NATURE OF THE RESOURCE:

The geopressured-geothermal resource consists of deeply buried reservoirs of hot brine, under abnormally high pressures, that contain dissolved methane. Geopressured brine reservoirs with pressures approaching the lithostatic load are known to occur both onshore and offshore beneath the Gulf of Mexico coast, along the Pacific west coast, in Appalachia, as well as in deep sedimentary basins elsewhere in the United States. The Department of Energy (DOE) has concentrated its research on the northern Gulf of Mexico sedimentary basin (Figure 1) which consists largely of Tertiary interbedded sandstones and shales deposited in alternating deltaic, fluvial, and marine environments. Thorsen (1964) and Norwood and Holland (1974) describe three generalized depositional facies in sedimentary beds of the Gulf Coast Geosyncline (Figure 2):

- a massive sandstone facies in which sandstone constitutes 50 percent or more of the sedimentary volume.

- an alternating sandstone and shale facies in which sandstone constitutes 15 to 35 percent of the sedimentary volume.

Figure 1. Subsurface Lower Cretaceous Shelf Margin And Geopressed Zone In The Northern Gulf Of Mexico Basin (From Bebout et al 1982).
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- a massive shale facies in which sandstone constitutes 15 percent or less of the sedimentary volume.

In general, at any given location the volume of sandstone decreases with increasing depth. The datum of higher-than-normal fluid pressures is associated with the alternating sandstone and shale facies and the massive shale facies. Faulting and salt tectonics have complicated the depositional patterns and influenced the distribution of geopressured reservoirs (Wallace et al 1978).

The sandstones in the alternating sandstone and shale facies have the greatest potential for geopressed-geothermal energy development. Due to the insulating effect of surrounding shales, temperatures of the geopressed-geothermal brines typically range from 250°F to over 350°F, and under prevailing temperature, pressure, and salinity conditions, the brine contains 20 or more cubic feet of methane per barrel. Wallace et al (1978) estimated the geopressed-geothermal energy in Gulf Coast sandstone pore fluids to a depth of 22,500 feet to be 5,700 TCF of methane and 11,000 quads of thermal energy.
GEOPRESSURED-GEOTHERMAL RESEARCH PROGRAM GOAL AND OBJECTIVES:

Since its inception in 1975, the goal of DOE's Geopressured-Geothermal Research Program has been to provide a technology base sufficient for industry to make rational investment decisions about the economic use of the resource. Recently, the goal was amended with a quantitative objective based on the cost of power: improve the technology for producing energy from the geopressured-geothermal resource at a cost equivalent to 6 to 10 cents/kWh by 1995. This compares with a current cost estimated at about 30 cents/kWh (Negus-deWys et al. 1989). The goal has served as the planning focus throughout the course of the Program.

At present, program objectives are being pursued under four research categories: resource analysis, brine production, energy conversion, and support operations. The objective of resource analysis is to improve the understanding of how geopressed reservoirs behave over extended periods by decreasing uncertainty in reservoir performance. This will enable predictions of reservoir performance with 90% confidence over a ten-year operating period. Research under this objective is focusing principally on determining reservoir-drive mechanisms. The objectives of brine production are to prove the long-term injectability of large volumes of spent brine at multiple sites and to minimize fluid production operating expenses. Long-term, large-volume injection has been shown to be feasible at two well sites. Under energy conversion, the objective is to improve methods for extracting commercially-useful energy from geopressed fluid. A small (1-MW) power plant will soon be tested at a well site to evaluate a hybrid power system. Under support operations, the objectives are to determine the environmental acceptability of production and disposal of geopressed fluids and to develop the technology for automated operation of geopressed production facilities. All design well sites are monitored periodically for signs of accelerated subsidence, abnormal seismicity, and ground-water contamination.

PAST ACTIVITIES AND RESULTS:

The strategy adopted by DOE to achieve the goal and objectives involves testing geopressed reservoirs via "wells of opportunity" and "design wells." This field activity is supplemented by a comprehensive program of university-based research.

