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### CARBON DIOXIDE CAPTURE

JULY 11, 2011.—Ordered to be printed

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

### R E P O R T

[To accompany S. 757]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 757) to provide incentives to encourage the development and implementation of technology to capture carbon dioxide from dilute sources on a significant scale using direct air capture technologies, having considered the same, reports favorably thereon with an amendment and recommends that the bill, as amended, do pass.

The amendment is as follows:

Strike out all after the enacting clause and insert in lieu thereof the following:

#### SECTION 1. SHORT TITLE.

This Act may be cited as the “Carbon Dioxide Capture Technology Prize Act of 2011”.

#### SEC. 2. FINDINGS AND PURPOSE.

(a) FINDINGS.—Congress finds that—

(1) flue gases from coal-fired electric generating facilities typically have carbon dioxide concentrations of approximately 17 percent by volume;

(2) it is possible to separate carbon dioxide from dilute sources and even the atmosphere, which has a carbon dioxide concentration of 0.038 percent, but substantial advances in research and technology will be necessary to provide the separation in an economical manner;

(3) developing practical separations of carbon dioxide from dilute sources is important to the future development of energy technology;

(4) economical onsite separation of atmospheric carbon dioxide can help leverage the use of carbon dioxide in energy applications such as enhanced oil recovery and enhanced geothermal systems at remote sites; and

(5) authorizing the Secretary of Energy to provide a technology prize for separation of carbon dioxide from dilute sources can provide the impetus for developing the novel technologies that will be needed in the future as part of the national energy system of the United States.

(b) PURPOSE.—The purpose of this Act is to provide incentives to encourage the development and implementation of technology to capture carbon dioxide from dilute sources on a significant scale using direct air capture technologies.

**SEC. 3. CARBON DIOXIDE CAPTURE TECHNOLOGY PRIZE.**

Section 703 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17251) is amended—

(1) by redesignating subsection (b) as subsection (c);

(2) by inserting after subsection (a) the following:

“(b) CARBON DIOXIDE CAPTURE TECHNOLOGY PRIZE.—

“(1) DEFINITIONS.—In this subsection:

“(A) BOARD.—The term ‘Board’ means the Carbon Dioxide Capture Technology Advisory Board established by paragraph (6).

“(B) DILUTE.—The term ‘dilute’ means a concentration of less than 1 percent by volume.

“(C) INTELLECTUAL PROPERTY.—The term ‘intellectual property’ means—

“(i) an invention that is patentable under title 35, United States Code; and

“(ii) any patent on an invention described in clause (i).

“(D) SECRETARY.—The term ‘Secretary’ means the Secretary of Energy or designee, in consultation with the Board.

“(2) AUTHORITY.—Not later than 1 year after the date of enactment of the Carbon Dioxide Capture Technology Prize Act of 2011, as part of the program carried out under this section, the Secretary shall establish and award competitive technology financial awards for carbon dioxide capture from media in which the concentration of carbon dioxide is dilute.

“(3) DUTIES.—In carrying out this subsection, the Secretary shall—

“(A) subject to paragraph (4), develop specific requirements for—

“(i) the competition process;

“(ii) minimum performance standards for qualifying projects; and

“(iii) monitoring and verification procedures for approved projects;

“(B) establish minimum levels for the capture of carbon dioxide from a dilute medium that are required to be achieved to qualify for a financial award described in subparagraph (C); and

“(C) offer financial awards for—

“(i) a design for a promising capture technology;

“(ii) a successful bench-scale demonstration of a capture technology;

“(iii) a design for a technology described in clause (i) that will—

“(I) be operated on a demonstration scale; and

“(II) achieve significant reduction in the level of carbon dioxide;

and

“(iv) an operational capture technology on a commercial scale that

meets the minimum levels described in subparagraph (B).

“(4) PUBLIC PARTICIPATION.—In carrying out paragraph (3)(A), the Board

shall—

“(A) provide notice of and, for a period of at least 60 days, an opportunity for public comment on, any draft or proposed version of the requirements described in paragraph (3)(A); and

“(B) take into account public comments received in developing the final version of those requirements.

