

STATEMENT OF

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U.S. DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES

UNITED STATES SENATE

September 26, 2007

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before the Committee today to provide the Department of Energy's views on S. 1543, the National Geothermal Initiative Act of 2007, and to update the Committee on the Department of Energy's (DOE) Geothermal Program.

S. 1543 establishes a national goal of achieving "20 percent of total electrical energy production in the United States from geothermal resources by not later than 2030." To accomplish that goal, the legislation requires the Department of Energy and the Department of the Interior to characterize the complete U.S. geothermal resource base by 2010; develop policies and programs to sustain an annual growth rate in geothermal power, heat, and heat pump applications of at least 10 percent, and to achieve new power or commercial heat production from geothermal resources in at least 25 States; demonstrate state-of-the-art geothermal energy production; and develop tools and techniques to construct an engineered geothermal system power plant. Additionally, the legislation directs the Secretary to establish a geothermal research, development, demonstration, commercialization, outreach and education program in support of the 20 percent national goal.

The Department has significant concerns with the feasibility of the national goal established in this legislation. Generating 20 percent of our nation's electricity from geothermal resources would require more than 165,000 megawatts of geothermal power plant capacity by 2030, in Energy Information Administration's (EIA) reference case electricity demand forecast¹. The 1978 USGS National Geothermal Resource Assessment estimated 23,000 megawatts of identified conventional geothermal resources, also called hydrothermal technology, that can be developed for electricity. The difference, more than 142,000 megawatts, would have to come from new discoveries, conventional resources that were not viable at the time of the 1978 assessment, and unconventional means such as Enhanced Geothermal Systems (EGS), co-produced fluid from oil and gas wells, and geopressured-geothermal resources, as well as avoided electricity use from heat, and heat pump applications. With the exception of one small co-production generator, none of these unconventional resources are being used currently to generate commercial power. A recent report by the Massachusetts Institute of Technology (MIT), *The Future of Geothermal Energy*, estimates that 100,000 megawatts of electricity could be installed by 2050 using EGS technology. The MIT projection assumes a 15-year technology development program is conducted by the public and private sector prior to wide-scale installations.

While the Department shares the Committee's interest in rapidly accelerating market penetration of all renewable energy technologies, including geothermal, this particular goal may be technically unattainable within the timeframe specified. The Department looks forward to working with the Committee to resolve these and other technical concerns with S. 1543.

Since the founding of the Department of Energy, the agency has supported geothermal research and development. Over that period, a number of key accomplishments have contributed to

¹ The Energy Information Administration projects Total Electric Power Sector Capacity in 2030 to be 1159 GW. This projection is based on an assumption that geothermal power plant has a capacity factor of 80-85 percent.

increased commercial development of hydrothermal resources – to a point where it has reached market maturity. The Department’s investment contributed to the identification of those resources, accurate characterization and modeling of hydrothermal reservoirs, improved drilling techniques, and advanced means of converting the energy for productive uses. The Federal government has realized many successes in hydrothermal technology development, as evidenced by winning eight R&D 100 Awards in the past ten years. I would like to share with the Committee the Department’s current assessment of the geothermal industry, and discuss briefly the future potential for geothermal development as a part of a diversified, domestic clean energy portfolio.

GEOHERMAL INDUSTRY

Geothermal energy is the heat from deep inside the earth, coming in large part from the decay of radioactive elements. Geothermal heat is considered a base load renewable energy source, and can be used for electricity generation and direct use (space heating, district heating, snow melting, aquaculture, etc.). While geothermal energy is available at some depth everywhere, in the U.S., it is most accessible in western states such as California, Nevada, Utah, and Hawaii, where it is found at shallow depths as hydrothermal resources. This is where the bulk of conventional, commercial geothermal development is taking place, but a number of other states, notably Idaho, Oregon, Arizona and New Mexico, could see new power projects coming online in the very near future.

Geothermal resources can be subdivided into four categories: 1. hydrothermal; 2. deep geothermal (Enhanced Geothermal Systems or EGS); 3. geopressured; and 4. fluid co-produced with oil and gas. Of these, hydrothermal resources, which are characterized by ample heat, fluid, and permeability, have been developed commercially around the world. The other resource categories have not reached commercial maturity and are less accessible through conventional geothermal processes. The United States has been and continues to be the world leader in online capacity of hydrothermal resources for electric power generation.

Currently, the U.S. has approximately 2850MWe of installed capacity and about 2,900 MWe of new geothermal power plants under development in 74 projects in the Western U.S., according to industry estimates. In 2006, EIA estimates that geothermal energy generated approximately 14,842 gigawatt-hours (GWh) of electricity. The geothermal industry presently accounts for approximately 5% of renewable energy-based electricity consumption in the U.S. Most of the balance is split between hydropower and biomass, with wind and solar contributing a small portion.

In general, conventional hydrothermal technology is sufficiently mature, based on the following:

- The Western Governors Association geothermal task force recently identified over 140 sites with an estimated 13,000 MWe of power with near-term development potential.
- Hydrothermal reservoirs discovered at shallow depths using existing drilling technology, based upon similar available oil and gas practices used in the industry, are cost-effective.