"Wells of opportunity" include commercial oil and gas wells that have ceased economic production and dry holes that have not yet been abandoned. In exchange for the right to study the geopressed zones in these wells, DOE assumes liability for final disposition from the owners. The wells are recompleted by perforating geopressed zones of interest and flow testing the zones for 10 to 20 days. Parameters such as gas/water ratio, salinity, temperature, and pressure are monitored regularly. Since 1977, nine such wells have been tested successfully. The results are shown in Table 1. In general,
permeabilities of the geopressured reservoirs were found to be higher than initially expected (Wallace 1989). Also, in five of the nine wells of opportunity, the brine salinity was less than that of sea water. Given inherent limitations, such as wellbore diameter which restricts flow rate, wells of opportunity are mainly useful as indicators of resource potential. In addition to using wells acquired from industry, DOE has drilled "design wells" to investigate long-term, sustained flow of geopressured brines at high production rates. Such wells provide useful data about reservoir-drive mechanisms and ultimate recoveries. Results from the design well tests are given in Table 2. These tests have established the existence of very large geopressed reservoirs.

Table 1. Well Of Opportunity Data* (From Lombard And Wallace 1987).

<table>
<thead>
<tr>
<th>Well</th>
<th>Dates Tested</th>
<th>Formation</th>
<th>Producing Interval Depth (m)</th>
<th>Sand Thickness (m)</th>
<th>Reservoir Pressure (MPa)</th>
<th>Temperature (°C)</th>
<th>Salinity (mg/l)</th>
<th>Porosity (%)</th>
<th>Permeability (MD)</th>
<th>Maximum Flow Rate (m³/d)</th>
<th>Sustained Flow Rate (m³/d)</th>
<th>Production Gas/Water Rate (m³/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coastal States, Edna Decambrine No. 1</td>
<td>Jan 29–July 21, 1977</td>
<td>Camerina Upper Oligocene</td>
<td>3650 to 3682</td>
<td>10.7</td>
<td>91.1</td>
<td>74.85</td>
<td>112</td>
<td>134,600</td>
<td>-29</td>
<td>100 to 364</td>
<td>-1900</td>
</tr>
<tr>
<td>2</td>
<td>Neuhoff Oil Co. Fairfax Foster Surry No. 2</td>
<td>May 19–July 10, 1979</td>
<td>M&amp;A Lower Miocene</td>
<td>3923 to 3935</td>
<td>15.2</td>
<td>14.6</td>
<td>75.93</td>
<td>114</td>
<td>114,100</td>
<td>-26</td>
<td>-447</td>
<td>-1390</td>
</tr>
<tr>
<td>3</td>
<td>Southport Exploration, Beulah Simon No. 2</td>
<td>Nov 17–Dec 31, 1979</td>
<td>Cameron Upper Oligocene</td>
<td>4473 to 4503</td>
<td>63.4</td>
<td>56.7</td>
<td>89.74</td>
<td>130</td>
<td>120,900</td>
<td>-19</td>
<td>-12</td>
<td>-1750</td>
</tr>
<tr>
<td>4</td>
<td>Wando Oil &amp; Gas Co. P.R. Goodall No. 1</td>
<td>July 22–Aug. 7, 1980</td>
<td>Frack-Magninoides</td>
<td>4684 to 4517</td>
<td>32.6</td>
<td>27.7</td>
<td>91.03</td>
<td>154</td>
<td>23,400</td>
<td>-26</td>
<td>200 to 240</td>
<td>-2380</td>
</tr>
<tr>
<td>5</td>
<td>Lessor Petroleum Exploration, Koehemay No. 1</td>
<td>Sept 12–Oct. 21, 1980</td>
<td>Yegua Lower Miocene</td>
<td>3568 to 3591</td>
<td>43.4</td>
<td>23.5</td>
<td>65.16</td>
<td>127</td>
<td>15,000</td>
<td>-26</td>
<td>100 to 200</td>
<td>-510</td>
</tr>
<tr>
<td>6</td>
<td>Ruddle Oil Co. Sweetwater No. 2</td>
<td>Nov 16–Sept. 21, 1980</td>
<td>Upper Wilson Upper Eocene</td>
<td>2970 to 2993</td>
<td>27.4</td>
<td>24.1</td>
<td>45.69</td>
<td>149</td>
<td>12,900</td>
<td>-20</td>
<td>20</td>
<td>210</td>
</tr>
<tr>
<td>7</td>
<td>Houston Oil &amp; Minerals, Praine Canal No. 1</td>
<td>Feb 21–April 4, 1981</td>
<td>Hackberry Upper Frio</td>
<td>4509 to 4517</td>
<td>7.6</td>
<td>4.3</td>
<td>89.23</td>
<td>146</td>
<td>42,900</td>
<td>-25</td>
<td>-95</td>
<td>-1130</td>
</tr>
<tr>
<td>8</td>
<td>Don Ross, Pauline Krait No. 1</td>
<td>March 19–20, 1981</td>
<td>Frack-Anderson sand Middle Oligocene</td>
<td>3880 to 3900</td>
<td>40.2</td>
<td>26.8</td>
<td>78 (net)</td>
<td>128 (net)</td>
<td>23,000</td>
<td>23 (est)</td>
<td>39 (est)</td>
<td>21</td>
</tr>
<tr>
<td>9</td>
<td>Martin Exploration, Crown Zellerbach No. 2</td>
<td>June 5–July 7, 1981</td>
<td>Tuscaloosa Upper Cretaceous</td>
<td>5096 to 5105</td>
<td>11.0</td>
<td>10.7</td>
<td>69.46</td>
<td>164</td>
<td>32,000</td>
<td>-17</td>
<td>-17</td>
<td>-450</td>
</tr>
</tbody>
</table>

