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DEPARTMENT OF ENERGY CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 2007

AUGUST 3, 2007.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. GORDON of Tennessee, from the Committee on Science and Technology, submitted the following

R E P O R T

together with

ADDITIONAL VIEWS

[To accompany H.R. 1933]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred the bill (H.R. 1933) to amend the Energy Policy Act of 2005 to reauthorize and improve the carbon capture and storage research, development, and demonstration program of the Department of Energy, and for other purposes, having considered the same, report favorably thereon with an amendment and recommend that the bill as amended do pass.

CONTENTS

		Page
I.	Amendment	2
II.	Purpose of the Bill	6
III.	Background and Need for the Legislation	6
IV.	Hearing Summary	7
V.	Committee Actions	9
VI.	Summary of Major Provisions of the Bill, as Reported	11
VII.	Section-by-Section Analysis (by Title and Section), as Reported	12
VIII.	Committee Views	14
IX.	Additional Views	18
X.	Cost Estimate	20
XI.	Congressional Budget Office Cost Estimate	20

59–006

XII. Compliance with Public Law 104–4 22
XIII. Committee Oversight Findings and Recommendations 22
XIV. Statement on General Performance Goals and Objectives 22
XV. Constitutional Authority Statement 22
XVI. Federal Advisory Committee Statement 23
XVII. Congressional Accountability Act 23
XVIII. Earmark Identification 23
XIX. Statement on Preemption of State, Local, or Tribal Law 23
XX. Changes in Existing Law Made by the Bill, as Reported 23
XXI. Committee Recommendations 28
XXII. Proceedings of the Subcommittee Markup 29
XXIII. Proceedings of the Full Committee Markup 59

I. AMENDMENT

The amendment is as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the "Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007".

SEC. 2. CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAM.

(a) AMENDMENTS.—Section 963 of the Energy Policy Act of 2005 (42 U.S.C. 16293) is amended—

(1) in the section heading, by striking "**RESEARCH AND DEVELOPMENT**" and inserting "**AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION**";

(2) in subsection (a)—

(A) by striking "research and development" and inserting "and storage research, development, and demonstration"; and

(B) by striking "capture technologies on combustion-based systems" and inserting "capture and storage technologies related to electric power generating systems";

(3) in subsection (b)—

(A) in paragraph (3), by striking "and" at the end;

(B) in paragraph (4), by striking the period at the end and inserting "; and"; and

(C) by adding at the end the following:

"(5) to expedite and carry out large-scale testing of carbon sequestration systems in a range of geological formations that will provide information on the cost and feasibility of deployment of sequestration technologies."; and

(4) by striking subsection (c) and inserting the following:

"(c) PROGRAMMATIC ACTIVITIES.—

"(1) FUNDAMENTAL SCIENCE AND ENGINEERING RESEARCH AND DEVELOPMENT AND DEMONSTRATION SUPPORTING CARBON CAPTURE AND STORAGE TECHNOLOGIES.—

"(A) IN GENERAL.—The Secretary shall carry out fundamental science and engineering research (including laboratory-scale experiments, numeric modeling, and simulations) to develop and document the performance of new approaches to capture and store carbon dioxide, or to learn how to use carbon dioxide in products to lead to an overall reduction of carbon dioxide emissions.

"(B) PROGRAM INTEGRATION.—The Secretary shall ensure that fundamental research carried out under this paragraph is appropriately applied to energy technology development activities and the field testing of carbon sequestration and carbon use activities, including—

"(i) development of new or advanced technologies for the capture of carbon dioxide;

"(ii) development of new or advanced technologies that reduce the cost and increase the efficacy of the compression of carbon dioxide required for the storage of carbon dioxide;

"(iii) modeling and simulation of geological sequestration field demonstrations;

"(iv) quantitative assessment of risks relating to specific field sites for testing of sequestration technologies; and

"(v) research and development of new and advanced technologies for carbon use, including recycling and reuse of carbon dioxide.