- Power plant technology is based on standard cycles and can be bought off-the-shelf. Major development of binary-cycle power plant technology has enabled the development of increasingly lower temperature hydrothermal resources.
- Hydrothermal-generated electricity is cost competitive in certain regions of the country, where the resource can be maximized.

Favorable provisions of the Energy Policy Act of 2005 (EPACT 2005) and other federal and local incentives encourage industry to develop hydrothermal resources. EPACT 2005 contains significant provisions to promote the installation of geothermal power plants and geothermal heat pumps. These include:

- **Resource Assessment** – USGS has been directed to update its 1978 assessment of geothermal resources (Circular 790). EPACT 2005 mandates that USGS complete the Resource Assessment report by September 2008. To date, the Department of Energy has contributed over \$1 million in financial support as well as technical support through its national laboratories and the Department's Geothermal Resources Exploration and Definitions activity.
- **Programmatic Environmental Impact Statement (PEIS)** – A PEIS is being developed for the major geothermal areas in the Western U.S. by the Bureau of Land Management (BLM), in partnership with the U.S. Forest Service. DOE is a cooperating agency for the PEIS and the Department anticipates that completion of the PEIS will encourage geothermal production.
- **Streamlined Permitting and Royalty Structure** -- EPACT changed the royalty structure for leasing on Federal land from a 50/50 State/Federal split to a 50/25/25 split for State/Federal/local, providing an incentive for local governments to attract geothermal resource developers. EPAct also streamlined leasing requirements, which lowers costs for potential developers.
- **Federal Purchases of Renewable Energy** - EPAct 2005 requires that the Secretary of Energy seek to ensure that federal consumption of electric energy during any fiscal year should include the following amounts of renewable energy; 1) not less than 3 percent in fiscal years 2007 through 2009, 2) not less than 5% in fiscal years 2010 through 2012 and 3) not less than 7.5% in fiscal year 2013 and each fiscal year thereafter.
- **Loan Guarantees** – EPACT 2005 authorizes the Department to issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and "employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued". On May 16, 2007, the Department issued a Notice of Proposed Rulemaking to establish the loan guarantee program. The comment period for that rulemaking has closed, and the Department anticipates finalizing the rule shortly. In addition, on August 3, 2007, the Department named David G. Frantz as the Director of the Loan Guarantee

Office, reporting directly to the Department's Chief Financial Officer. By providing the full faith and credit of the United States government, loan guarantees will enable the Department to share some of the financial risks of projects that employ new or significantly improved technologies. DOE is currently authorized to provide \$4 billion in loan guarantees, and the 2008 President's Budget requested \$9 billion in loan volume limitation.

In addition, the Tax Relief and Health Care Act of 2006 extended the production tax credit for geothermal and other renewables that are put into service through December 31, 2008. This provision has had a significant impact on encouraging new installations of conventional geothermal power facilities; as I mentioned previously, over 2,900 MWe are now under development in the U.S. An investment tax credit of 10 percent is also available to the industry, but cannot be combined with the production tax credit. Because conventional geothermal is a mature technology and favorable policy changes have clearly resulted in the growth of the industry, the FY 2008 Budget Request terminates the current Geothermal Technology program.

ENHANCED GEOTHERMAL SYSTEMS (EGS)

Enhanced Geothermal Systems (EGS) involves technology that enables geothermal resources that lack sufficient water or permeability (compared to conventional hydrothermal resources) to be developed. The ultimate intent is to tap energy from hot impermeable rocks that are at a depth of between 3 and 10 kilometers in the earth's crust. Such rock formations require engineered enhancements to enable productive reservoirs.

DOE funded MIT to conduct a study of EGS potential in the U.S. MIT made the following key findings:

- EGS has the potential to produce up to approximately 100,000 MW of new electric power by 2050 based in part on an abundance of available geothermal resources.
- Elements of the technology to capture EGS are in place.
- Multiple reservoir experiments are required.
- Successful R&D could provide performance verification at a commercial scale within a 15-year period nationwide.

The Department is currently considering the findings of the MIT study. DOE is holding discussions with industry and academic experts, further defining technical barriers and gaps, and determining the technical and commercial actions that can help industry overcome the barriers and to bridge the gaps. Input has come from oil and gas companies, service companies, academia, the geothermal industry, international experts, government agencies, and the national laboratories. We expect to release this evaluation by the end of 2007.

CONCLUSION

In conclusion, Mr. Chairman, the Department anticipates that geothermal resources will continue to play an important and potentially growing role in our nation's energy portfolio, as we look to rapidly expand the availability of clean, secure, reliable domestic energy. The industry currently benefits from tax incentives and regulatory streamlining in EPACT 2005, and future industry investments in enhanced geothermal have the potential to significantly expand domestic geothermal energy production. The Department looks forward to working with this Committee to resolve concerns related to S. 1543, and to continue our national commitment to clean, renewable energy production. Mr. Chairman, this concludes my prepared remarks, and I would be happy to answer any questions the Committee Members may have.