*Wells locations are shown in Fig 3.
*Perforated interval.
*Producing gas and oil at any completion.

Table 2. Design Well Data* (From Lombard And Wallace 1987).

<table>
<thead>
<tr>
<th>Well</th>
<th>Years Tested</th>
<th>Formation</th>
<th>Perforated Interval Depth (m)</th>
<th>Sand Thickness (m)</th>
<th>Reservoir Pressure (MPa)</th>
<th>Temperature (°C)</th>
<th>Salinity (mg/l)</th>
<th>Porosity (%)</th>
<th>Permeability (MD)</th>
<th>Maximum Flow Rate (m³/d)</th>
<th>Sustained Flow Rate (m³/d)</th>
<th>Production Gas/Water Rate (m³/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General Crude Oil, DOE, Pleasant Bayou No. 2</td>
<td>1979, 1980</td>
<td>Fract-Magninoides</td>
<td>4645.5 to 4681.5</td>
<td>18.3</td>
<td>16.2</td>
<td>77.00</td>
<td>152</td>
<td>-131,300</td>
<td>-18</td>
<td>-192</td>
<td>-4600</td>
</tr>
<tr>
<td>B</td>
<td>Magnolia Gulf-Technadril DOE, AmocoFee No. 1</td>
<td>1981</td>
<td>Mosquitoes Sand Upper Oligocene</td>
<td>4646.7 to 4684.7</td>
<td>10.4</td>
<td>7.3</td>
<td>81.96</td>
<td>145</td>
<td>-168,500</td>
<td>-20</td>
<td>-42</td>
<td>-1105</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sand Upper Oligocene</td>
<td>4651.3 to 4674</td>
<td>9.7</td>
<td>4.3</td>
<td>88.23</td>
<td>149</td>
<td>42,900</td>
<td>-25</td>
<td>-95</td>
<td>-1130</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Sand Zone 3)</td>
<td>4690.8 to 4715.5</td>
<td>9.9</td>
<td>8.2</td>
<td>83.30</td>
<td>148</td>
<td>-165,000</td>
<td>-22</td>
<td>-162</td>
<td>-1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Sand Zone 5)</td>
<td>4610.8 to 4687.8</td>
<td>22.3</td>
<td>17.5</td>
<td>78.67</td>
<td>114</td>
<td>99,700</td>
<td>27</td>
<td>126</td>
<td>-1700</td>
</tr>
<tr>
<td>C</td>
<td>Technadril Fenix &amp; Scotch-DOE, Olaone McCall No. 1</td>
<td>1982-present</td>
<td>Lower Miocene Sand</td>
<td>4625.0 to 4715.3</td>
<td>103.0</td>
<td>101.5</td>
<td>88.25</td>
<td>144</td>
<td>-97,800</td>
<td>-16</td>
<td>-150</td>
<td>-5800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Sand Zone 9)</td>
<td>4727.8 to 4763.7</td>
<td>95.0</td>
<td>34.7</td>
<td>99.02</td>
<td>148</td>
<td>-96,500</td>
<td>-16</td>
<td>-70</td>
<td>-700</td>
</tr>
<tr>
<td>D</td>
<td>Dow Chemical Co. DOE, L.R. Swetly No. 1</td>
<td>1981-83</td>
<td>Upper Frio Oligocene</td>
<td>4082.8 to 4086.2</td>
<td>22.3</td>
<td>17.5</td>
<td>78.67</td>
<td>114</td>
<td>99,700</td>
<td>27</td>
<td>126</td>
<td>-1700</td>
</tr>
</tbody>
</table>

*Well locations are shown in Fig 3.
*Flow data indicate that permeability may change 60 m from the wellbore. Alternatively, the wellbore may be near the apex of a 26° pie shaped reservoir.
Locations of the wells of opportunity and design wells are shown in Figure 3. Two design wells, the Gladys McCall No. 1 well in Louisiana and the Pleasant Bayou No. 2 well in Texas, are still operational. The Hulin No. 1 well in Louisiana is a well of opportunity currently in the process of recompletion. Testing at all other well sites has been completed.

