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SENATE

{ REPORT  
{ 112-145

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### GEOTHERMAL EXPLORATION AND TECHNOLOGY ACT

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FEBRUARY 7, 2012.—Ordered to be printed

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Mr. BINGAMAN, from the Committee on Energy and Natural Resources, submitted the following

### R E P O R T

[To accompany S. 1142]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 1142) to promote the mapping and development of United States geothermal resources by establishing a direct loan program for high risk geothermal exploration wells, to amend the Energy Independence and Security Act of 2007 to improve geothermal energy technology and demonstrate the use of geothermal energy in large scale thermal applications, and for other purposes, having considered the same, reports favorably thereon with amendments and recommends that the bill, as amended, do pass.

The amendment are as follows:

On page 3, lines 11 through 13, strike “previously unexplored, underexplored, or unproven geothermal resources in a variety of geologic and geographic settings” and insert “projects likely to lead to successful new geothermal development leading to electricity production”.

On page 5, strike lines 20 through 22 and insert the following:

(2) TRANSFERS TO FUND.—The Fund shall consist of—

(A) such amounts as are appropriated to the Fund under subsection (j); and

(B) amounts repaid on loans under subsection (g)(3).

On page 7, line 1, strike “Not later” and insert the following:

(1) IN GENERAL.—Not later

On page 7, line 2, strike “develop” and insert “issue”.

On page 7, between lines 3 and 4, insert the following:

(2) ADMINISTRATION.—The guidelines shall—

(A) specify—

(i) the terms and conditions that would require a higher or lower level of cost sharing under this section;

(ii) the conditions under which the Secretary will allow loan modifications or forgiveness in cases in which a well cannot be used for production or injection; and

(iii) the information necessary to provide a loan applicant with certainty about application of subsection (f), including the level of cost and risk that the applicant and the Secretary will assume; and

(B) require that—

(i) loans be provided under this section only after the developer has committed the share of the developer for expenditures for drilling costs; and

(ii) loans for successful wells shall to be repaid by the developer within a 10-year period.

On page 9, line 12, strike “via” and insert “by way of”.

On page 9, line 20, insert “with a name-plate capacity, expected resource, or rating of 10 or more megawatts” after “large entities”.

On page 10, line 19, strike “and”.

On page 10, between lines 21 and 22, insert the following:

“(iii) improvements in design methodology and energy analysis procedures; and

“(iv) improved methods for determination of ground thermal properties and ground temperatures;”.

#### PURPOSE

The purpose of S. 1142 is to promote the mapping and development of United States geothermal resources by establishing a direct loan program for high risk geothermal exploration wells, to amend the Energy Independence and Security Act of 2007 to improve geothermal energy technology and demonstrate the use of geothermal energy in large-scale thermal applications, and to amend the Geothermal Steam Act of 1970 to facilitate coproduction of geothermal energy on existing oil and gas leases.

#### BACKGROUND AND NEED

Geothermal energy is an enormous source of clean, reliable, and domestic energy, which can be used to drive turbines to generate electricity or as a direct source of heat in both industrial and residential applications. Despite its advantages, geothermal energy’s potential is just beginning to be tapped. It currently produces only 0.4 percent of the nation’s electricity, and its growth lags behind solar and wind energy.

Congress first statutorily recognized geothermal energy’s potential with the enactment of the Geothermal Steam Act of 1970, which authorized the Secretary of the Interior to issue leases for the development of geothermal resources on public lands. The Geothermal Energy Research, Development, and Demonstration Act of 1974 and the Geothermal Energy Act of 1980 sought to encourage development of geothermal energy through research and demonstration projects, loan guarantees, and loans, though the Secretary’s authority to provide loan guarantees and loans under these

laws has long since expired. In addition, the Advanced Geothermal Energy Research and Development Act of 2007 authorized the Department of Energy to undertake further research and development to expand the use of geothermal energy, and the American Recovery and Reinvestment Act of 2009 enabled the Department to fund additional geothermal projects.

Despite these authorities, significant barriers to geothermal energy production remain. The Department of Energy has testified that most of the identified hydrothermal resources have already been developed and the high cost and risk of exploring for new resources pose significant hurdles, and that “removing these obstacles to exploratory drilling is vitally important to increasing our geothermal power generation capacity.” In addition, the Department has testified that geothermal heat pumps for building applications face barriers in the form of high initial costs associated with installation, lack of consumer knowledge, and limitations in design and infrastructure. It has also identified delays in the siting and permitting process, which increase overall project costs, as significant obstacles to geothermal energy.