“(5) PEER REVIEW.—No financial awards may be provided under this subsection until the proposal for which the award is sought has been peer reviewed in accordance with such standards for peer review as are established by the Secretary.

“(6) CARBON DIOXIDE CAPTURE TECHNOLOGY ADVISORY BOARD.—

“(A) ESTABLISHMENT.—There is established an advisory board to be known as the ‘Carbon Dioxide Capture Technology Advisory Board’.

“(B) COMPOSITION.—The Board shall be composed of 7 members appointed by the President that provide expertise in—

“(i) climate science;

“(ii) physics;

“(iii) chemistry;

“(iv) biology;

“(v) engineering;

“(vi) economics;

“(vii) business management; and

“(viii) such other disciplines as the Secretary determines to be necessary to achieve the purposes of this subsection.

“(C) INITIAL MEETING.—Not later than 30 days after the date on which all members of the Board have been appointed, the Board shall hold the initial meeting of the Board.

“(D) MEETINGS.—The Board shall meet at the call of the Chairperson.

“(E) QUORUM.—A majority of the members of the Board shall constitute a quorum, but a lesser number of members may hold hearings.

“(F) CHAIRPERSON AND VICE CHAIRPERSON.—The Board shall select a Chairperson and Vice Chairperson from among the members of the Board.

“(G) DUTIES.—The Board shall advise the Secretary on carrying out the duties of the Secretary under this subsection.

“(7) INTELLECTUAL PROPERTY.—

“(A) IN GENERAL.—As a condition of receiving a financial award under this subsection, an applicant shall agree to vest the intellectual property of the applicant derived from the technology in 1 or more entities that are incorporated in the United States.

“(B) RESERVATION OF LICENSE.—The United States—

“(i) may reserve a nonexclusive, nontransferable, irrevocable, paid-up license, to have practiced for or on behalf of the United States, in connection with any intellectual property described in subparagraph (A); but

“(ii) shall not, in the exercise of a license reserved under clause (i), publicly disclose proprietary information relating to the license.

“(C) TRANSFER OF TITLE.—Title to any intellectual property described in subparagraph (A) shall not be transferred or passed, except to an entity that is incorporated in the United States, until the expiration of the first patent obtained in connection with the intellectual property.

“(8) TERMINATION OF AUTHORITY.—The Board and all authority provided under this subsection shall terminate on the date that is 5 years after the date of enactment of the Carbon Dioxide Capture Technology Prize Act of 2011.”; and (3) in subsection (c) (as redesignated by paragraph (1))—

(A) by striking “There is” and inserting the following:

“(1) IN GENERAL.—There is”;

(B) by striking “this section” and inserting “subsection (a)”;

(C) by striking “2013” and inserting “2011 and \$195,000,000 for each of fiscal years 2012 and 2013”; and

(D) by adding at the end the following:

“(2) CARBON DIOXIDE CAPTURE TECHNOLOGY PRIZE.—There is authorized to be appropriated to the Secretary to carry out subsection (b) \$10,000,000 for the period of fiscal years 2012 through 2016.”.

#### PURPOSE OF THE MEASURE

The purpose of S. 757 is to provide incentives to encourage the development and implementation of technology to capture carbon dioxide from dilute sources on a significant scale using direct air capture technologies by creating a carbon dioxide capture technology prize to be implemented by the Secretary of Energy.

#### BACKGROUND AND NEED

Carbon capture and storage (CCS) technology holds great promise of removing large amounts of carbon dioxide emitted from the use of fossil fuels. Deployment of CCS technology would reduce carbon dioxide emissions from electricity generation facilities that use fossil fuels and from other sources. In addition, captured carbon dioxide could be used in energy applications such as enhanced oil recovery and enhanced geothermal systems. Serious technical challenges to achieving cost-effective commercial deployment of CCS technology remain, however.