The wells of opportunity and design wells have tested upper Cretaceous to lower Miocene reservoirs that ranged in depth from 9,745 feet to 16,750 feet at temperatures from 234 to 327°F and salinities from 12,800 to 190,900 mg/L (Wallace 1986). This testing confirmed the size and extent of the resource, demonstrated that the brine is generally saturated with methane, and proved that modified oil and gas technology could be used for brine production, gas separation, and brine disposal. In addition, long-term, high-volume brine production has been accomplished at two wells, and a highly effective scale inhibitor process was developed and successfully tested (Wallace 1986; Lombard and Goldsberry 1988).

Several Gulf Coast universities supported the well testing activities. Geologic studies of the Gulf Coast region identified a number of "fairways" containing prospective geopressed reservoirs where thick sandstone bodies have fluid temperatures higher than 300°F (Bebout et al 1978). Analyses of geopressed brines discerned the presence of aromatic compounds of geologic origin; the concentration of the aromatics was found to vary with cumulative brine production (Keeley and Meriwether 1988). The aromatics appear to be important for understanding hydrocarbon origin and migration in the geopressed zone. Researchers also determined, experimentally, the solubility of methane in brine over a wide range of pressures, temperatures, and salinities (Price et al 1981). Salinities derived from the self-potential log
were shown to be influenced by changes in make-up water resistivity and mud additives used during drilling (Dunlap et al 1985); accurate salinities from logs are necessary for determining the amount of methane that could be dissolved in the brine.

CURRENT RESEARCH - WELL TESTING:

The Program has three active well sites: the Pleasant Bayou site, about 40 miles south of Houston, Texas; the Gladys McCall site, about 6 miles east of Grand Chenier, Louisiana; and the Willis Hulin site in Vermilion Parish, Louisiana, about 23 miles south of Lafayette.

The Pleasant Bayou No. 2 well is completed with 5%-inch production tubing and is perforated from 14,644 to 14,704 feet in the Oligocene Frio Formation. The brine contains about 130,000 mg/L total dissolved solids and has a flowing wellhead temperature of 290°F. At the surface, the solution gas is separated from the brine by two parallel gravity separators at a pressure of about 700 psia. At this pressure, about 19 cubic feet of gas per barrel is removed from the brine, which contains 23 cubic feet of gas per barrel. By mole percent, the separator gas contains 85% methane, 10% carbon dioxide, 3% ethane, 1% propane, 0.5% nitrogen, and smaller quantities of heavier hydrocarbons (C4+), helium, and hydrogen. The gas has a gross dry heating value of 95 BTU/SCF (60°F, 14.73 psia) (Randolph et al 1988). Except for a slightly high carbon dioxide content, the gas is of acceptable pipeline quality. After separation, the brine flows into a disposal well perforated from 6,226 to 6,538 feet. The journey of the brine from the production well, through the surface facilities, and into the disposal well is driven by the inherent hydraulic pressure of the geopressed brine, obviating the need for brine pumps.

The Pleasant Bayou No. 2 well has been producing geopressed brine since May 1988 at a rate of roughly 20,000 barrels per day. This well produced about 4-million barrels of brine, intermittently, from 1979 through 1983, but testing was plagued by scaling of the production tubing. The current phase of testing has been aided by application of a downhole treatment, whereby scale inhibitor is pumped into the reservoir and adsorbed onto the reservoir-rock grains. During brine production, the inhibitor is released gradually and flows to the surface in sufficient quantities to prevent scaling. Similar inhibitor treatments in the Gladys McCall No. 1 well have been effective for periods up to 21 months, at flow rates up to 30,000 barrels per day.

The Gladys McCall No. 1 well is undergoing long-term, pressure-buildup that began October 29, 1987, after production of more than 27 million barrels of brine and 676 million standard cubic feet of gas. Downhole temperature and pressure measurements are taken periodically to provide data for reservoir analysis.