Additional legislation is needed to address these obstacles. S. 1142 supplements the Department’s existing authorities by authorizing the Secretary of Energy to make loans for high risk geothermal exploration wells, establishing a new, focused program of research, development, demonstration, and commercial application for geothermal heat pumps and direct use of geothermal energy, and by amending the Geothermal Steam Act of 1970 to facilitate coproduction of geothermal energy on existing oil and gas leases.

#### LEGISLATIVE HISTORY

S. 1142 was introduced by Senator Tester on May 26, 2011. Senators Begich, Murkowski, and Reid are cosponsors. The Committee on Energy and Natural Resources held a hearing on the bill on July 12, 2011. The Committee on Energy and Natural Resources considered the bill ordered it favorably reported without amendment on December 15, 2011.

#### COMMITTEE RECOMMENDATION AND TABULATION OF VOTES

The Committee on Energy and Natural Resources, in an open business session on December 15, 2011, by a roll call vote of a quorum present, recommends that the Senate pass S. 1142, if amended as described herein.

The rollcall vote on reporting the measure was 13 yeas, 8 nays, as follows:

YEAS	NAYS
Mr. Bingaman	Mr. Barrasso*
Mr. Wyden*	Mr. Risch*
Mr. Johnson	Mr. Lee*
Ms. Landrieu*	Mr. Paul*
Ms. Cantwell	Mr. Coats
Mr. Sanders	Mr. Portman*
Ms. Stabenow	Mr. Hoeven*
Mr. Udall	Mr. Corker*
Mrs. Shaheen	
Mr. Frankin	
Mr. Manchin	
Mr. Coons	
Ms. Murkowski	

\*Indicates vote by proxy.

#### COMMITTEE AMENDMENTS

During its consideration of S. 1142, the Committee adopted nine amendments. The first amendment directs the Secretary of Energy, in selecting applicants for loans under section 2, to provide a preference for projects likely to lead to successful new geothermal development leading to electricity production. The second amendment provides that the Geothermal Investment Fund established under section 2(h) shall consist of amounts repaid on loans under section 2(g)(3), as well as amounts appropriated to the Fund under section 2(j). The third amendment redesignates section 2(i) as paragraph (1) under section 2(i) and provides a heading for the paragraph. The fourth amendment makes it clear that the Secretary must not only develop, but also issue, guidelines for implementation of the program within 180 days after the date of enactment. The fifth amendment adds a new paragraph (2) under section 2(i) specifying the contents of the guidelines. The sixth amendment clarifies the definition of a closed loop geothermal heat pump. The seventh amendment clarifies the definition of the term "large-scale application." The eighth amendment is technical. The ninth amendment adds two additional means of reducing costs for geothermal ground loop installations.

#### SECTION-BY-SECTION ANALYSIS

*Section 1* designates the short title.

*Section 2* establishes a direct loan program for high risk geothermal exploration wells. Subsection (a) defines key terms used in the section. Subsection (b) establishes the program. Subsection (c) authorizes the Secretary to prescribe the form and content of loan applications. Subsection (d)(1) establishes project criteria. Subsection (d)(2) establishes a preference for projects likely to lead to successful new geothermal development leading to electricity production. Subsection (e) requires data from all exploratory wells drilled under the program to be provided to both the Secretary of Energy and the Secretary of the Interior for use in mapping national geothermal resources and other uses, including the National Geothermal Data System. Subsection (f)(1)(A) authorizes the Sec-

retary of Energy to determine the cost share for loans made under section 2. Subsection (f)(1)(B) allows the Secretary to base the cost share on risk, with higher risk receiving more financial support. Subsection (f)(2) allows the Secretary to determine the number of wells for each project for which a loan may be made. Subsection (f)(3) allows the Secretary to delay or dispense with the repayment obligation for unproductive projects. Subsection (g)(1) provides that the repayment process will commence 4 years after the loan is provided or when the project is put into service, whichever is sooner. Subsection (g)(2) permits the Secretary to extend the payback date for an additional 4 years. Subsection (g)(3) provides that amounts repaid on loans shall be deposited in the Geothermal Investment Fund. Subsection (h)(1) establishes the Geothermal Investment Fund. Subsection (h)(2) provides that the Fund shall consist of amounts appropriated to the Fund and amounts repaid on loans. Subsection (h)(3) prohibits use of the Fund for any other purpose. Subsection (h)(4) calls for annual reports on the financial status of the Fund. Subsection (i) requires the Secretary to issue project qualification guidelines within 180 days after the date of enactment. Subsection (j) authorizes appropriations for the program through fiscal year 2021.

