Converting Geopressured-Geothermal Reservoirs to Renewable Energy Systems with Thermal Enhanced Oil Recovery

Introduction at the Southern Methodist University Geothermal Laboratory Conference:

Geothermal Energy Utilization Associated with Oil & Gas Development

Dallas, Texas 17-18 June 2008

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GEM technology converts GPGT reservoirs to renewable energy systems (solar ponds) while enabling cost effective TEOR of collocated oil

Half the fuel per bbl steam (v. gas-fired steam generators)

$3.50-$5.50 savings per bbl steam (@ $10/Mcf gas)

Establish renewable energy systems (goal: *revenue neutral*)

Half the carbon footprint (*~zero with renewable system offset*)

Building a bridge to a sustainable tomorrow while meeting the energy demands of today

GEM Technology

- What is it?
- What are the benefits?
- What is the status of its implementation?

System Overview

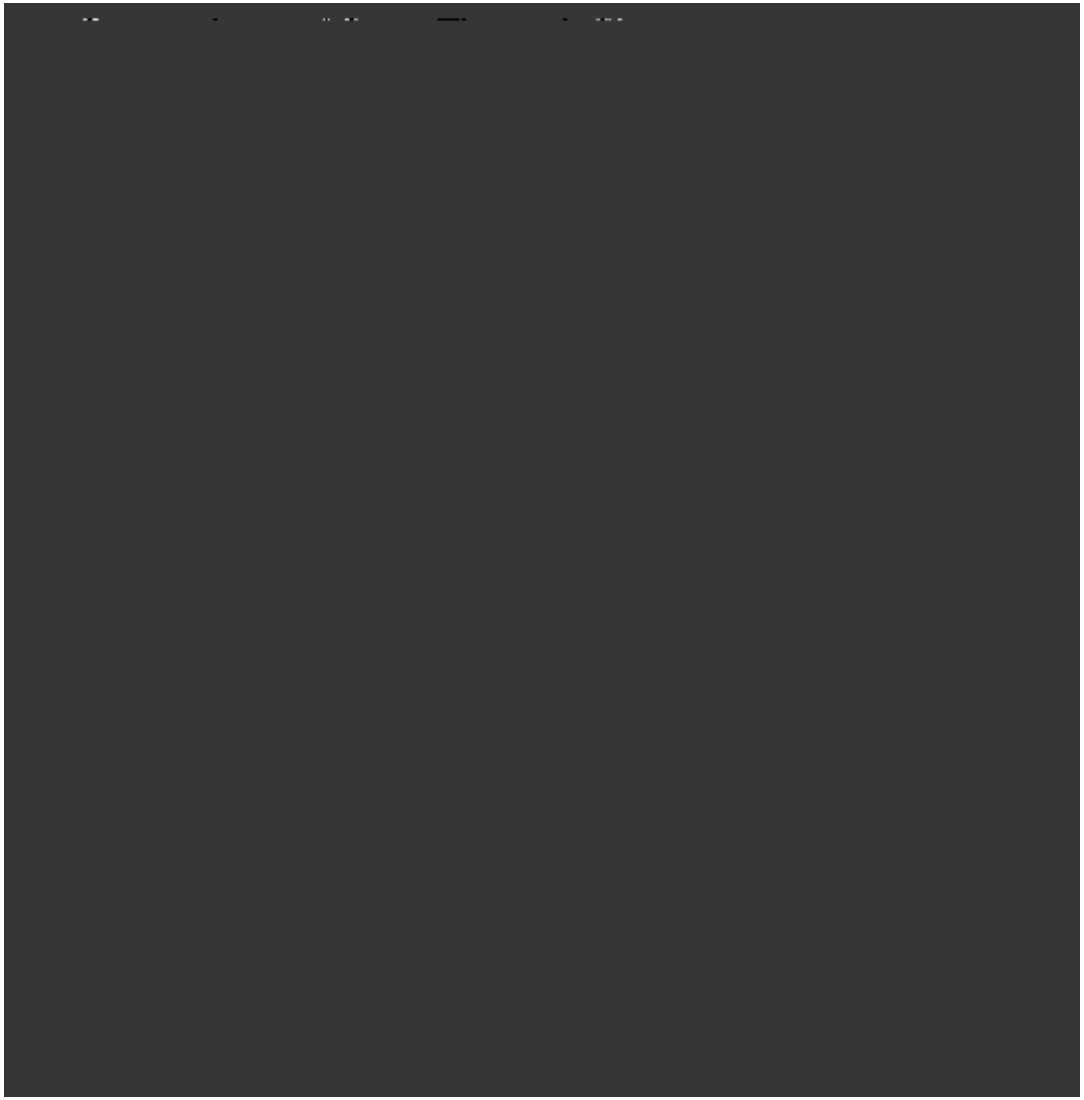
GPGT Conversion Segment

GEM Technology

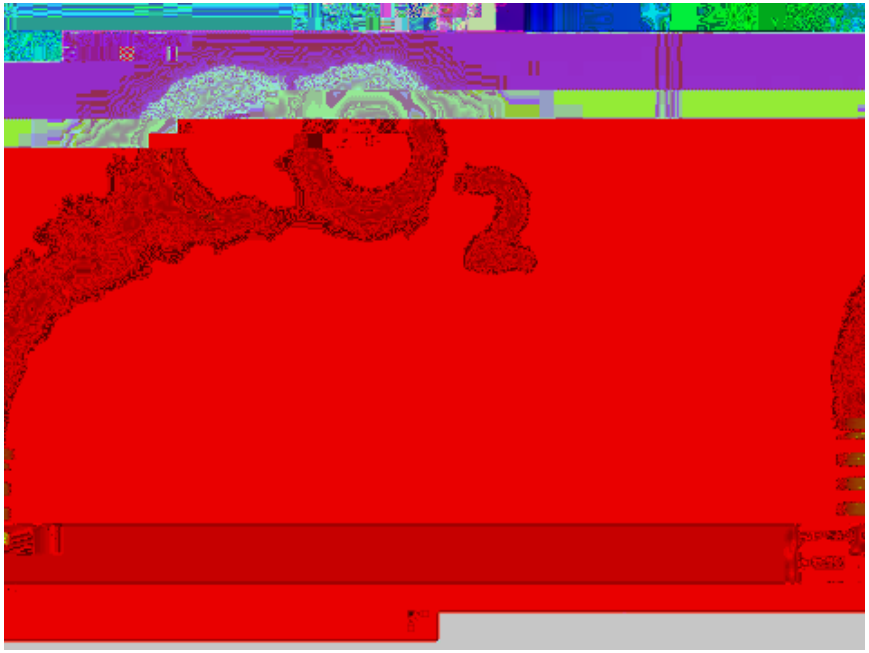
What is it?

What are the benefits?

Cheap Steam for TEOR



Zero-to-Negative Carbon Footprint



Carbon Avoidance – GEM TEOR

The GEM TEOR method reduces the fuel gas by half which also reduces by half the CO2 release for TEOR operations.