"(2) FIELD VALIDATION TESTING ACTIVITIES.—

"(A) IN GENERAL.—The Secretary shall promote, to the maximum extent practicable, regional carbon sequestration partnerships to conduct geologic sequestration tests involving carbon dioxide injection and monitoring, mitigation, and verification operations in a variety of candidate geological settings, including—

"(i) operating oil and gas fields;

"(ii) depleted oil and gas fields;

"(iii) unmineable coal seams;

"(iv) deep saline formations;

"(v) deep geologic systems that may be used as engineered reservoirs to extract economical quantities of heat from geothermal resources of low permeability or porosity;

"(vi) deep geologic systems containing basalt formations; and

"(vii) high altitude terrain oil and gas fields.

"(B) OBJECTIVES.—The objectives of tests conducted under this paragraph shall be—

"(i) to develop and validate geophysical tools, analysis, and modeling to monitor, predict, and verify carbon dioxide containment;

"(ii) to validate modeling of geological formations;

"(iii) to refine storage capacity estimated for particular geological formations;

"(iv) to determine the fate of carbon dioxide concurrent with and following injection into geological formations;

"(v) to develop and implement best practices for operations relating to, and monitoring of, injection and storage of carbon dioxide in geologic formations;

"(vi) to assess and ensure the safety of operations related to geological storage of carbon dioxide;

"(vii) to allow the Secretary to promulgate policies, procedures, requirements, and guidance to ensure that the objectives of this subparagraph are met in large-scale testing and deployment activities for carbon capture and storage that are funded by the Department of Energy; and

"(viii) to support Environmental Protection Agency efforts, in consultation with other agencies, to develop a scientifically sound regulatory framework to enable commercial-scale sequestration operations while safeguarding human health and underground sources of drinking water.

"(3) LARGE-SCALE CARBON DIOXIDE SEQUESTRATION TESTING.—

"(A) IN GENERAL.—The Secretary shall conduct not less than 7 initial large-volume sequestration tests, not including the FutureGen project, for geological containment of carbon dioxide (at least 1 of which shall be international in scope) to validate information on the cost and feasibility of commercial deployment of technologies for geological containment of carbon dioxide.

"(B) DIVERSITY OF FORMATIONS TO BE STUDIED.—In selecting formations for study under this paragraph, the Secretary shall consider a variety of geological formations across the United States, and require characterization and modeling of candidate formations, as determined by the Secretary.

"(C) SOURCE OF CARBON DIOXIDE FOR LARGE-SCALE SEQUESTRATION DEMONSTRATIONS.—In the process of any acquisition of carbon dioxide for sequestration demonstrations under subparagraph (A), the Secretary shall give preference to purchases of carbon dioxide from industrial and coal-fired electric generation facilities. To the extent feasible, the Secretary shall prefer test projects from industrial and coal-fired electric generation facilities that would facilitate the creation of an integrated system of capture, transportation and storage of carbon dioxide. Until coal-fired electric generation facilities, either new or existing, are operating with carbon dioxide capture technologies, other industrial sources of carbon dioxide should be pursued under this paragraph. The preference provided for under this subparagraph shall not delay the implementation of the large-scale sequestration tests under this paragraph.

"(D) DEFINITION.—For purposes of this paragraph, the term 'large-scale' means the injection of more than 1,000,000 metric tons of carbon dioxide annually, or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability continuously to inject quantities on the order of several million metric tons of industrial carbon dioxide annually for a large number of years.

"(4) LARGE-SCALE DEMONSTRATION OF CARBON DIOXIDE CAPTURE TECHNOLOGIES.—

"(A) IN GENERAL.—The Secretary shall carry out at least 3 and no more than 5 demonstrations, that include each of the technologies described in subparagraph (B), for the large-scale capture of carbon dioxide from industrial sources of carbon dioxide, at least 2 of which are facilities that generate electric energy from fossil fuels. Candidate facilities for other demonstrations under this paragraph shall include facilities that refine petroleum, manufacture iron or steel, manufacture cement or cement clinker, manufacture commodity chemicals, and ethanol and fertilizer plants. Consideration may be given to capture of carbon dioxide from industrial facilities and electric generation carbon sources that are near suitable geological reservoirs and could continue sequestration. To ensure reduced carbon dioxide emissions, the Secretary shall take necessary actions to provide for the integration of the program under this paragraph with the long-term carbon dioxide sequestration demonstrations described in paragraph (3). These actions should not delay implementation of the large-scale sequestration tests authorized in paragraph (3).