The Willis Hulin No. 1 well, a well of opportunity, was recently recompleted by DOE for geopressed-geothermal testing. The first phase of recompletion concluded in February 1989. The reservoir of
interest is a lower Miocene sandstone that lies at depths between 20,135 and 20,690 feet, the deepest zone to be studied by the Program. The bottomhole pressure and temperature are about 17,850 psia and 350°F, respectively. A 3%-inch production-tubing string is currently installed in the well, down to a packer at 15,950 feet. In order to clean-out mud used in workover operations, the well was perforated from 20,670 to 20,690 feet and allowed to flow briefly. Preliminary analysis showed that the brine contains about 194,000 mg/L total dissolved solids, 18,400 mg/L calcium, 48,800 mg/L sodium, and 115,000 mg/L chloride. Analysis of the dissolved gas indicates methane to be the most abundant component; a high carbon dioxide content is indicated; very small amounts of other hydrocarbons are present. (Randolph 1989).

**CURRENT RESEARCH - SUPPORT STUDIES:**

In support of geopressed-geothermal well activities, university-based research is being conducted in rock mechanics, well logging, geology, reservoir engineering, geochemistry, and environmental monitoring.

Compaction testing on cores from the Gladys McCall and Pleasant Bayou wells is providing data to study the effect of pore-pressure reduction on well performance. Data soon to be generated by tensile-failure testing of the cores will be used to study the extent to which rock strength, depth, fluid-flow rate, temperature, and formation stresses are involved in wellbore stability during fluid production. Recent creep testing produced inconclusive results due to a large amount of noise in the data; improved test equipment is needed before more creep testing is attempted. No further work on creep is planned, pending completion of the compaction testing (Gray and Fahrenthold 1988).

Well-logging research is concentrated in two areas: 1) the effect of rock stress, wettability, and shale content on the resistivity log, and 2) the effect on the neutron log of trace elements having very-high thermal neutron cross-sections. The resistivity research is supported in part by industry and the Gas Research Institute. Early experimental work on glass bead packs and Berea sandstone cores showed that the primary variable affecting rock resistivity is wettability; stress has a much smaller effect (Lewis, Sharma, and Dunlap 1988). Theoretical work to study the effect of wettability and shale content on rock resistivity supports the experimental finding that oil-wet rocks typically show substantially higher resistivity than water-wet rocks, for a given level of saturation (Wang and Sharma 1988). Researchers recently have developed a computer program to measure the resistance. Boron, a trace element with a very-high neutron cross-section, has been shown to occur in quantities large enough to affect the logs of several formations in Texas Gulf Coast wells. Boron concentrations of more than 10 parts per million in the reservoir rock will have a significant effect on neutron-log porosity measurements and gas-detection capabilities. Researchers have found a
clear trend toward higher boron content in Frio shales and shaley sands than in relatively clean sand. Boron also occurs in significant amounts in drilling mud constituents, such as bentonite, barite, and lignosulfonate (Dunlap and Coates 1988). The resistivity and neutron-log research enhances the interpretation of these logs for evaluation of conventional oil and gas reservoirs, as well as geopressed reservoirs.

Geologic analysis of the Pleasant Bayou reservoir was completed recently; included were sandstone and mudstone geometries and continuities, structural configuration and fault barriers, effective pore volume, and gas production and pressure trends from nearby wells. This analysis, coupled with pressure and temperature data from the Pleasant Bayou well, is being used to refine the reservoir model. The current model geometry, shown in Figure 4, has a main, high-porosity layer, sandwiched between two low-porosity layers that represent thinner, more isolated sandstones considered to comprise the remote volume of the reservoir. The low-porosity layers are connected to the main, high-porosity layer by cross-flow along circuitous flow paths around shale interbeds and internal faults (Riney 1989).

Figure 5 compares downhole pressure measurements with the pressure buildup response predicted by the computer simulation of the Gladys McCall reservoir with cross-flow as the assumed reservoir-drive mechanism. The cross-flow model requires that other sands be connected to the main Gladys McCall reservoir at some distance from the wellbore. Agreement of predicted and measured values is good, except for the two most recent downhole pressure measurements which are above the predicted downhole pressures.
Models that match observed reservoir behavior at Gladys McCall can be devised based on other reservoir-drive mechanisms. Besides cross-flow, other possible drive mechanisms include stress-dependent rock-formation compressibility, long-term formation creep, recharge from shales, leakage along or across faults, and free-gas evolution.