The Department of Energy’s ongoing CCS research and development programs, regional carbon sequestration partnerships, and commercial-scale demonstrations are important efforts toward solving these technical challenges. In addition, however, the National Academy of Engineering has recommended that Congress make greater use of competitions that are designed to foster progress toward scientific and technological goals by offering prizes or awards. The Academy found that inducement prizes attract a broader spec-

trum of ideas and participants, enable federal agencies to shift more of the risk of pursuing a scientific or technological breakthrough from the agency to the contestants, and have the capacity for educating, inspiring, and mobilizing the public.

Since the National Academy of Engineering recommended greater use of prizes for achieving scientific and technological goals, Congress has enacted legislation authorizing the Secretary of Energy to award cash prizes for breakthrough achievements in research, development, demonstration, and commercial application (“Grand Challenges Prizes”), for technologies that serve to reduce the dependence of the United States on imported oil (“Freedom Prizes”), for advances in hydrogen energy (“H-Prize”), and for various lighting technologies (“Bright Tomorrow Lighting Prizes”). 42 U.S.C. 16396 and 17243.

S. 757 is needed to provide financial incentives to encourage the development and implementation of technology to capture carbon dioxide from dilute sources on a significant scale using direct air capture technologies.

#### LEGISLATIVE HISTORY

S. 757 was introduced by Senator Barrasso on April 7, 2011. Senators Bingaman, Enzi, and Hoeven are cosponsors. The Committee on Energy and Natural Resources held a hearing on the bill on Thursday, May 12, 2011. The Committee considered the bill at its business meeting on Thursday, May 26, 2011. The Committee adopted an amendment in the nature of a substitute and ordered the bill, as amended, favorably reported.

#### COMMITTEE RECOMMENDATION

The Senate Committee on Energy and Natural Resources, in open business session on May 26, 2011, by voice vote of a quorum present, recommends that the Senate pass S. 757, if amended, as described herein. Mr. Coats (by proxy), Mr. Lee, Mr. Paul (by proxy), and Mr. Heller asked that they be recorded as voting no.

#### COMMITTEE AMENDMENT

During its consideration of the bill, the Committee adopted an amendment in the nature of a substitute. The amendment authorizes appropriation of \$10 million over a five-year period for the prize program. The amendment offsets the authorization by reducing an existing carbon capture program under section 703 of the Energy Independence and Security Act of 2007 by \$5 million in fiscal years 2012 and 2013. The amendment also reduces the number of advisory board members from 9 to 7 and eliminates compensation for service on the board.

#### SECTION-BY-SECTION ANALYSIS

*Section 1* provides a short title.

*Section 2(a)* finds that it is possible to capture carbon dioxide from dilute sources and the atmosphere, that developing practical carbon dioxide capture technologies is important to future energy development, and that authorizing the Secretary of Energy to award a technology prize can provide an impetus for developing

novel technologies. Subsection (b) states that the purpose of the bill is to authorize the Secretary of Energy to provide a technology prize for the separation of carbon dioxide from dilute sources using direct air capture technologies.

Section 3 authorizes the Secretary of Energy to create a competitive technology financial awards program for carbon dioxide capture from media in which the concentration of carbon dioxide is dilute (a concentration of less than 1 percent of carbon dioxide by volume). Awards will be given for basic design, bench-scale demonstration of technology, operational demonstration, and commercial scale for the carbon dioxide capture technologies. The Secretary will receive advice concerning the program from a 7-person advisory board. Any technology that receives a financial award under this program must vest the intellectual property derived from the technology into an entity or entities incorporated in the U.S. The program is authorized to be appropriated \$10,000,000 for the period of fiscal years 2012 through 2016.

#### COST AND BUDGETARY CONSIDERATIONS

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

##### *S. 757—Carbon Dioxide Capture Technology Prize Act of 2011*

Summary: S. 757 would authorize appropriations for the Department of Energy (DOE) to provide competitive financial awards to support the development of advanced technologies to capture carbon dioxide from the atmosphere. Because the bill also would reduce an existing authorization of appropriations for other activities, CBO estimates that implementing S. 757 would have no significant net impact on discretionary spending over the 2012–2016 period.