"(B) TECHNOLOGIES.—The technologies referred to in subparagraph (A) are precombustion capture, post-combustion capture, and oxycombustion.

"(C) SCOPE OF AWARD.—An award under this paragraph shall be only for the portion of the project that carries out the large-scale capture (including purification and compression) of carbon dioxide, as well as the cost of transportation and injection of carbon dioxide.

"(5) PREFERENCE IN PROJECT SELECTION FROM MERITORIOUS PROPOSALS.—In making competitive awards under this subsection, subject to the requirements of section 989, the Secretary shall give preference to proposals from partnerships among industrial, academic, and government entities.

"(6) COST SHARING.—Activities under this subsection shall be considered research and development activities that are subject to the cost-sharing requirements of section 988(b), except that the Federal share of a project under paragraph (4) shall not exceed 50 percent.

"(d) AUTHORIZATION OF APPROPRIATIONS.—

"(1) IN GENERAL.—There are authorized to be appropriated to the Secretary for carrying out this section, other than subsection (c)(3) and (4)—

"(A) $100,000,000 for fiscal year 2008;

"(B) $100,000,000 for fiscal year 2009;

"(C) $100,000,000 for fiscal year 2010; and

"(D) $100,000,000 for fiscal year 2011.

"(2) SEQUESTRATION.—There are authorized to be appropriated to the Secretary for carrying out subsection (c)(3)—

"(A) $140,000,000 for fiscal year 2008;

"(B) $140,000,000 for fiscal year 2009;

"(C) $140,000,000 for fiscal year 2010; and

"(D) $140,000,000 for fiscal year 2011.

"(3) CARBON CAPTURE.—There are authorized to be appropriated to the Secretary for carrying out subsection (c)(4)—

"(A) $180,000,000 for fiscal year 2009;

"(B) $180,000,000 for fiscal year 2010;

"(C) $180,000,000 for fiscal year 2011; and

"(D) $180,000,000 for fiscal year 2012.".

(b) TABLE OF CONTENTS AMENDMENT.—The item relating to section 963 in the table of contents for the Energy Policy Act of 2005 is amended to read as follows:

"Sec. 963. Carbon capture and storage research, development, and demonstration program.".

SEC. 3. REVIEW OF LARGE-SCALE PROGRAMS.

The Secretary of Energy shall enter into an arrangement with the National Academy of Sciences for an independent review and oversight, beginning in 2011, of the programs under section 963(c)(3) and (4) of the Energy Policy Act of 2005, as added by section 2 of this Act, to ensure that the benefits of such programs are maximized. Not later than January 1, 2012, the Secretary shall transmit to the Congress a report on the results of such review and oversight.

SEC. 4. SAFETY RESEARCH.

(a) PROGRAM.—The Assistant Administrator for Research and Development of the Environmental Protection Agency shall conduct a research program to determine procedures necessary to protect public health, safety, and the environment from impacts that may be associated with capture, injection, and sequestration of greenhouse gases in subterranean reservoirs.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated for carrying out this section $5,000,000 for each fiscal year.

SEC. 5. GEOLOGICAL SEQUESTRATION TRAINING AND RESEARCH.

(a) STUDY.—

(1) IN GENERAL.—The Secretary of Energy shall enter into an arrangement with the National Academy of Sciences to undertake a study that—

(A) defines an interdisciplinary program in geology, engineering, hydrology, environmental science, and related disciplines that will support the Nation's capability to capture and sequester carbon dioxide from anthropogenic sources;

(B) addresses undergraduate and graduate education, especially to help develop graduate level programs of research and instruction that lead to advanced degrees with emphasis on geological sequestration science;

(C) develops guidelines for proposals from colleges and universities with substantial capabilities in the required disciplines that wish to implement geological sequestration science programs that advance the Nation's capacity to address carbon management through geological sequestration science; and

(D) outlines a budget and recommendations for how much funding will be necessary to establish and carry out the grant program under subsection (b).