*Section 3* amends title VI of the Energy Independence and Security Act of 2007 to add a new section 616A establishing a Large-Scale Geothermal Energy program to spur investment in enhanced geothermal systems. Subsections (a), (b), and (c) of the new section 616A makes findings, states the purposes of the section, and defines key terms used in the new section, respectively. Section 616A(d) directs the Secretary to establish a program to improve geothermal heat pump technologies and increase the direct usage of geothermal energy technologies, specifically in large scale applications. Section 616A(d)(2) lists 15 potential areas of focus, spanning from research through commercialization. Section 616A(e)(1) directs the Secretary to make grants to state and local governments, institutions of higher education, nonprofit entities, utilities, and for-profit companies to promote the development of geothermal heat pumps and the direct use of geothermal energy. Section 616A(e)(2) directs the Secretary to give priority to proposals that apply to large buildings, commercial districts, and residential communities. Section 616A(e)(3) directs the Secretary to issue a solicitation for grants within 180 days after the date of enactment. Section 616A(f) calls for progress reports on implementation of the program. Subsection 616A(g) authorizes appropriation of such sums as may be necessary to carry out the program for each of fiscal years 2012 through 2016.

*Section 4* amends section 4 of the Geothermal Steam Act of 1970 by adding a new paragraph (4) to allow for co-leasing of geothermal production with an approved application for a permit to drill (APD) for an oil and gas well, as long as it is in the public interest.

#### COST AND BUDGETARY CONSIDERATIONS

The following estimate of costs of this measure has been provided by the Congressional Budget Office:

*S. 1142—Geothermal Exploration and Technology Act of 2011*

Summary: S. 1142 would authorize the Secretary of Energy to provide loans and grants to support certain activities related to the production and consumption of geothermal energy. Assuming appropriation of the necessary amounts, CBO estimates that implementing S. 1142 would cost \$67 million over the 2012–2017 period. Pay-as-you-go procedures do not apply to this legislation because it would not affect direct spending or revenues.

S. 1142 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA).

Estimated cost to the federal government: The estimated budgetary impact of S. 1142 is shown in the following table. The costs of this legislation fall within budget function 270 (energy).

	By fiscal year, in millions of dollars—						
	2012	2013	2014	2015	2016	2017	2012–2017
CHANGES IN SPENDING SUBJECT TO APPROPRIATION							
Estimated Authorization Level .....	15	15	15	15	15	15	90
Estimated Outlays .....	4	8	11	14	15	15	67

Basis of estimate: S. 1142 would authorize the appropriation of amounts necessary—for fiscal years 2012 through 2021—for the Department of Energy (DOE) to provide direct loans and grants to promote the development and use of technologies that generate energy from geothermal resources. The bill would authorize the Secretary of Energy to make direct loans to defray the costs of high-risk geothermal exploration wells. In contrast to the budgetary treatment for federal credit programs required under the Federal Credit Reform Act, S. 1142 would credit repayments of such loans to a separate fund that would be available, without further Congressional action, to support new loans under the bill—thereby increasing the estimated subsidy cost of loans to 100 percent of their aggregate face value. S. 1142 also would authorize DOE to make grants to state and local governments, institutions of higher education, and certain other entities to promote the development of geothermal heat pumps and direct use of geothermal energy, particularly on a large scale.

Based on information from DOE and industry sources, CBO estimates that making appreciable progress toward objectives set forth in S. 1142 would require appropriations totaling \$15 million annually. (By comparison, CBO estimates that federal funding for geothermal technologies and related activities in 2012 totals about \$50 million.) That estimate is based in part on the cost of geothermal programs carried out under the American Recovery and Reinvestment Act, which provided funds for DOE to undertake activities similar to those authorized by S. 1142. Under S. 1142, CBO anticipates that DOE would provide a small number of new loans for exploration wells each year and increase the number of projects to demonstrate large-scale use of geothermal technology. Assuming appropriation of the necessary amounts, CBO estimates that implementing the bill would cost \$67 million over the 2012–2017 period, with additional spending occurring in later years.

Pay-As-You-Go considerations: None.

Intergovernmental and private-sector impact: S. 1142 contains no intergovernmental or private-sector mandates as defined in UMRA. The bill would authorize grants to state and local governments, institutions of higher education, and other entities to promote the development of geothermal technologies. Any costs to those entities would be incurred voluntarily as conditions of federal assistance.

