant Prideco. Decreases deep drilling time & cost through real time data transfer. Provide pipe and links. Twice cost of normal pipe. Size: 5”, 5 7/8”.
Heat acquisition – O&G industry knows how to move water, but will need to learn to generate electricity.

**Ormat**

And if Kinder Morgan can generate electricity at the Sac Rock field, so can other companies.

**UTC Power**

**AND.....**

PureCycle™ 200
200 kW net range
It Has Already Been Proven Once!

**Sept 1989 - May 1990: Brazoria County, Texas**

- Three heat exchangers at Pleasant Bayou
- Condensers at Pleasant Bayou
- Fire protection system at Pleasant Bayou

**Comparison:**
- Minimum rating 1.191
- Binary Cycle Turbine 541 kW
- Gas Engine 650 kW
- Parasitic Load -209 kW
- Capacity factor 80.2%
- (3-day plant outage & 4-wk turbine outage)
- Plant availability 97.5%

Compare with Ormat heat exchangers, Imperial Valley Geothermal
Environmental – O&G biggest problems have been solved through chemical inhibitors; highly toxic mineralization not of concern.

Data – huge amounts of subsurface data regarding temperature, seismic, porosity, permeability, reservoir imaging, etc. are all important for heat extraction.
Human Variable

Perception – O&G industry must think of hot water as an energy asset, not as a production liability; biggest hurdle to overcome.

- Waste water storage.
- Pit liner for produced water.
- Oil field water hauling.
Transmission – a huge infrastructure for transmission already exists. Transmission right of ways are important to maintain. Many existing right-of-ways may eventually double as electrical right-of-ways.

Electrical right-of-ways within existing oil fields can send electricity out.
It Is Time To Define Best Use Practice For Energy Resources

Oil, Gas, Coal, Nuclear, Biomass

Storable/Transportable Energy Resources

Use these for electricity...

Wind, Solar, Geothermal, Tidal, Hydroelectric

Non-Storable/Non-Transportable Energy Resources

Not these.

Oil, Gas, Coal, Biomass

Solid Energy Used For Product Development
Embrace A New Energy Future!

It Is Time!

Oil and Gas was derived from Geothermal heat.

You don’t find oil/gas unless you put the drill bit into the ground.

An oil – gas – geothermal triad gives added economic incentive to drill.

You can’t just think outside box. . . You must do outside the box.

“The future of the Texas oil and gas industry is tied to The future of a Texas geothermal industry.”