S. 757 would not affect direct spending or revenues; therefore, pay-as-you-go procedures do not apply.

S. 757 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. 757 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	2012–2016
CHANGES IN SPENDING SUBJECT TO APPROPRIATION						
Carbon Dioxide Capture Technology Prize:						
Authorization Level .....	10	0	0	0	0	10
Estimated Outlays .....	1	3	5	1	0	10
Carbon Capture and Sequestration Research, Development and Demonstration:						
Authorization Level .....	–5	–5	0	0	0	–10
Estimated Outlays .....	–2	–4	–3	–1	0	–10
Total Changes:						
Authorization Level .....	5	–5	0	0	0	0
Estimated Outlays .....	1	–1	2	0	0	0

Basis of estimate: For this estimate, CBO assumes that S. 757 will be enacted near the start of fiscal year 2012 and that future appropriations will be provided as specified under the bill. S. 757 would authorize funding of \$10 million for a new program related

to capturing carbon dioxide from the atmosphere and reduce, by \$10 million, an existing authorization of funding for related activities. Taken together, CBO estimates that those changes would have no net impact on spending subject to appropriation over the 2012–2016 period.

S. 757 would authorize the appropriation of \$10 million over the 2012–2016 period for DOE to establish a program to provide competitive financial awards to promote the development of technologies to capture large amounts of carbon dioxide from certain sources, such as the air. Under the bill, a seven-member advisory board would advise the Secretary of Energy in evaluating proposals and providing awards to eligible projects. Based on historical spending patterns for similar activities, CBO estimates that implementing the proposed program would cost \$10 million over the 2012–2016 period, assuming appropriation of the authorized amount.

That increase in discretionary spending would be offset by a reduction in amounts currently authorized to be appropriated for research, development, and demonstration activities related to carbon capture and sequestration (CCS). Public Law 110–140 currently authorizes appropriations totaling \$200 million a year through 2013. S. 757 would reduce that specified amount by \$5 million in each of fiscal years 2012 and 2013, thereby reducing the authorization for future spending subject to appropriation by a total of \$10 million.

Based on historical spending patterns for CCS-related activities and assuming appropriations are reduced accordingly, CBO estimates that spending over the 2012–2016 period would be \$10 million lower.

Pay-As-You-Go considerations: None.

Intergovernmental and private-sector impact: S. 757 contains no intergovernmental or private-sector mandates as defined in UMRA and would impose no costs on state, local, or tribal governments.

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 which would be incurred in carrying out S. 757.

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. 757.

## CONGRESSIONALLY DIRECTED SPENDING

The bill, as 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 Committee's May 12, 2011, hearing on S. 757 follows:

## STATEMENT OF SCOTT KLARA, DEPUTY LABORATORY DIRECTOR, NATIONAL ENERGY TECHNOLOGY LABORATORY, DEPARTMENT OF ENERGY

Thank you Chairman Bingaman, Ranking Member Barroso, and members of the Committee; I appreciate the opportunity to discuss the Department of Energy's activities to promote the development of carbon capture and storage (CCS) technologies. My testimony will provide an overview of the Department of Energy's (DOE) research efforts in developing CCS technologies. The Administration is still reviewing S. 699 and S. 757 and does not have a position on either bill at this time.

## INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE

Before I discuss the Department's Clean Coal Research Program, I will briefly review the conclusions from the Interagency Task Force on CCS. In August 2010, the final report from the Task Force was issued summarizing the Administration's efforts to develop and deploy CCS technologies, and proposed a plan to overcome the barriers to the widespread, cost-effective deployment of CCS within ten years, with a goal of bringing five to ten commercial demonstration projects on line by 2016. This report is the collective work of 14 executive departments and federal agencies, which were tasked with developing a comprehensive and coordinated Federal strategy to speed the commercial development and deployment of clean coal technologies. The task force concluded that while there are no insurmountable technological, legal, institutional, regulatory or other barriers that prevent CCS from playing a role in reducing GHG emissions, early CCS projects face economic challenges related to climate policy uncertainty, first-of-a-kind technology risks, and the current high cost of CCS relative to other technologies.