Carbon Offset – Solar Ponds

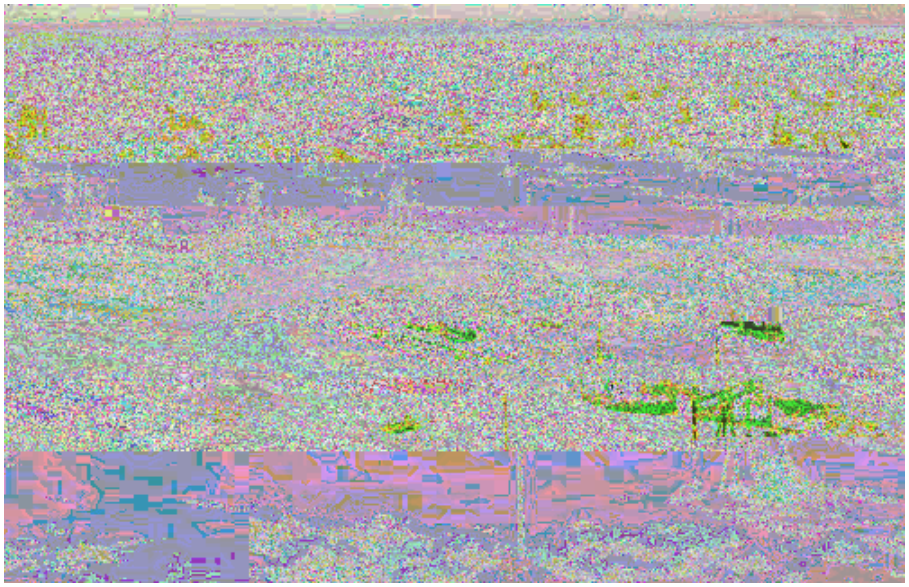
A 2MWe solar pond, producing *perpetual* solar-thermal electric power, will offset the CO2 release during the GEM TEOR phase.

CO2 Sequestration – GPGT Reservoirs

The post-TEOR GPGT brine reservoirs will provide for geo-sequestration of CO2, using industry methods currently in development.

The GEM TEOR method will result in a net-negative carbon footprint

TEOR Produced Water Management



TEOR Steamflood Return Water

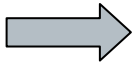
Conventional TEOR steamflood practice results in 3-10 bbl of “produced water” for every bbl recovered oil. Management of these produced waters is becoming an increasing problem to the operators, e.g., regulations restricting disposal using percolation-evap ponds. The GEM TEOR method provides various options for dealing with the produced water, e.g., reclamation for potable/irrigation, reduce and use for solar ponds, and recirculate to the GPGT reservoir for thermal regeneration.

The GEM TEOR method results in zero-discharge of produced water

GEM Technology

What is it?

What are the benefits?



What is the status of its implementation?