Estimate prepared by: Federal costs: Megan Carroll; Impact on state, local, and tribal governments: Ryan Miller; Impact on the private sector: Amy Petz.

Estimate approved by: Theresa Gullo, Deputy Assistant Director for Budget Analysis.

#### REGULATORY IMPACT EVALUATION

In compliance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee makes the following evaluation of the regulatory impact that would be incurred in carrying out S. 1142.

The bill is not a regulatory measure in the sense of imposing Government-established standards or significant economic responsibilities on private individuals and businesses.

No personal information would be collected in administering the program. Therefore, there would be no impact on personal privacy.

Little, if any, additional paperwork would result from the enactment of S. 1142, as ordered reported.

#### CONGRESSIONALLY DIRECTED SPENDING

S. 1142, as ordered reported, does not contain any congressionally directed spending items, limited tax benefits, or limited tariff benefits as defined in rule XLIV of the Standing Rules of the Senate.

#### EXECUTIVE COMMUNICATIONS

The testimony provided by the Department of Energy at the July 12, 2011 Full Committee hearing on S. 1142 follows:

STATEMENT OF STEVEN G. CHALK, DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Chairman Bingaman, Ranking Member Murkowski and Members of the Committee, thank you for the opportunity to discuss the Department of Energy's (DOE's) solar and geothermal energy programs. Today, I am pleased to discuss the Department's perspective and answer questions related to the Department of Energy Administrative Improvement Act (S. 1160), the 10 Million Solar Roofs Act of 2011 (S. 1108) and the Geothermal Exploration and Technology Act of 2011 (S. 1142). However, the Administration is still reviewing these bills and we do not have a position on any of them at this time.

## SOLAR TECHNOLOGY

We thank the committee and the sponsors of this legislation for your strong leadership on solar technologies over the years. The Department has set an ambitious goal for solar energy with the SunShot Initiative (SunShot)—to reduce the total costs of solar energy systems by about 75 percent so that they are cost competitive with other forms of energy without subsidies before the end of the decade. In 2012, under SunShot, the Department will support solar research across the development pipeline, from basic photovoltaic (PV) cell technologies to manufacturing scale-up to total system development.

Reducing the total installed cost for utility-scale solar electricity to roughly 6 cents per kilowatt hour without subsidies will result in rapid, large-scale adoption of solar electricity across the United States. Reaching this goal will help re-establish American technological leadership, improve the nation's energy security, and strengthen U.S. economic competitiveness in the global clean energy race.

SunShot takes a unique approach to developing solar energy. Historically, solar investments focused on achieving incremental efficiency improvements to solar cells and arrays. SunShot focuses on reducing the installed cost of the system as a whole, including non-technical barriers. In addition to investing in improvements in cell technologies and manufacturing, the SunShot Initiative also focuses on steps to reduce installation and permitting costs, which account for 40 percent of the total installed system price of solar electricity.<sup>1</sup> This includes efforts to streamline and digitize local permitting processes and to develop codes and standards that ensure high performance over the approximately 20-year lifetime of residential solar products. Decreasing the installed cost of solar is one of the key goals of SunShot.

As the United States is the world's largest consumer of electricity and, at the same time, has the largest solar resource of any industrialized country, SunShot is well-positioned to help the Nation realize the significant benefits from the wide-scale use of solar energy. Sunshot underscores solar energy's benefits to the United States and will have multiple positive impacts for the country, including:

- Achieving solar energy cost parity with baseload energy rates. Attaining a total installed system cost of utility solar equivalent to the wholesale cost of electricity from fossil fuels (\$0.06 per kWh) would likely result in rapid and large-scale adoption of solar electricity across the United States.
- Increasing solar photovoltaic market share. As recently as 1995, the United States manufactured 43 percent of the world's PV materials, whereas today our manufacturers are only responsible for 6 percent.<sup>2</sup> Expanding the use of solar will help boost the U.S. solar manufacturing

<sup>1</sup>[http://www.eere.energy.gov/solar/sunshot/pdfs/dpw\\_white\\_paper.pdf](http://www.eere.energy.gov/solar/sunshot/pdfs/dpw_white_paper.pdf).

<sup>2</sup>PV News (2/1993, 3/2001, 3/2006) and Navigant Consulting (2/2011).



industry while driving innovation and providing long lasting, domestic jobs to support global PV demand that will represent a multibillion dollar industry.

- Reducing greenhouse gas emissions—Solar technologies have the potential to significantly reduce the amount of conventional fossil-based electricity generation necessary, which in turn would reduce the amount of greenhouse gases emitted into the atmosphere.

Recently, as part of ongoing Market Transformation activities, DOE announced a Funding Opportunity Announcement (FOA) which we are calling the “Race to the Rooftop” to help standardize, streamline and digitize the permitting process, while improving interconnection and net metering standards, increasing access to financing, and updating planning and zoning codes. This national competition engaging teams of local and state governments along with utilities, installers, and nongovernment organizations, will help standardize processes, cut upfront fees and paperwork, and reduce the overall costs associated with permitting and installation, making it easier and cheaper for homeowners, businesses, and their local communities to deploy solar energy. The standardization and uniformity of local permitting efforts under the “Race to the Rooftop” are similar to the challenge grant provision in the 10 Million Solar Roofs Act, which calls for applicants to develop best practices for solar permitting.

The proposed legislation, S. 1108, employs a bottom-up approach so that local teams can identify approaches best-suited for them. A bottom-up approach, coupled with a preference for applicants that have partnered with states, public utility commissions, or other stakeholders, could allow for local and regional variability while still increasing the speed and scale of installation across large geographic areas. This approach could also allow states to expand existing state programs that have been effective in promoting rooftop solar installations.

#### GEOTHERMAL TECHNOLOGY

The Department is committed to developing and deploying a portfolio of innovative technologies for clean, domestic geothermal power generation. Geothermal energy is a baseload energy resource with a small environmental footprint and emits little to no greenhouse gases.

Despite geothermal’s enormous potential, in 2010, only 15 MW of new geothermal power generation was added to the grid in the United States. There are two principal barriers facing the geothermal industry: the high cost and risk of exploration and most of the identified hydrothermal resources have already been developed.

Drilling costs represent approximately 42 percent of geothermal project development costs, and financing costs are significantly higher for exploratory drilling than for plant

construction.<sup>3</sup> Removing the obstacles to exploratory drilling is vitally important to increasing our geothermal power generation capacity. In many cases, geothermal resources have no surface expression, leaving our nation's hydrothermal potential—estimated at 30 GWe by the U.S. Geological Survey—untapped and inaccessible. Exploratory drilling could also identify resources for enhanced geothermal systems (EGS), which have the potential to produce 16,000 GWe of power in a wide range of geographic areas throughout the U.S.<sup>4</sup>

Under the American Recovery and Reinvestment Act of 2009 (Recovery Act), DOE invested \$97.3 million in 24 hydrothermal exploration projects, at which 34 exploration wells are planned. It is expected that from these wells, 400 MW of new resources will be confirmed by 2014.

DOE is also funding seven EGS demonstrations. At Desert Peak, Nevada, the initial stages of reservoir stimulation were successfully completed—a critical milestone in creating an enhanced geothermal reservoir.

DOE supports projects in low temperature geothermal resources as well. For example, DOE is working with industry to develop and field test a variable phase turbine which has the potential to generate 30 percent more power from low temperature geothermal resources than current power conversion technologies, at a lower cost.

DOE's National Geothermal Data System (NGDS) effort is a distributed information system for data sharing in its second year of development, which will enable the availability of comprehensive and accurate data to facilitate geothermal development. The NGDS is scheduled to be fully operational in August 2014, at which time it will make geothermal data from major geothermal centers, DOE-funded geothermal projects and state geological surveys or universities publicly available.<sup>5</sup>

Geothermal heat pumps (GHPs) for building applications also face barriers impeding greater marketplace adoption: high initial cost associated with the installation of the ground loop heat-exchanger, lack of consumer knowledge in GHP benefits, and limitations in GHP design and business planning infrastructure. DOE is developing a roadmap that will serve to strategically direct activities in geothermal heat pumps.

Through the Recovery Act, DOE currently funds 26 projects deploying geothermal heat pumps. \$24M of the \$58M Recovery Act funds allocated to GHPs have been spent in 15 states in both new and retrofit applications. Two projects are completed and several more are already

<sup>3</sup>[http://www.nrel.gov/applying\\_technologies/pdfs/46022.pdf](http://www.nrel.gov/applying_technologies/pdfs/46022.pdf).

<sup>4</sup>Augustine, Young, and Anderson, Updated US. Geothermal Supply Curve, National Renewable Energy Laboratory and US Department of Energy, February, 2010, <http://www.nrel.gov/docs/fy10osti/47458.pdf>.