## CLEAN COAL RESEARCH PROGRAM

DOE continues to play a leadership role in the development of clean coal technologies with a focus on CCS. The Clean Coal Research Program—administered by DOE's Office of Fossil Energy and implemented by the National Energy Technology Laboratory—is designed to enhance our energy security and reduce environmental concerns over the future use of coal by developing a portfolio of revolu-

tionary clean coal technologies. The Program is well positioned to help overcome the technical challenges associated with the development of clean coal technologies.

The Clean Coal Program, in partnership with the private sector, is focused on maximizing efficiency and environmental performance, while minimizing the costs of these new technologies. In recent years, the Program has been restructured to focus on clean coal technologies with CCS. The Program pursues the following two major strategies:

- (1) capturing and storing greenhouse gases; and
- (2) improving the efficiency of fossil energy systems.

The first strategy aims to eliminate concerns over emissions of greenhouse gases from fossil fueled energy systems. The second strategy seeks to improve the fuel-to-energy efficiencies of these systems, thus reducing pollutant emissions, water usage, and carbon emissions on a per unit of energy basis. Collectively, these two strategies comprise the Clean Coal Program's approach to ensure that current and future fossil energy plants will have options to meet all emerging requirements for a safe and secure energy future.

#### CORE RESEARCH AND DEVELOPMENT ACTIVITIES

The Clean Coal Program is addressing the key technical challenges that confront the development and deployment of clean coal technologies through research on cost-effective capture technologies; monitoring, verification, and accounting technologies to ensure permanent storage; permitting issues; and development of advanced energy systems. The Program is also actively engaged in interagency efforts to address liability issues, public outreach, and infrastructure needs. As an example, today's commercially available CCS technologies would add around 80 percent to the cost of electricity for a new pulverized coal plant, and around 35 percent to the cost of electricity for a new integrated gasification combined cycle plant. The Program is aggressively pursuing developments to reduce these costs to less than a 35 percent increase in the cost of electricity for pulverized coal energy plants and less than a 10 percent increase in the cost of electricity for new gasification-based energy plants.

Research is focused on developing technology options that dramatically lower the cost of capturing carbon dioxide (CO<sub>2</sub>) from fossil fueled energy plants. This research can be categorized into three technical pathways: post-combustion, pre-combustion, and oxy-combustion. Post-combustion refers to capturing CO<sub>2</sub> from the stack gas after a fuel has been combusted in air. Pre-combustion refers to a process where a hydrocarbon fuel is gasified to form a mixture of hydrogen and carbon dioxide, and CO<sub>2</sub> is captured from the synthesis gas before it is combusted. Oxy-combustion is an approach where a hydrocarbon fuel is combusted in pure or nearly pure oxygen rather than air, which produces a mixture of CO<sub>2</sub> and water that can

easily be separated to produce pure CO<sub>2</sub>. Collectively, research in each of these technical pathways is exploring a wide range of approaches such as membranes; oxy-combustion concepts; solid sorbents; CO<sub>2</sub> hydrates; and advanced gas/liquid scrubbing technologies. These efforts cover not only improvements to state-of-the-art technologies but also development of several revolutionary concepts, such as metal organic frameworks, ionic liquids, and enzyme based systems. Coupling these developments with other advances in efficiency improvements and cost reduction from developments in gasification, turbines, and fuel cells, will help provide a technology base for commercial deployment of fossil energy systems integrated with CCS.

The Department is the primary supporter of the National Carbon Capture Center (NCCC), which is a joint partnership between DOE and industry. The NCCC is a one of a kind, world class facility which offers an opportunity to validate capture technologies on actual gas from a coal fired power plant or gasification facility. Because of the ability to operate under a wide range of process conditions, research at the NCCC can effectively evaluate technologies at various levels of maturity for many different applications.

#### REGIONAL CARBON SEQUESTRATION PARTNERSHIPS

The Regional Carbon Sequestration Partnerships were created by the DOE in 2003 through a competitive solicitation. The Partnerships were designed to address a range of issues associated with geologic storage of CO<sub>2</sub>. The Clean Coal Program has been performing CCS field tests focused on injection, monitoring, verification, accounting and other aspects of geologic storage for many years, and the seven Regional Carbon Sequestration Partnerships are critical to this effort. These Partnerships are comprised of state agencies, universities, and private companies. They represent more than 400 unique organizations in 43 States, and four Canadian Provinces. Geographic differences in fossil fuel use and potential storage sites across the United States dictate the use of regional approaches in addressing CCS, so each Partnership is focused on a specific region of the United States and Canada that hold similar characteristics relating to CCS opportunities.

Together, the Partnerships form a network of capability, knowledge, and infrastructure that will help enable geologic storage technology to play a role in the clean energy economy. They represent regions encompassing 97 percent of coal-fired CO<sub>2</sub> emissions, 97 percent of industrial CO<sub>2</sub> emissions, 96 percent of the total land mass, and essentially all the geologic storage sites that can potentially be available for geologic carbon storage. Regional Partnerships are drilling wells and injecting small quantities of CO<sub>2</sub> to validate the potential of key storage locations throughout the country. To date, the Regional Partnerships have injected over 1 million tons of CO<sub>2</sub> at 18 small scale injection projects throughout the United States and

Canada. These tests have helped to validate storage at a small scale and understand the fate of CO<sub>2</sub> in different depositional systems containing saline water, oil, and natural gas. Several large scale projects are also underway that will inject several million tons of CO<sub>2</sub> over the life of the projects. One of these projects has safely and securely injected over 2 million metric tons of CO<sub>2</sub>. Several more large-scale field tests will begin later this year.

Over the course of these initiatives, DOE and the Partnerships are addressing key infrastructure issues related to permitting, pore space ownership, site access, liability, public outreach, and education. We are also jointly developing Best Practice Manuals on topics such as site characterization, site construction, operations, monitoring, mitigation, closure, and long-term stewardship. These manuals will serve as guidelines for a future geologic sequestration industry in their regions, and help transfer the lessons learned from DOE's Program to all regional stakeholders.

Finally, DOE and the Partnerships continue to work closely with the Environmental Protection Agency (EPA) and other federal and state agencies in developing CCS regulatory strategies, which will provide additional certainty for future CCS deployments.

#### DEMONSTRATIONS AT COMMERCIAL-SCALE

The success of the Clean Coal Program will ultimately be judged by the extent to which emerging technologies get deployed in domestic and international marketplaces. Both technical and financial challenges associated with the deployment of new "high risk" coal technologies must be overcome in order to be capable of achieving success in the marketplace. Commercial scale demonstrations help the industry understand and overcome start-up issues, address component integration issues, and gain the early learning commercial experience necessary to reduce risk and secure private financing and investment for future plants.

The Department is implementing large-scale projects through the Regional Partnerships, the Clean Coal Power Initiative (CCPI), and FutureGen. Phase III of the Partnerships is focused on large-scale field tests of geologic carbon sequestration on the order of 1 million metric tons of CO<sub>2</sub> per year, and are addressing the liability, regulatory, permitting, and infrastructure needs of these projects. As described previously in this statement, the Partnerships have brought an enormous amount of capability and experience together to work on the challenges of these large projects.

The CCPI is a cost-shared partnership between the government and industry to develop and demonstrate advanced coal-based power generation technologies at the commercial scale. CCPI demonstrations address the reliability and affordability of the Nation's electricity supply from coal-based generation. By enabling advanced technologies to overcome technical risks involved with scale-up and bringing them to the point of commercial readiness, CCPI accelerates the development of both advanced coal

generation technologies and the integration of CCS with both new and existing generation technologies. The CCPI also facilitates the movement of technologies into the market place that are emerging from the core research and development activities. The CCPI program received an additional \$800 million from the 2009 American Recovery and Reinvestment Act (Recovery Act) which, in combination with base funding, was used to fund four active CCPI projects, two pre-combustion and two post-combustion projects.

In addition, a CCPI round II project has been modified to demonstrate CCS at a new integrated gasification combined cycle power plant. We are working closely with the project developers to comply with NEPA, air and water regulatory requirements, and complete initial Front End Engineering & Design (FEED) studies for the facilities. All five of these projects are on track to be operational between 2013 and 2015.

The FutureGen Project intends to conduct novel large-scale testing to accelerate the deployment of a set of advanced oxy-combustion power production technologies integrated with CCS. This project will be the first advanced repowering oxy-combustion project to store CO<sub>2</sub> in a deep saline geologic formation. On August 5, 2010, Secretary of Energy Steven Chu announced an award of \$1 billion in Recovery Act funding to the FutureGen Alliance, Ameren Energy Resources, Babcock & Wilcox, and Air Liquide Process and Construction, Inc., to build FutureGen 2.0, a clean coal repowering program and carbon dioxide storage network. On February 28, 2011, the FutureGen Alliance selected Morgan County, Illinois, as the preferred location for the FutureGen 2.0 CO<sub>2</sub> storage site, visitor center, research, and training facilities.

In addition to the CCPI and FutureGen 2.0 projects, the Recovery Act has also helped fund more than 80 additional projects which includes three large scale Industrial CCS demonstrations, ten geologic site characterizations, forty-three university research training projects, seven CCS research training centers, six Industrial CCS projects focused CO<sub>2</sub> reuse, and 14 projects focused on accelerated component development in the core research program.

#### CONCLUSION

CCS and related clean coal technologies can play a critical role in mitigating CO<sub>2</sub> emissions under many potential future carbon stabilization scenarios. Nevertheless, challenges remain to achieving cost-effective commercial deployment of CCS. The Department's research programs are a vital step to advancing the readiness of clean coal technologies for future commercial deployment. I thank this Committee and its members for allowing me the opportunity to provide an overview of DOE's research efforts in developing CCS technologies and I look forward to your questions. The Administration is still reviewing S. 699 and S. 757 and does not have a position on either bill at this time.

## 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. 757, 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

\* \* \* \* \*

**TITLE VII—CARBON CAPTURE AND SEQUESTRATION****Subtitle A—Carbon Capture and Sequestration Research, Development, and Demonstration**

\* \* \* \* \*

**SEC. 703. CARBON CAPTURE.****(a) PROGRAM ESTABLISHMENT.—**

(1) **IN GENERAL.**—The Secretary shall carry out a program to demonstrate technologies for the large-scale capture of carbon dioxide from industrial sources. In making awards under this program, the Secretary shall select, as appropriate, a diversity of capture technologies to address the need to capture carbon dioxide from a range of industrial sources.

\* \* \* \* \*

(4) **REQUIREMENT.**—For projects that generate carbon dioxide that is to be sequestered, the carbon dioxide stream shall be of a sufficient purity level to allow for safe transport and sequestration.

(5) **COST-SHARING.**—The cost-sharing requirements of section 988 of the Energy Policy Act of 2005 (42 U.S.C. 16352) for research and development projects shall apply to this section.

**(b) CARBON DIOXIDE CAPTURE TECHNOLOGY PRIZE.—****(1) DEFINITIONS.—In this subsection:**

(A) **BOARD.**—*The term “Board” means the Carbon Dioxide Capture Technology Advisory Board established by paragraph (6).*

(B) **DILUTE.**—*The term “dilute” means a concentration of less than 1 percent by volume.*

(C) **INTELLECTUAL PROPERTY.**—*The term “intellectual property” means—*

*(i) an invention that is patentable under title 35, United States Code; and*

*(ii) any patent on an invention described in clause (i).*

(D) **SECRETARY.**—*The term “Secretary” means the Secretary of Energy or designee, in consultation with the Board.*

(2) **AUTHORITY.**—*Not later than 1 year after the date of enactment of the Carbon Dioxide Capture Technology Prize Act of 2011, as part of the program carried out under this section, the Secretary shall establish and award competitive technology fi-*

financial awards for carbon dioxide capture from media in which the concentration of carbon dioxide is dilute.

(3) *DUTIES.*—In carrying out this subsection, the Secretary shall—

(A) subject to paragraph (4), develop specific requirements for—

(i) the competition process;

(ii) minimum performance standards for qualifying projects; and

(iii) monitoring and verification procedures for approved projects;

(B) establish minimum levels for the capture of carbon dioxide from a dilute medium that are required to be achieved to qualify for a financial award described in subparagraph (C); and

(C) offer financial awards for—

(i) a design for a promising capture technology;

(ii) a successful bench-scale demonstration of a capture technology;

(iii) a design for a technology described in clause (i) that will—

(I) be operated on a demonstration scale; and

(II) achieve significant reduction in the level of carbon dioxide; and

(iv) an operational capture technology on a commercial scale that meets the minimum levels described in subparagraph (B).

(4) *PUBLIC PARTICIPATION.*—In carrying out paragraph (3)(A), the Board shall—

(A) provide notice of and, for a period of at least 60 days, an opportunity for public comment on, any draft or proposed version of the requirements described in paragraph (3)(A); and

(B) take into account public comments received in developing the final version of those requirements.

(5) *PEER REVIEW.*—No financial awards may be provided under this subsection until the proposal for which the award is sought has been peer reviewed in accordance with such standards for peer review as are established by the Secretary.

(6) *CARBON DIOXIDE CAPTURE TECHNOLOGY ADVISORY BOARD.*—

(A) *ESTABLISHMENT.*—There is established an advisory board to be known as the “Carbon Dioxide Capture Technology Advisory Board”.

(B) *COMPOSITION.*—The Board shall be composed of 7 members appointed by the President that provide expertise in—

(i) climate science;

(ii) physics;

(iii) chemistry;

(iv) biology;

(v) engineering;

(vi) economics;

(vii) business management; and

(viii) such other disciplines as the Secretary determines to be necessary to achieve the purposes of this subsection.

(C) *INITIAL MEETING.*—Not later than 30 days after the date on which all members of the Board have been appointed, the Board shall hold the initial meeting of the Board.

(D) *MEETINGS.*—The Board shall meet at the call of the Chairperson.

(E) *QUORUM.*—A majority of the members of the Board shall constitute a quorum, but a lesser number of members may hold hearings.

(F) *CHAIRPERSON AND VICE CHAIRPERSON.*—The Board shall select a Chairperson and Vice Chairperson from among the members of the Board.

(G) *DUTIES.*—The Board shall advise the Secretary on carrying out the duties of the Secretary under this subsection.

(7) *INTELLECTUAL PROPERTY.*—

(A) *IN GENERAL.*—As a condition of receiving a financial award under this subsection, an applicant shall agree to vest the intellectual property of the applicant derived from the technology in 1 or more entities that are incorporated in the United States.

(B) *RESERVATION OF LICENSE.*—The United States—

(i) may reserve a nonexclusive, nontransferable, irrevocable, paid-up license, to have practiced for or on behalf of the United States, in connection with any intellectual property described in subparagraph (A); but

(ii) shall not, in the exercise of a license reserved under clause (i), publicly disclose proprietary information relating to the license.

(C) *TRANSFER OF TITLE.*—Title to any intellectual property described in subparagraph (A) shall not be transferred or passed, except to an entity that is incorporated in the United States, until the expiration of the first patent obtained in connection with the intellectual property.

(8) *TERMINATION OF AUTHORITY.*—The Board and all authority provided under this subsection shall terminate on the date that is 5 years after the date of enactment of the Carbon Dioxide Capture Technology Prize Act of 2011.

**[(b)] (c) AUTHORIZATION OF APPROPRIATIONS.**—**[There is]**

(1) *IN GENERAL.*—There is authorized to be appropriated to the Secretary to carry out **[this section]** subsection (a) \$200,000,000 per year for fiscal years 2009 through **[2013]** 2011 and \$195,000,000 for each of fiscal years 2012 and 2013.

(2) *CARBON DIOXIDE CAPTURE TECHNOLOGY PRIZE.*—There is authorized to be appropriated to the Secretary to carry out subsection (b) \$10,000,000 for the period of fiscal years 2012 through 2016.