GEM Technology is Pilot Project Ready

Establish a Pilot Project to profitably demonstrate GEM TEOR

- Patented technology to protect stakeholder interests
- Profitable pilot, revenue sharing amongst stakeholders
- Further assess the CA GPGT characteristics (TX assessment by DOE tests)
- Proof-test the GEM TEOR systems performance
- Proof-test the instantiation and performance of co-product solar ponds

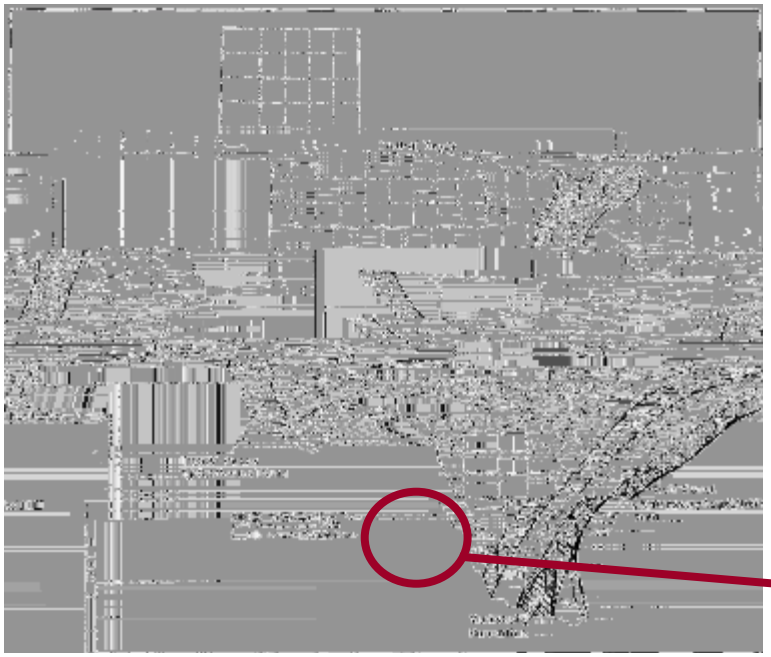
Candidate Pilot Project Partners:

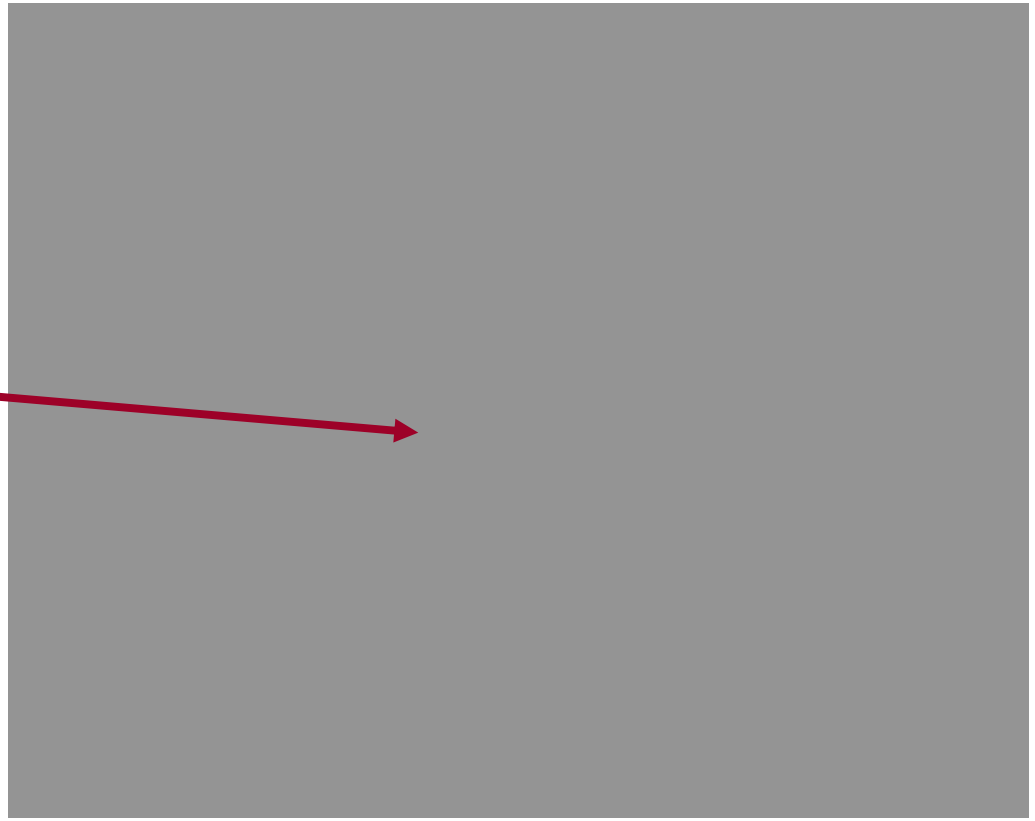
- Heavy-oil lease operators
- Renewable-energy infrastructure developer / purveyor
- Other industry partners (equipment suppliers)
- State and Federal agencies (e.g., for cost share, data support)

Role of Good Earth Mechanics, LLC

- Holds GEM TEOR intellectual property
- Association of subject matter experts to promote/optimize GEM GPGT designs
- Provide subject matter expertise to help develop/support/manage the pilot(s)
- Preliminary vendor and stakeholder coordination, feasibility studies complete