<sup>5</sup>NGDS data sources include: DOE Geothermal Data Repository (Boise State University); Energy & Geoscience Institute (University of Utah); Geo-Heat Center (Oregon Institute of Technology); Stanford Geothermal Program (Stanford University); Great Basin Science Sample and Records Library (University of Nevada, Reno); SMU Geothermal Laboratory (Southern Methodist University); and state geological surveys represented by Arizona Geological Survey and the American Association of State Geologists (AASG).

providing data for performance analysis. The Recovery Act projects incorporate innovative business and financial strategies and/or GHP technologies and applications designed to overcome the initial cost premium that has prevented GHPs from being directly cost-competitive with other HVAC technologies, and from gaining wider marketplace acceptance.

DOE currently has projects in many of the areas identified for further RD&D and commercial application in S. 1142, including district heating and cooling at large institutions, use of hot water in shaft mines, combined GHP-solar PV and desiccant projects, and use of carbon dioxide as a refrigerant fluid for heat exchange.

The Department is also addressing other obstacles to geothermal development such as delays in the siting and permitting process which increase overall project costs and could further strain economics. Currently, it takes approximately seven years for a new geothermal project to move from exploration to power generation.

While the Administration is still reviewing the bill, there are serious technical concerns that would need to be addressed. Any new program should be consistent with applicable laws, and structured to mitigate risks and costs to the taxpayer.

S. 1160—DEPARTMENT OF ENERGY ADMINISTRATIVE  
IMPROVEMENT ACT

S. 1160 proposes a variety of changes intended to improve the administration of the Department of Energy. The Department is still reviewing this bill and does not have a position on it at this time. However, I will address Sections 4, 6, and 7 as they relate to the Department's current authority.

*Section 4*

Section 4 of S. 1160 concerns the administration of the Department's "Other Transactions" (OT) Authority. Section 4 is similar in many respects to DOE's current OT Authority, which is codified at Section 646(g) of the DOE Organization Act (42 U.S.C. 7256(g)). However, there are some important differences.

Currently, the Department has two kinds of OT Authority: Research OT Authority and Prototype OT Authority. Research OT Authority is used to carry out a public purpose of support or stimulation (e.g., RD&D projects). By contrast, Prototype OT Authority is used for the pre-acquisition development of technology prototypes. Such prototypes are used to evaluate the technical or manufacturing feasibility or utility to DOE's mission of a particular technology, process, concept, end item, or system.

Section 4 provides DOE with permanent and independent OT Authority similar to the authority Congress provided the Defense Department in 1991. However, the precise scope of DOE's OT Authority is left undefined in S. 1160.

Additionally, Section 4 of S. 1160 requires the Secretary to determine that “the use of a standard contract, grant, or cooperative agreement for the project is not feasible or appropriate” before the Department’s OT Authority can be used. Section 4 restricts the delegation of this authority to officials “appointed by the President and confirmed by the Senate.”

*Section 6 and 7*

Section 6 of S. 1160 provides the Secretary with direct hire authority for “highly qualified scientists, engineers, or critical technical personnel” for two years following the enactment of the Act. Similarly, Section 7 provides the Secretary with special hiring and pay authority for persons with “expertise in an extremely high level in a scientific or technical field.” The Secretary’s authority under Section 7 is permanent, but not more than 40 persons may be hired under this authority at any time.

Sections 6 and 7 are analogous to Sections 621(b) and (d) of the DOE Organization Act (42 U.S.C. § 7231(b)–(d)). Section 621(b), which expired after four years, allowed the Secretary to appoint 311 scientific, engineering, and administrative personnel without regard to civil service laws and to fix their compensation at “super grades” (formerly GS–18, now Executive Level IV). Section 621(d), which is still in effect, authorizes the Secretary to appoint 200 scientific, engineering, professional, and administrative staff without regard to civil service laws, but subject to a GS–18 pay cap (now Executive Level IV).

Additionally, Congress granted the Department’s ARPA–E program special hiring authority. The Director of ARPA–E has the authority to make appointments of scientific, engineering, and professional personnel “without regard to the civil service laws,” “fix the basic pay of such personnel” up to Level II of the Executive Schedule, and provide “additional payments” up to a certain cap.

CONCLUSION

In conclusion, I would like to again thank this Committee for its leadership in supporting both solar and geothermal energy technologies.

It is important to tap valuable assets like solar and geothermal energy to continue growing our economy to expand the Nation’s clean energy portfolio and energy security.