(2) REPORT.—Not later than 1 year after the date of enactment of this Act, the Secretary of Energy shall transmit to the Congress a copy of the results of the study provided by the National Academy of Sciences under paragraph (1).

(3) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this subsection $1,000,000 for fiscal year 2008.

(b) GRANT PROGRAM.—

(1) ESTABLISHMENT.—The Secretary of Energy, through the National Energy Technology Laboratory, shall establish a competitive grant program through which colleges and universities may apply for and receive 4-year grants for—

(A) salary and startup costs for newly designated faculty positions in an integrated geological carbon sequestration science program; and

(B) internships for graduate students in geological sequestration science.

(2) RENEWAL.—Grants under this subsection shall be renewable for up to 2 additional 3-year terms, based on performance criteria, established by the National Academy of Sciences study conducted under subsection (a), that include the number of graduates of such programs.

(3) INTERFACE WITH REGIONAL GEOLOGICAL CARBON SEQUESTRATION PARTNERSHIPS.—To the greatest extent possible, geological carbon sequestration science programs supported under this subsection shall interface with the research of the Regional Carbon Sequestration Partnerships operated by the Department of Energy to provide internships and practical training in carbon capture and geological sequestration.

(4) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this subsection such sums as may be necessary.

SEC. 6. UNIVERSITY BASED RESEARCH AND DEVELOPMENT GRANT PROGRAM.

(a) ESTABLISHMENT.—The Secretary of Energy, in consultation with other appropriate agencies, shall establish a university based research and development program to study carbon capture and sequestration using the various types of coal.

(b) GRANTS.—Under this section, the Secretary shall award 5 grants for projects submitted by colleges or universities to study carbon capture and sequestration in conjunction with the recovery of oil and other enhanced elemental and mineral recovery. Consideration shall be given to areas that have regional sources of coal for the study of carbon capture and sequestration.

(c) RURAL AND AGRICULTURAL INSTITUTIONS.—The Secretary shall designate that at least 2 of these grants shall be awarded to rural or agricultural based institutions that offer interdisciplinary programs in the area of environmental science to study carbon capture and sequestration in conjunction with the recovery of oil and other enhanced elemental and mineral recovery.

(d) AUTHORIZATION OF APPROPRIATIONS.—There are to be authorized to be appropriated $10,000,000 to carry out this section.

II. Purpose

The purpose of H.R. 1933 is to amend the Energy Policy Act of 2005 to reauthorize and improve the carbon capture and storage research, development, and demonstration program of the Department of Energy.

III. Background and Need for the Legislation

Approximately 50 percent of the electricity generated in the United States comes from coal. According to the Department of Energy's Energy Information Administration (EIA) carbon dioxide emissions in the United States and its territories were 6,008.6 million metric tons (MMT) in 2005. In the United States, most anthropogenic carbon dioxide (CO_2) is emitted as a result of the combustion of fossil fuels. In particular, the electric power sector accounts for nearly 40 percent of the manmade CO_2 emissions in the U.S, according to EIA. For the foreseeable future, the U.S. will continue to rely on coal to meet our energy demand. With that understanding, the challenge lies in balancing our environmental goals with our energy needs. The Massachusetts Institute of Technology (MIT) report The Future of Coal (2007) concludes "that CO_2 capture and sequestration is the critical enabling technology that would reduce CO_2 emissions significantly while also allowing coal to meet the world's pressing energy needs."