Example TX Pilot Project Locations

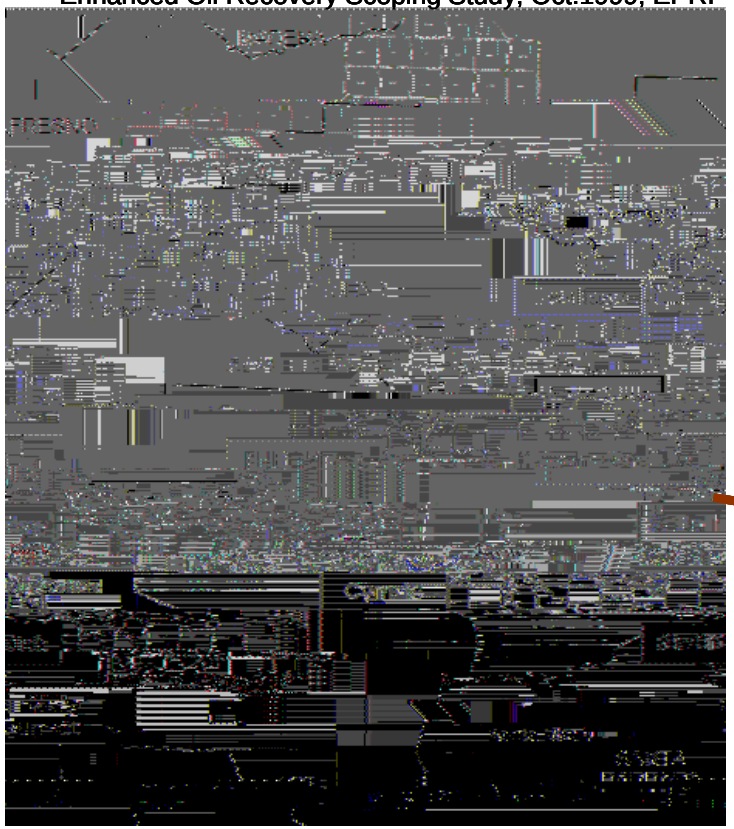




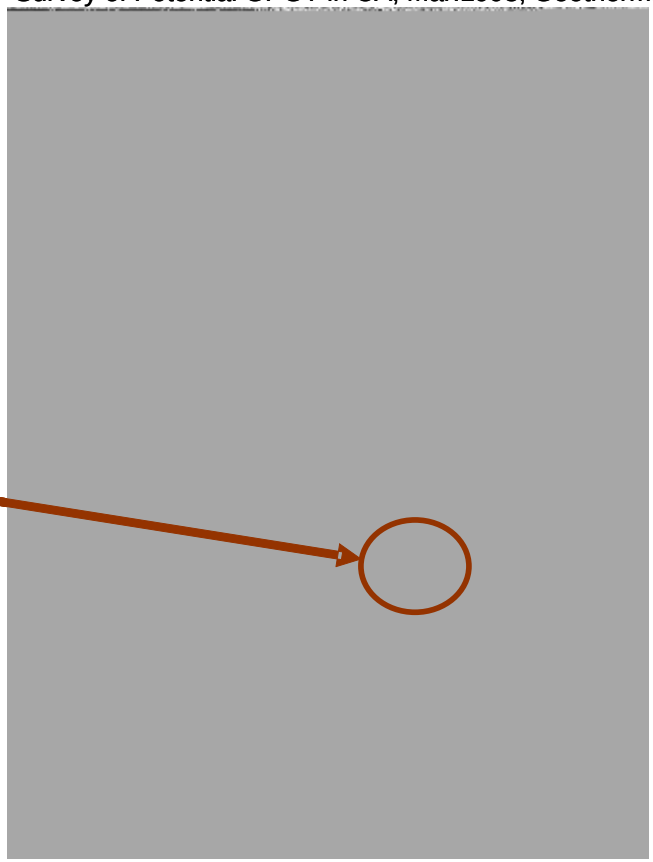
Ref.: Thermal Enhanced Oil Recovery Using GPGT Brine,
Idaho National Engineering Laboratory, Dec. 1989

Example CA Pilot Project Locations

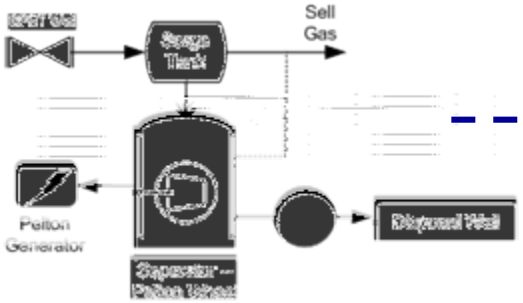
Enhanced Oil Recovery Scoping Study, Oct.1999, EPRI



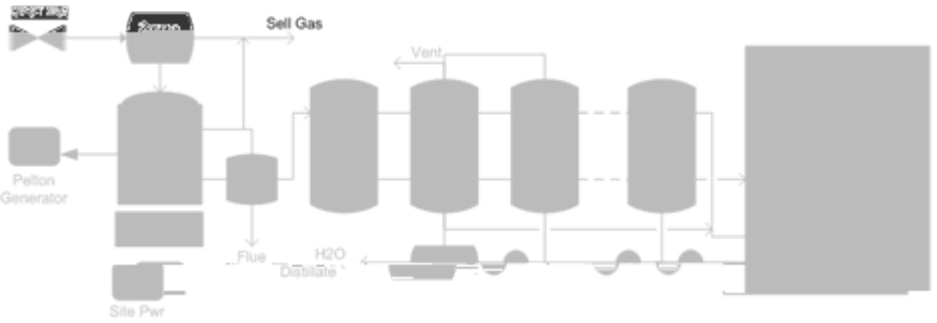
Survey of Potential GPGT in CA, Mar.1993, GeothermEx

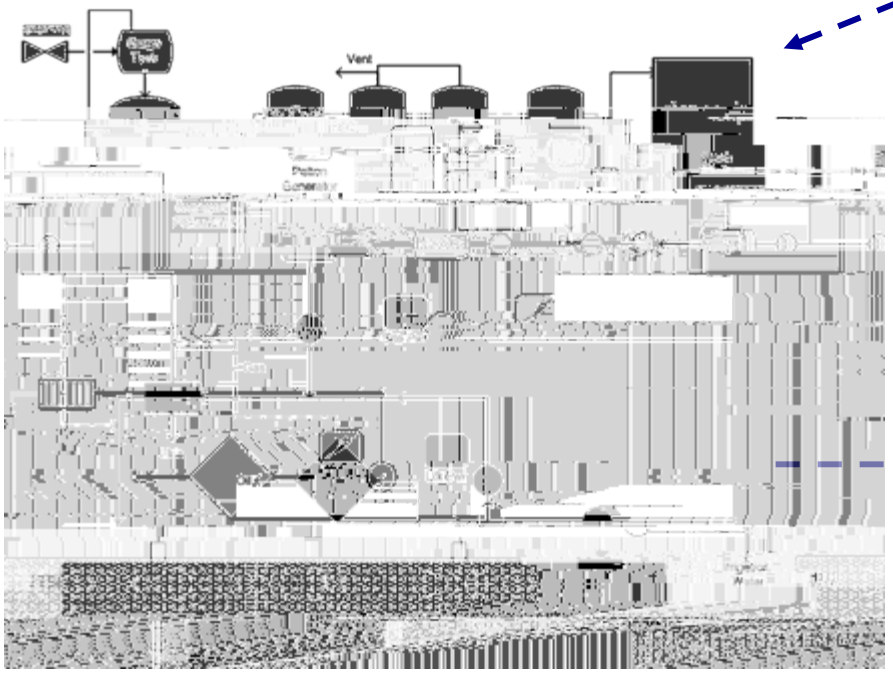


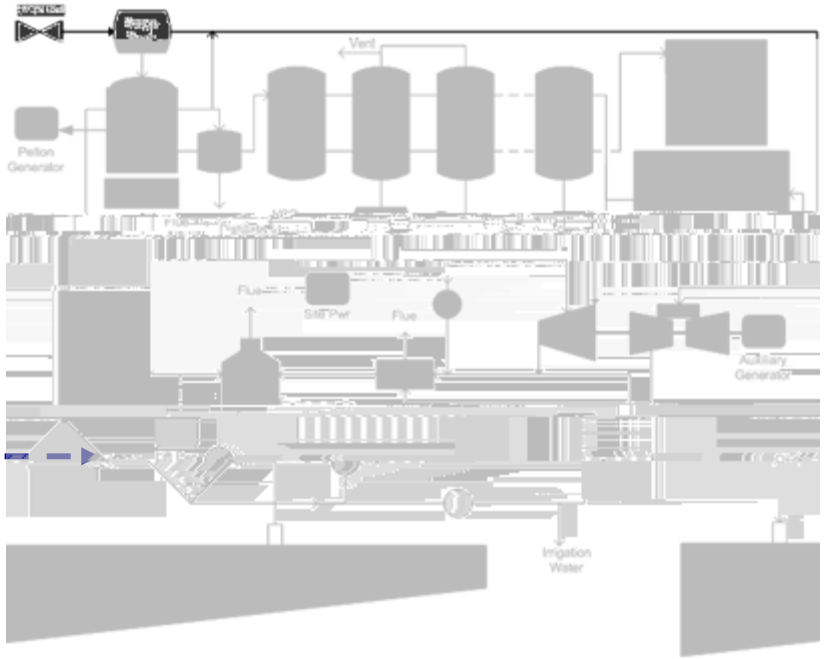
Flexible Pilot Configuration Build-Up



Simple to complex







GEM Technology Summary

GEM TEOR design concept is ready for piloting in CA, TX

- Half the fuel per bbl steam (v. gas-fired steam generators)
- $3.50-$5.50 savings per bbl steam (@ $10/Mcf gas)
- Establish renewable energy systems (goal: *revenue neutral*)
- Half the carbon footprint (*~zero with renewable system offset*)

Seeking pilot partners / sponsors / Govt. cost share

- Revenue sharing amongst stakeholders, arrangement TBD
- Patent-protected technology
- Utilize GEM engineering support, studies, and vendor coordination

For more information contact:

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www.goodearthmechanics.com

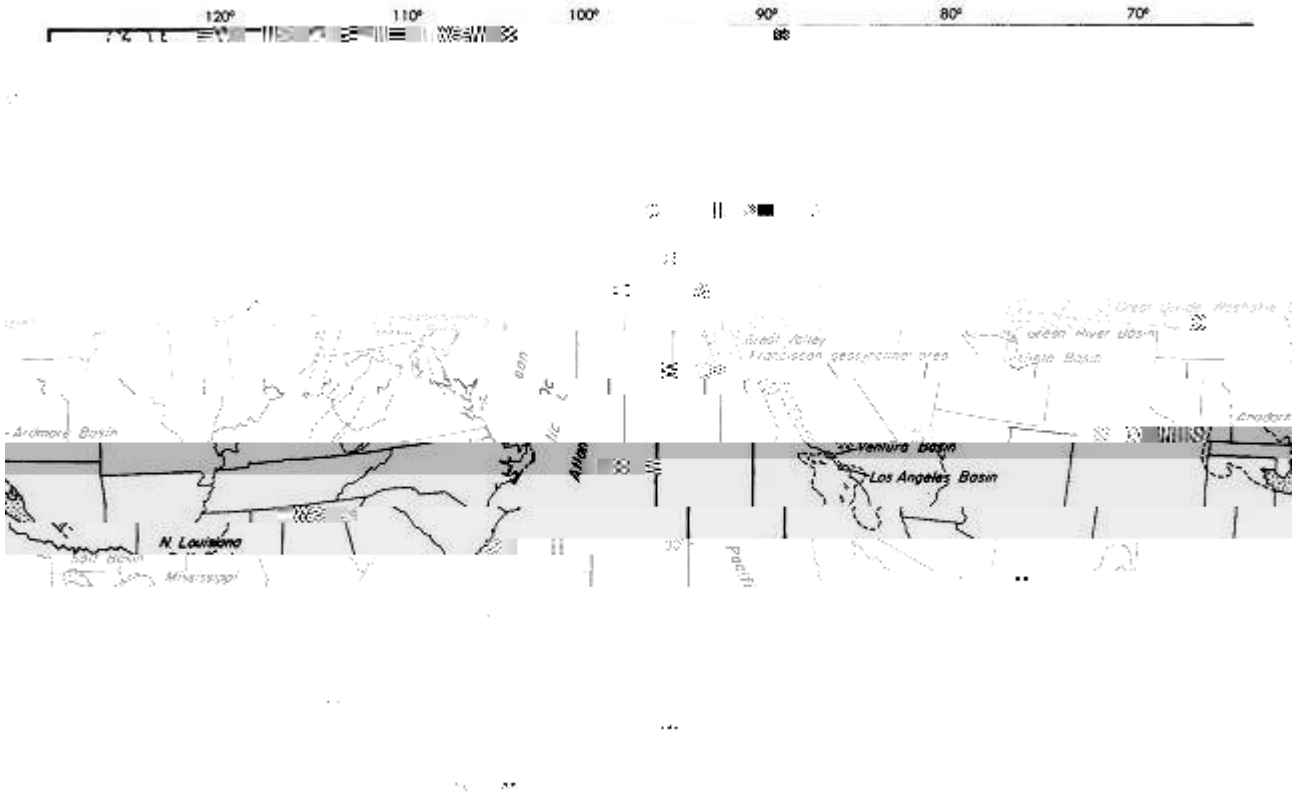

Thank you!

The GPGT Resource

Geopressured-Geothermal energy (GPGT) is an immense energy resource that remains relatively untapped throughout the world

- **High pressure, high temperature, gas cut, brine reservoirs**
  - wellhead pressure: 1000–4000 psi
  - brine temperature: 250–400°F
  - GPGT brines contain 20–100 scf/bbl natural gas
  - normally found at depths greater than 10,000 feet
  - can be produced at high flow rates: 20,000–40,000 bbl/day
  - GPGT brines contain 15,000–200,000 ppm dissolved solids, typically 85% NaCl
  - outstanding flow longevity (Dept. of Energy flow tests, Gulf Coast region)
- **The recoverable GPGT energies are**
  - thermal (heat exchange with brine)
  -

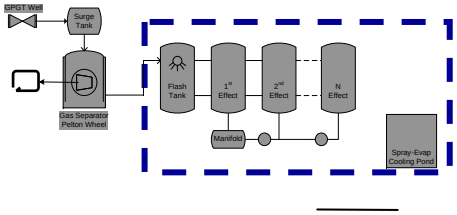
The GPGT Resource



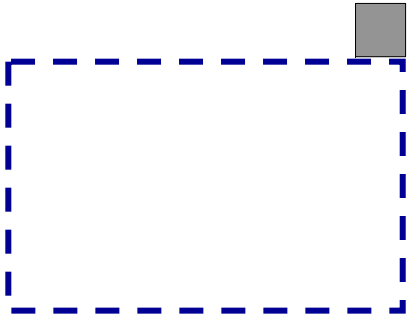
U.S. GPGT Regions

Subsystems: GPGT Well & Turbine

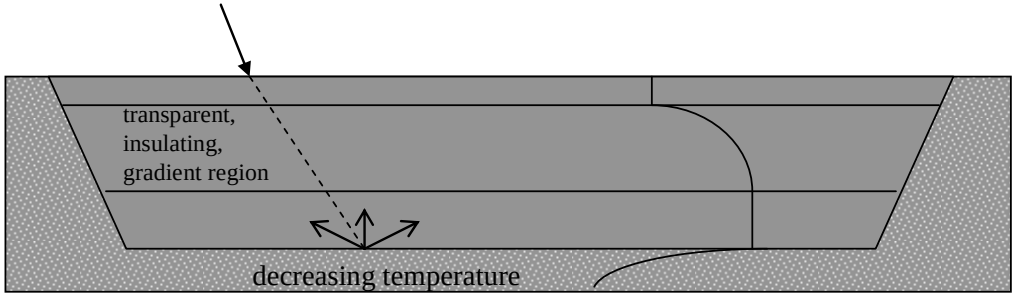
Subsystems: Multi-Effect Distillation



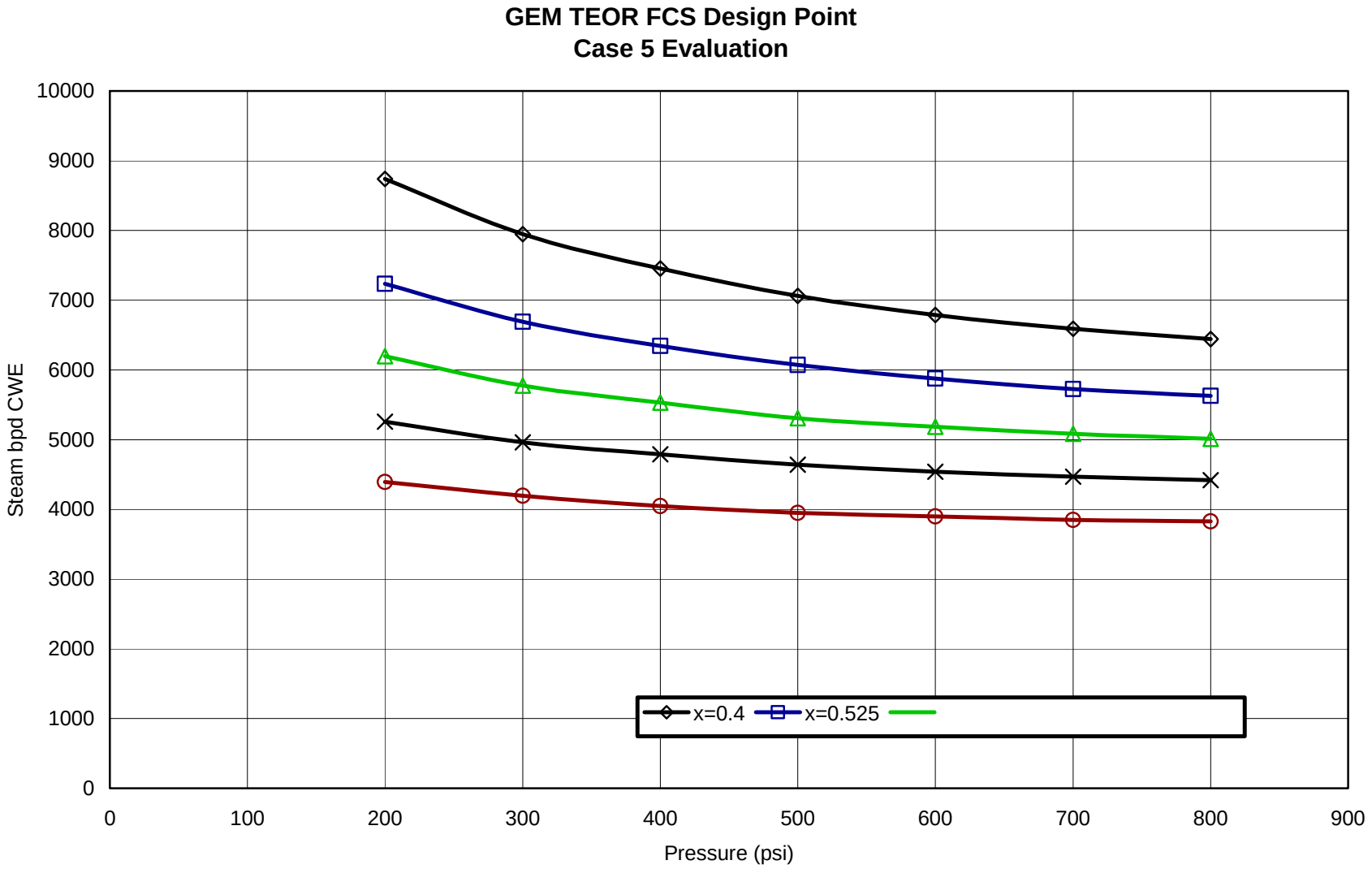
Subsystems: TEOR Fluid Conditioning



Subsystems: Solar Ponds



GEM TEOR FCS Design Point (x,P)
Case 5 Evaluation



H.R.6: Energy Independence and Security Act of 2007, Sec.602

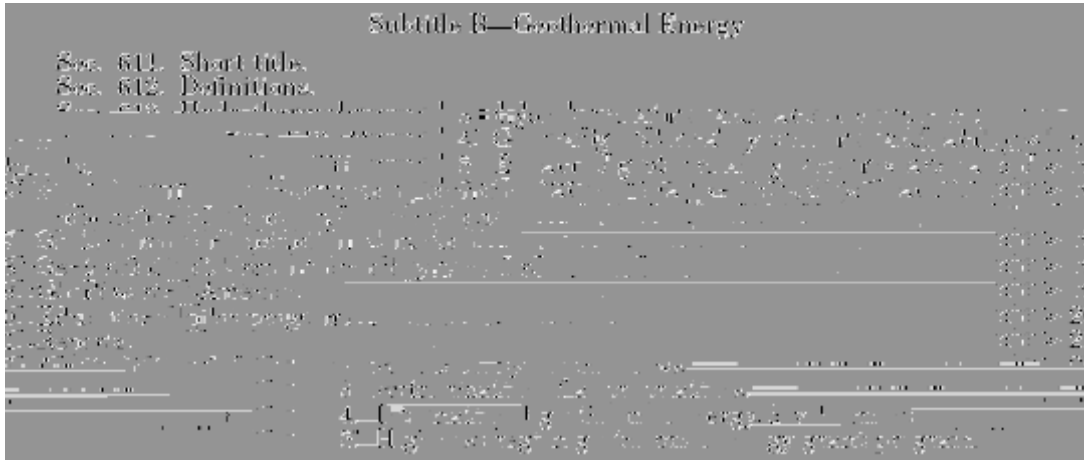
SEC. 602. THERMAL ENERGY STORAGE RESEARCH AND DEVELOPMENT PROGRAM.

(a) ESTABLISHMENT.—The Secretary shall establish a program of research and development to provide lower cost and more viable thermal energy storage technologies to enable the shifting of electric power loads on demand and extend the operating time of concentrating solar power electric generating plants.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section

$5,000,000 for fiscal year 2008, $7,000,000 for fiscal year 2009, $9,000,000 for fiscal year 2010, $10,000,000 for fiscal year 2011, and $12,000,000 for fiscal year 2012.

H.R.6: Energy Independence and Security Act of 2007, Sec.616


Subtitle B—Geothermal Energy

Sec. 611. Short title.
Sec. 612. Definitions.

Sec. 616 (d) GEOPRESSURED GAS RESOURCE RECOVERY AND PRODUCTION.

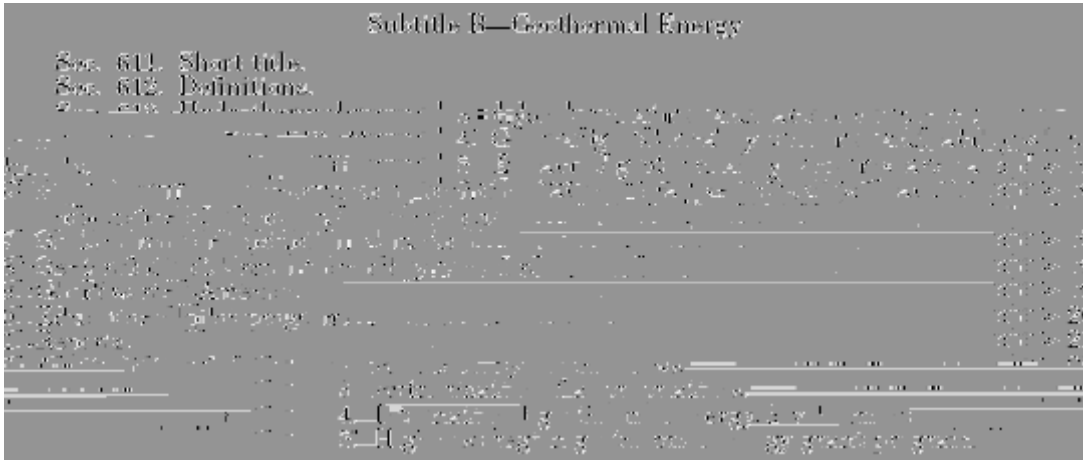
(1) The Secretary shall implement a program to support the research, development, demonstration, and commercial application of cost-effective techniques to produce energy from geopressured resources.

(2) The Secretary shall solicit preliminary engineering designs for geopressured resources production and recovery facilities.

(3) Based upon a review of the preliminary designs, the Secretary shall award grants, which may be cost-shared, to support the detailed development and completion of engineering, architectural and technical plans needed to support construction of new designs.

(4) Based upon a review of the final design plans above, the Secretary shall award cost-shared development and construction grants for demonstration geopressured production facilities that show potential for economic recovery of the heat, kinetic energy and gas resources from geopressured resources.

H.R.6: Energy Independence and Security Act of 2007, Sec.618


Subtitle B—Geothermal Energy

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Sec. 612. Definitions.

SEC. 618. CENTER FOR GEOTHERMAL TECHNOLOGY TRANSFER.

(a) IN GENERAL.—The Secretary shall award to an institution of higher education (***or consortium thereof***) a grant to establish a Center for Geothermal Technology Transfer (referred to in this section as the ''Center'').

(b) DUTIES.—The Center shall—

(1) serve as an information clearinghouse for the geothermal industry by collecting and disseminating information on best practices in all areas relating to developing and utilizing geothermal resources;

(2) make data collected by the Center available to the public; and

(3) seek opportunities to coordinate efforts and share information with domestic and international partners engaged in research and development of geothermal systems and related technology.

(c) SELECTION CRITERIA.—In awarding the grant under subsection (a) the Secretary shall select an institution of