Parametric reservoir simulations, using rock mechanics data for Gladys McCall reservoir rocks, found that the effects of stress-dependent rock-formation compressibility were insignificant. Parametric reservoir simulations of free-gas evolution found that any free gas evolved during production would be confined to the immediate neighborhood of the well. The ongoing test program for the design wells will help to distinguish between reservoir-drive mechanisms (Riney January 1988). Downhole-pressure measurements at Gladys McCall are continuing and are scheduled to be completed by October 1989.

All geopressured brines sampled by the Program contain small amounts (less than 50μL/L) of C6 hydrocarbons that are primarily aromatic in nature and range from benzene to substituted anthracenes. The brines also contain a variety of ions and light C1 to C6 aliphatic
hydrocarbons (Keeley and Meriwether 1988). On a monthly basis, the aromatic hydrocarbons in the gas at Pleasant Bayou are sampled, using a dry-ice/acetone bath. The aromatic hydrocarbons in the brine also are sampled using an ice/water bath. These cryocondensate samples, as determined by gas chromatographic analysis, contain over 95 different compounds (Keeley and Meriwether 1985). At the Gladys McCall well, the concentration of cryocondensate in the brine was observed to increase, followed by the onset of oil production. Keeley and Meriwether (1988) postulated that the change in cryocondensate concentration, as a function of cumulative brine volume, results from extraction of additional aromatic components from oil migrating into the production zone from adjacent shale.

Environmental monitoring at the geopressed-geothermal well sites assesses whether brine production and disposal have had adverse effects, such as land-surface subsidence, growth-fault activation, or surface and/or ground water contamination. Subsidence monitoring, by means of leveling surveys, has not detected significant correlation between subsidence and withdrawal and disposal of geopressed brine. Also, no significant correlation exists between well testing and microseismicity, as detected by microseismic monitoring networks at the well sites. Quarterly sampling of surface and ground water around the well sites has not detected significant contamination (Van Sickle et al 1988).

DOE and the Electric Power Research Institute (EPRI) are cosponsoring a hybrid-power system test at the Pleasant Bayou site. The hybrid-power system (Figure 6) will use both natural gas and hot geothermal brine for power generation. The system is designed for 10,000 barrels per day of geopressed brine, containing 22 standard cubic feet of gas per barrel of brine. The working fluid in the binary cycle is isobutane. The design output is approximately 650 kWe from the gas engine/generator and 540 kWe from the binary turbine/generator, with parasitic loads of 210 kWe. The power produced will feed into the local power grid. The hybrid-power system will be operated in conjunction with the reservoir testing program of the Pleasant Bayou No. 2 well. Construction of the hybrid-power system will be completed in May 1989; a nominal 12-month testing period is planned. As designed, the system can produce at least 15 percent more electricity than the same amount of fuel and geothermal fluid used in separate power plants. The hybrid concept provides greater flexibility to developers in deciding how to market the energy produced from geopressed-geothermal resources.

The purposes of the DOE/EPRI geopressed hybrid-power experiment are: (1) to evaluate the potential of combustion/geothermal hybrid-power cycles for use in the development of geopressed and low-temperature hydrothermal resources, and (2) to evaluate the role of thermal energy in geopressed development economics.
POTENTIAL FUTURE ACTIVITIES:

After the pressure buildup test at the Gladys McCall well is completed in October 1989, a final scientific testing program at the well may be implemented. Two questions that need to be answered are: (1) what has been the effect of high-volume production on the sandstone reservoir and surrounding shale units, and (2) what are the drive mechanisms responsible for pressure maintenance in the reservoir? The first question could be answered by coring the reservoir sandstone and the overlying and underlying shales and comparing the cores with pre-production cores; logging the well for comparison with pre-production logs should also be helpful. The second question could be answered by isolating and pressure-testing adjacent sandstone zones to determine if cross-flow from adjacent sandstone zones into the main reservoir has occurred.

The Pleasant Bayou well is currently being tested to acquire pressure drawdown data and to provide geopressed brine and gas for operation of the hybrid-power system, beginning in the summer of 1989. Long-term flow testing will continue at least until the summer of 1990. A long-term pressure buildup test is tentative, pending the outcomes of the drawdown test at Pleasant Bayou and the buildup test at Gladys McCall.
Finally, the Hulin well, which penetrates the deepest, hottest reservoir in the geopressed program, will be flow tested in 1989 for a short period; if the reservoir is capable of long-term production, permanent production facilities may be installed, and a long-term testing program initiated.

REFERENCES:


