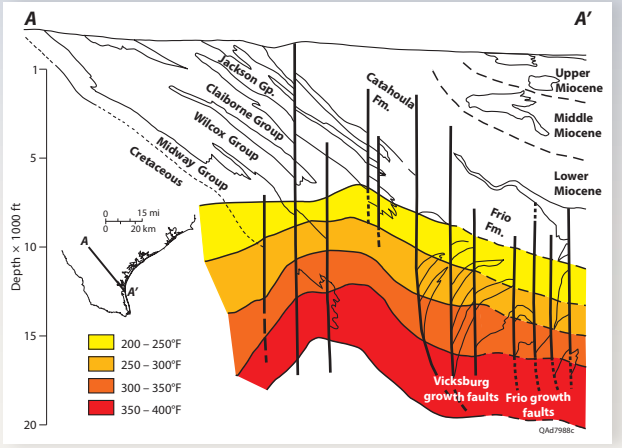
Geothermal Research in Deep Sedimentary Basins

Mission and History

The Bureau of Economic Geology is pursuing transformational research related to geothermal energy (GE) development from deep sedimentary basins. The northern Gulf of Mexico (GOM) is a representative environment of deep, hot, sedimentary basins worldwide that may contain 70 to 80% of extractable/renewable GE resources.

The mission of the GE Research Group is to

- Define multiparameter, multiobjective boundaries that characterize developable geothermal resources and reservoirs;
- Apply existing analytical and stochastic tools and develop new tools useful in identifying, defining, and managing target geothermal energy reservoirs; and
- Develop the geoscience, modeling, and engineering to optimize GE production.



Bureau scientists have been engaged in identification and evaluation of GE resources since the 1970's, when we identified the potential to develop GE from northern GOM thick, sedimentary sequences and defined GE fairways along the Gulf Coast in Wilcox, Vicksburg, and Frio Formations. In the 1980's, under research funded by the U.S. Department of Energy (DOE), we used long-term testing of Pleasant Bayou and Gladys McCall GE wells to demonstrate high, consistent yields from geopressured GE zones. Now we are engaged in two new DOE-funded programs supporting development of GE nationwide. We hope to leverage these funds by extending our regional assessment into detailed reservoir identification, assessment, and development. Derived techniques will be able to be applied, not only in North America, but worldwide.

Impact

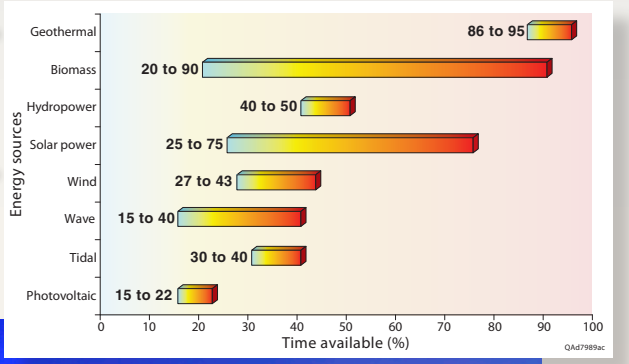
GE development once focused only on volcanic areas and hot springs. Now, advances in deep-hole technology have made drilling depths to 10 km economically accessible and electrical generation using binary heat-exchange systems practical from fluid temperatures as low as 150°F. In 2007 DOE funded a reassessment of GE, concluding that the developable magnitude for GE may be 2,000+ times the annual primary energy consumption of the U.S. in 2005. If this new estimate is realizable, GE could contribute to the national energy supply at a level equal to, or in excess of, wind, solar, and hydropower combined. Sedimentary basins with thicknesses of permeable rocks >6 km and high heat flow occur in many continental interiors and margins, not only in the northern GOM. We think that these resources can be developed in an environmentally conscientious manner and competitively produce gigawatts of energy for hundreds of years, with no CO_2 emissions, consumptive water use, or restriction of large land areas. To realize this opportunity, however, substantial technical questions must be answered.

Challenges

- Reservoir and reservoir-characteristics identification represents the greatest challenge for development of GE.
- Sustainability of fluid flow and temperature must be assessed so as to explain the economic potential of the resource and define the threshold for investment in GE.
- Management of produced fluids is critical to the economic life of the resource, whether by injection into the producing reservoir to maintain fluid pressure or into a disposal zone to limit potentially adverse environmental impact.
- Use of alternative heat-mining fluids may double extractable heat energy while reducing the cost of heat extraction from geothermal reservoirs. Study of the utility of alternative fluids, including supercritical CO_2 and other high-pressure gases, may substantially improve performance and economics of GE production.
- Combining CO_2 sequestration with GE production may represent an application that could make CO_2 capture from the exhaust streams of coal-fired power plants energy neutral and substantially contribute to global-warming mitigation.

Memberships Available

Annual fee: $50,000



Staff

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