I would be pleased to address any questions the Committee might have.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill S. 1142, as ordered reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is

printed in *italic*, existing law in which no change is proposed is shown in *roman*):

**ENERGY INDEPENDENCE AND SECURITY ACT OF 2007**

(Public Law 110–140, as amended)

AN ACT To move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes.

\* \* \* \* \*

**TITLE VI—ACCELERATED RESEARCH AND DEVELOPMENT**

\* \* \* \* \*

**Subtitle B—Geothermal Energy**

\* \* \* \* \*

**SEC. 616. GEOTHERMAL ENERGY PRODUCTION FROM OIL AND GAS FIELDS AND RECOVERY AND PRODUCTION OF GEOPRESSURED GAS RESOURCES.**

(a) **IN GENERAL.**—The Secretary shall establish a program of research, development, demonstration, and commercial application to support development of geothermal energy production from oil and gas fields and production and recovery of energy, including electricity, from geopressured resources. In addition, the Secretary shall conduct such supporting activities including research, resource characterization, and technology development as necessary.

\* \* \* \* \*

(e) **COMPETITIVE GRANT SELECTION.**—Not less than 90 days after the date of the enactment of this Act, the Secretary shall conduct a national solicitation for applications for grants under the programs outlined in subsections (b) and (d). Grant recipients shall be selected on a competitive basis based on criteria in the respective subsection.

(f) **WELL DRILLING.**—No funds may be used under this section for the purpose of drilling new wells.

**SEC. 616A. LARGE-SCALE GEOTHERMAL ENERGY.**

(a) **FINDINGS.**—*Congress finds that—*

(1) *the Geothermal Technologies Program of the Office of Energy Efficiency and Renewable Energy of the Department has included a focus on direct use of geothermal energy in the low-temperature geothermal energy subprogram (including in the development of a research and development plan for the program);*

(2) *the Building Technologies Program of the Office of Energy Efficiency and Renewable Energy of the Department—*

*(A) is focused on the energy demand and energy efficiency of buildings; and*

*(B) includes geothermal heat pumps as a component technology in the residential and commercial deployment activities of the program; and*

(3) *geothermal heat pumps and direct use of geothermal energy, especially in large-scale applications, can make a significant contribution to the use of renewable energy but are under-represented in research, development, demonstration, and commercialization.*

(b) *PURPOSES.—The purposes of this section are—*

(1) *to improve the components, processes, and systems used for geothermal heat pumps and the direct use of geothermal energy; and*

(2) *to increase the energy efficiency, lower the cost, increase the use, and improve and demonstrate the applicability of geothermal heat pumps to, and the direct use of geothermal energy in, large buildings, commercial districts, residential communities, and large municipal, agricultural, or industrial projects.*

(c) *DEFINITIONS.—In this section:*

(1) *DIRECT USE OF GEOTHERMAL ENERGY.—The term “direct use of geothermal energy” means systems that use water that is at a temperature between approximately 38 degrees Celsius and 149 degrees Celsius directly or through a heat exchanger to provide—*

(A) *heating to buildings; or*

(B) *heat required for industrial processes, agriculture, aquaculture, and other facilities.*

(2) *GEOTHERMAL HEAT PUMP.—The term “geothermal heat pump” means a system that provides heating and cooling by exchanging heat from shallow ground or surface water using—*

(A) *a closed loop system, which transfers heat via buried or immersed pipes that contain a mix of water and anti-freeze; or*

(B) *an open loop system, which circulates ground or surface water directly into the building and returns the water to the same aquifer or surface water source.*

(3) *LARGE-SCALE APPLICATION.—The term “large-scale application” means an application for space or process heating or cooling for large entities, such as a large building, commercial district, residential community, or a large municipal, agricultural, or industrial project.*

(4) *SECRETARY.—The term “Secretary” means Secretary of Energy, acting through the Assistant Secretary for Energy Efficiency and Renewable Energy.*

(d) *PROGRAM.—*

(1) *IN GENERAL.—The Secretary shall establish a program of research, development, demonstration, and commercial application for geothermal heat pumps and the direct use of geothermal energy.*

(2) *AREAS.—The program may include research, development, demonstration, and commercial application of—*

(A) *geothermal ground loop efficiency improvements through more efficient heat transfer fluids;*

(B) *geothermal ground loop efficiency improvements through more efficient thermal grouts for wells and trenches;*

(C) *geothermal ground loop installation cost reduction through?*

(i) *improved drilling methods; and*

(ii) improvements in drilling equipment;