Crafting a Carbon Capture and Storage (CCS) strategy for the United States calls for an understanding of the technical challenges that exist with the development, demonstration and deployment of carbon dioxide capture technologies and the development of safe, effective large-scale containment of carbon dioxide. Appropriate investment in continued research is necessary to answer outstanding concerns with large-volume storage of CO_2 in underground reservoirs. The Department of Energy has produced an Atlas of the CO_2 storage capacity in the United States and Canada. This Atlas will be updated as the Department continues to conduct field injection tests. Sequestration demonstrations will help to address the outstanding safety and environmental issues associated with large underground reservoirs of carbon dioxide. Once the CO_2 is injected, do we have the capability of successfully monitoring and verifying the movement of the subsurface CO_2? The demonstrations will provide greater information about the probability of the CO_2 leaking, the ability to detect a leak, how the CO_2 would leak and how fast it would leak. Ultimately, the goal is to determine with increased certainty the measurable benefits of CCS strategies to reduce emissions of heat-trapping gases.

There is also recognition that additional federal investment in carbon dioxide capture technologies is needed to bring these technologies to full-scale deployment. The MIT Report points out that there is no operational experience with carbon capture from coal plants and notes the absence of operational experience with an integrated capture and sequestration system. The MIT report states that "the priority objective with respect to coal should be the successful large-scale demonstration of the technical, economic, and environmental performance of the technologies that make up all of the major components of a large-scale integrated CCS system—capture, transportation and storage." H.R. 1933 follows that rec-

ommendation and reauthorizes the Department of Energy's research and development and field testing programs, and specifically authorizes large-scale demonstrations of both carbon dioxide capture technologies and carbon dioxide containment.

IV. Hearing Summary

The Energy and Environment Subcommittee held a hearing on Tuesday, May 15, 2007 to hear testimony on the Prospects for Advanced Coal Technologies: Efficient Energy Production, Carbon Capture and Sequestration to gain a better understanding of the programmatic needs at the Department of Energy to address the challenge of climate change. The following five witnesses testified at the hearing:

- Mr. Carl O. Bauer, Director of the Department of Energy's National Energy Technology Laboratory, a national laboratory owned and operated by the Department of Energy. In his current position as Director of NETL, he oversees the implementation of major science and technology development programs to resolve the environmental, supply and reliability constraints of producing and using fossil resources, including advanced coal-fueled power generation, carbon sequestration, and environmental control for the existing fleet of fossil steam plants.
- Dr. Robert L. Finley, Director, Energy and Earth Resources Center for Illinois State Geological Survey with specialization in fossil energy resources. He is currently heading a regional carbon sequestration partnership in the Illinois Basin aimed at addressing concerns with geological carbon management.
- Mr. Michael Rencheck, Senior Vice President for Engineering Projects and Field Services at American Electric Power, headquartered in Columbus, Ohio. He is responsible for engineering, regional maintenance and shop service organizations, projects and construction, and new generation development.
- Mr. Stuart Dalton, Director, Generation at the Electric Power Research Institute. His current research activities cover a wide variety of generation options with special focus on emerging generation, coal-based generation, emission controls and CO_2 capture and storage. He also helped to create the EPRI *Coal Fleet for Tomorrow* program.
- Mr. Gardiner Hill, Director of Technology in Alternative Energy Technology, is responsible for BP group-wide aspects of CO_2 Capture and Storage technology development, demonstration and deployment. He also is the BP manager responsible for the BP/Ford/Princeton Carbon Mitigation Initiative at Princeton University as well as the BP manager responsible for the BP/Harvard partnership on the Energy Technology Innovation Project. He possesses 20 years of technical and managerial experience which is directly relevant to technology, business and project management.

Recognizing that coal is a critical resource for meeting our Nation's energy demand, witnesses at the hearing discussed strategies for managing carbon dioxide emissions. The challenges include advancing technologies that help gain combustion efficiencies from electric generating coal plants and demonstrating both carbon dioxide capture and sequestration technologies. Specifically, witnesses emphasized the need to demonstrate large-scale injection and stor-

age of CO_2 in underground geologic formations in order to monitor and verify the fate of the CO_2.

Such large-scale storage demonstrations would provide an understanding of the risks associated with sequestering large volumes of CO_2 and offer solutions to mitigate those risks.

Available carbon capture and sequestration technologies are currently too expensive for commercial use. Mr. Stu Dalton, Director of Generation at the Electric Power Research Institute (EPRI), testified that using today's capture, compression, transportation, and storage technologies would increase pulverized coal plant costs by 40–60 percent and Integrated Gasification Combined Cycle (IGCC) plant costs would increase by 40–50 percent. Mr. Carl Bauer explained the Department of Energy is working to address these added operational costs by developing CCS technology that can capture and store at least 90 percent of the potential CO_2 emissions from coal-fired power plants with less than a 10 percent increase in the cost of electricity. Accomplishing this goal requires the Department to develop cost-effective technology options by leveraging basic and applied research with field verification.

According to the Carbon Sequestration Atlas of the United States and Canada, Dr. Finley explained there is roughly 3,500 billion tons of storage capacity. Moreover, industry already has gained experience injecting carbon dioxide underground through Enhanced Oil Recovery (EOR). While the geologic capacity and injection techniques exist, the Nation has not assessed short-term and long-term risks of CO_2 storage in geologic reservoirs, such as leakage. According to the witnesses, the main challenges to CCS—showing CO_2 can be captured and stored in underground geologic formations with long-term stability, developing CO_2 monitoring capabilities, and gaining public and regulatory acceptance—can be addressed through large-scale demonstration projects.

Demonstration is the best method for successfully commercializing capture technology as well. Capturing carbon dioxide for sequestration is currently a very energy intensive and costly process. Witnesses explained CO_2 capture and compression could require 20–30 percent of the overall energy of the plant. They also noted that for oxyfuel combustion and IGCC plants, making the oxygen or separating the nitrogen and the oxygen from air for partial combustion is one of the biggest cost drivers or inefficiencies.

Witnesses also urged the Committee to integrate carbon capture with storage. They suggested operating and studying large-scale capture, transport and storage together will increase efficiency and operability.

Just as integrated carbon capture and sequestration systems reduce carbon dioxide emissions, employing cost-effective efficient technologies and practices can dramatically reduce energy use and consequent CO_2 emissions. Mr. Stu Dalton estimates that over the next 20 years, improvements in power plant efficiency can achieve CO_2 reductions of up to 20 percent per megawatt-hour without additional CO_2 capture.

Finally, during the hearing, witnesses emphasized that for the foreseeable future, coal will continue to be used to meet our energy needs. Therefore, if the Nation is going to reduce carbon dioxide emissions, it is essential that we develop techniques to safely capture and sequester carbon as a byproduct of coal combustion. H.R.

1933, the Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007 introduced by Mark Udall (D–CO), is based on the recommendations in the MIT report *The Future of Coal* and authorizes research and development and demonstration programs to set a path that mitigates carbon dioxide emissions with continued use of coal as an energy resource.

V. Committee Actions

The Subcommittee on Energy and Environment met to consider H.R. 1933 on June 21, 2007 and consider the following two amendments to the bill:

1. Mr. Udall offered a Manager's amendment which made a number of technical and substantive changes to H.R. 1933. The amendment adds a new section to the bill authorizing three, but no more than five, demonstrations of carbon dioxide capture technologies. It further includes an authorization for funding these carbon dioxide capture demonstrations at $180 million per year for 4 years starting in Fiscal Year 2009. It increases the funding level for the large-scale carbon dioxide sequestration demonstrations to $140 million per year for four years beginning in Fiscal Year 2008. The amendment defines the large-scale demonstrations of carbon dioxide sequestration as one million tons of carbon dioxide annually or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability to continuously inject large quantities of carbon dioxide for a number of years. The amendment encourages the integration of the storage demonstrations with the capture technology demonstrations. This is intended to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale. The amendment includes an authorization for the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized. The amendment also authorizes the Assistant Administrator of the Office of Research and Development of EPA to conduct a research program to determine what procedures may be necessary to protect public health, safety and the environment from impacts that may be associated with sequestration of greenhouse gases. Finally, the amendment includes an authorization of appropriation for Fiscal Years 2008, 2009, 2010 and 2011 to fund the Department of Energy's fundamental R&D at the laboratory scale to allow for continued examination of new approaches on carbon dioxide capture and sequestration. The amendment was adopted by voice vote.

2. Mr. Costello offered an amendment which authorizes a study by the National Academy of Sciences to define an interdisciplinary program to train a workforce to support development and deployment of carbon capture and sequestration. The study will define curricula for undergraduate and graduate programs that would lead to degrees in geological sequestration science. The amendment also establishes a competitive grant program through which institutions of higher education can apply for four-year grants to support start-up costs for integrated geological carbon sequestration programs as well as internships for graduate students in geological sequestration science. The amendment was adopted by voice vote.

The bill was approved for final passage by voice vote. Ms. Woolsey moved that the Subcommittee favorably report the bill H.R. 1933, as amended, to the full Committee on Science and Technology. The motion was agree to by voice vote.

On Wednesday, June 27, 2007 the full Committee on Science and Technology met to consider H.R. 1933 and the following amendments to the bill:

1. Mr. Udall offered a Manager's amendment that added a provision to the Carbon Dioxide Capture Demonstration section of the bill to authorize the Secretary of Energy to take actions needed to further integrate the carbon dioxide capture demonstrations with the Department of Energy's large-scale carbon dioxide sequestration program. This provision is intended to build on testimony from the May 15, 2007 hearing and the MIT Report to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale. The amendment also made a number of technical changes to H.R. 1933 and clarified the funding levels for the programs authorized in the bill without changing the authorized funding levels. Specifically, the amendment included a separate authorization of appropriations for the basic Research and Development and field testing programs at $100 million for each of fiscal years 2008–2011, thus clarifying that the carbon dioxide sequestration testing program is funded at $140 million for each of fiscal years 2008–2011. The amendment was adopted by voice vote.

2. Mr. Matheson offered an amendment to include high altitude terrain oil and gas fields to the Department of Energy's geologic sequestration field validation testing activities which include carbon dioxide injection and monitoring, mitigation and verification operations for a range of settings. The amendment was adopted by voice vote.

3. Mr. Ross offered an amendment to add a new section to the bill creating a university research and development program aimed at studying carbon dioxide capture and sequestration using all different coal types in conjunction with enhanced oil and mineral recovery. Five grant projects are authorized with at least two of the grants being awarded to rural and/or agricultural based institutions that offer interdisciplinary programs in the area of environmental science to study carbon capture and sequestration in conjunction with the enhanced recovery of oil and other elemental and mineral recovery. The amendment authorized $10,000,000 to carry out this university grant program. The amendment was adopted by voice vote.

4. Ms. Johnson offered an amendment to require that two of the three carbon dioxide capture demonstrations authorized occur at fossil fuel electric generation plants. The amendment was adopted by voice vote.

5. Mr. McCaul offered an amendment to make coal-to-liquid facilities eligible for participation in both the carbon dioxide capture demonstrations and the large-scale carbon dioxide sequestration program. The amendment was defeated by recorded vote of 15–22.

The bill was approved for final passage by voice vote. Ms. Johnson moved that the Committee favorably report the bill H.R. 1933, as amended, to the House for consideration. The motion was agreed to by voice vote.

VI. Summary of Major Provisions of the Bill, as Reported

H.R. 1933 provides federal support for the Department of Energy to demonstrate large-volume sequestration tests for geological containment of carbon dioxide and carry out at least three demonstrations of large-scale CO_2 capture technologies. The bill defines large-scale sequestration demonstration as the injection of more than 1,000,000 metric tons of carbon dioxide annually. The bill requires that two of the carbon dioxide capture demonstrations are conducted at facilities that generate electric energy from fossil fuels. The bill will provide for the testing of a variety of geological settings for carbon dioxide storage and it will accelerate the demonstration of the three main categories of carbon dioxide capture technologies bringing them closer to commercial application. H.R. 1933 aims to integrate the carbon dioxide capture with the large-scale storage demonstration in order to gain the operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale.

The bill authorizes $100,000,000 for each of fiscal years 2008–2011 for the Department of Energy's basic research and development and field testing programs. $140,000,000 is authorized each of fiscal years 2008–2011 for the large-scale carbon dioxide sequestration demonstration program to conduct research on the fate of large volumes of CO_2 stored in underground geologic formations. And, $180,000,000 is authorized each of fiscal years 2009–2012 to carry out the carbon dioxide capture demonstration program.