(D) installing geothermal ground loops near the foundation walls of new construction to take advantage of existing structures;

(E) using gray or black wastewater as a method of heat exchange;

(F) improving geothermal heat pump system economics through integration of geothermal systems with other building systems, including providing hot and cold water and rejecting or circulating industrial process heat through refrigeration heat rejection and waste heat recovery;

(G) advanced geothermal systems using variable pumping rates to increase efficiency;

(H) geothermal heat pump efficiency improvements;

(I) use of hot water found in mines and mine shafts and other surface waters as the heat exchange medium;

(J) heating of districts, neighborhoods, communities, large commercial or public buildings (including office, retail, educational, government, and institutional buildings and multifamily residential buildings and campuses), and industrial and manufacturing facilities;

(K) geothermal system integration with solar thermal water heating or cool roofs and solar-regenerated desiccants to balance loads and use building hot water to store geothermal energy;

(L) use of hot water coproduced from oil and gas recovery;

(M) use of water sources at a temperature of less than 150 degrees Celsius for direct use;

(N) system integration of direct use with geothermal electricity production; and

(O) coproduction of heat and power, including on-site use.

(3) ENVIRONMENTAL IMPACTS.—In carrying out the program, the Secretary shall identify and mitigate potential environmental impacts in accordance with section 614(c).

(e) GRANTS.—

(1) IN GENERAL.—The Secretary shall make grants available to State and local governments, institutions of higher education, nonprofit entities, utilities, and for-profit companies (including manufacturers of heat-pump and direct-use components and systems) to promote the development of geothermal heat pumps and the direct use of geothermal energy.

(2) PRIORITY.—In making grants under this subsection, the Secretary shall give priority to proposals that apply to large buildings (including office, retail, educational, government, institutional, and multifamily residential buildings and campuses and industrial and manufacturing facilities), commercial districts, and residential communities.

(3) NATIONAL SOLICITATION.—Not later than 180 days after the date of enactment of this section, the Secretary shall conduct a national solicitation for applications for grants under this section.

(f) REPORTS.—

(1) *IN GENERAL.*—Not later than 2 years after the date of enactment of this section and annually thereafter, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Science and Technology of the House of Representatives a report on progress made and results obtained under this section to develop geothermal heat pumps and direct use of geothermal energy.

(2) *AREAS.*—Each of the reports required under this subsection shall include—

(A) an analysis of progress made in each of the areas described in subsection (d)(2); and

(B)(i) a description of any relevant recommendations made during a review of the program; and

(ii) any plans to address the recommendations under clause (i).

(g) *AUTHORIZATION OF APPROPRIATIONS.*—There are authorized to be appropriated to the Secretary to carry out this section such sums as are necessary for each of fiscal years 2012 through 2016.

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**GEOHERMAL STEAM ACT OF 1970**

AN ACT To authorize the Secretary of the Interior to make disposition of geothermal steam and associated geothermal resources, and for other purposes.

[As Amended Through P.L. 109–58, Enacted August 8, 2005]

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**SEC. 4. LEASING PROCEDURES.**

(a) *NOMINATIONS.*—The Secretary shall accept nominations of land to be leased at any time from qualified companies and individuals under this Act.

(b) *COMPETITIVE LEASE SALE REQUIRED.*—

(1) *IN GENERAL.*—Except as otherwise specifically provided by this Act, all land to be leased that is not subject to leasing under subsection (c) shall be leased as provided in this subsection to the highest responsible qualified bidder, as determined by the Secretary.

(2) *COMPETITIVE LEASE SALES.*—The Secretary shall hold a competitive lease sale at least once every 2 years for land in a State that has nominations pending under subsection (a) if the land is otherwise available for leasing.

(3) *LANDS SUBJECT TO MINING CLAIMS.*—Lands that are subject to a mining claim for which a plan of operations has been approved by the relevant Federal land management agency may be available for noncompetitive leasing under this section to the mining claim holder.

(4) *LAND SUBJECT TO OIL AND GAS LEASE.*—Land under an oil and gas lease issued pursuant to the Mineral Leasing Act (30 U.S.C. 181 et seq.) or the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351 et seq.) that is subject to an approved application for permit to drill and from which oil and gas production is occurring may be available for leasing under subsection (c) by the holder of the oil and gas lease—

(A) on a determination that—



*(i) geothermal energy will be produced from a well producing or capable of producing oil and gas; and  
(ii) the public interest will be served by the issuance of such a lease; and  
(B) in order to provide for the coproduction of geothermal energy with oil and gas.*

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