In addition, the bill provides for the Environmental Protection Agency (EPA) to conduct a research program to determine what procedures may be necessary to protect public health, safety and the environment with regard to the long-term storage of carbon dioxide in geological reservoirs. The EPA research program is authorized at $5,000,000 for each of the fiscal years from 2009–2012. Also, the bill authorizes the National Academy of Sciences to conduct an independent review and oversight of the carbon dioxide injection program to ensure its benefits are maximized. The bill also authorizes the National Academy of Sciences (NAS) to undertake a study defining an interdisciplinary program to train a workforce to support the development and deployment of carbon capture and sequestration systems. For fiscal year 2008, $1,000,000 is authorized to carry out this NAS study.

The bill establishes a competitive grant program for institutions of higher learning to provide start up costs for integrated geological carbon sequestration programs and implement internships for graduate students in geological sequestration science. The bill also establishes a Department of Energy university grant program designed to study carbon dioxide capture and sequestration using a variety of coal types. Specifically, five grants are to be awarded to conduct the research on CO_2 capture and sequestration in conjunction with the recovery of oil and other enhanced elemental and mineral recovery. At least two of the grants shall be awarded to rural or agricultural based institutions that offer interdisciplinary programs in the area of environmental science which explore carbon capture and sequestration combined with oil and mineral recovery. The bill authorizes $10,000,000 for this program.

VII. Section-by-Section Analysis

Section 1. Short title

"Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007."

Section 2. Carbon capture and storage research, development, and demonstration program

Directs the Secretary of Energy to carry out fundamental science and engineering research to develop and document the performance of new approaches to capture and store carbon dioxide, or use carbon dioxide in products that lead to an overall reduction of carbon dioxide emissions. The fundamental research shall be applied to energy technology development activities and the field testing of carbon sequestration activities.

Requires the Secretary to promote regional carbon sequestration partnerships to conduct geologic sequestration field testing involving carbon dioxide injection and monitoring practices, mitigation, and verification operations in a variety of geologic settings including operating oil and gas fields, depleted oil and gas fields, unmineable coal seams, saline formations, deep geologic systems used to extract heat from geothermal resources, and high altitude terrain oil and gas fields.

The field tests are aimed at advancing and validating geophysical tools and analysis and modeling used to monitor, predict, and verify carbon dioxide containment. The Secretary is authorized to promulgate policies, procedures, requirements and guidance to ensure that the objectives of the field testing are met in large-scale testing and deployment activities for carbon capture and storage funded by the Department.

In addition, the bill authorizes seven large-volume sequestration tests for geologic containment of carbon dioxide. The Secretary shall select meritorious proposals on a competitive basis giving preference to proposals from partnerships among industrial, academic, and government entities. The Secretary shall consider a variety of geological formations across the United States and require characterization and modeling of candidate formations, as determined by the Secretary. The bill integrates the storage demonstrations with the demonstration of carbon dioxide capture technologies by giving preference to carbon dioxide captured from coal-fired electric generating plants and other industrial CO_2 sources to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale. This preference shall not delay the implementation of the large-scale sequestration tests. H.R. 1933 defines large-scale injection of carbon dioxide as one million tons of carbon dioxide annually or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability to continuously inject large quantities of carbon dioxide for a number of years. The large-scale carbon dioxide sequestration demonstrations shall be considered research and development and meet the cost-sharing requirements of Section 988(b) of the Energy Policy Act of 2005—the Secretary shall require not less than 20 percent of the cost of a research or development activity to be provided by a non-Federal source.

The bill directs the Secretary to carry out three, but no more than five, demonstrations of carbon dioxide capture technologies—two of these demonstrations shall be conducted at facilities that generate electric energy from fossil fuels. These demonstrations must include the three main approaches to carbon dioxide capture: pre-combustion, post-combustion and oxycombustion. Any award under this carbon dioxide capture demonstration program is available only for the portion of the project that carries out the large-scale capture (including purification and compression) of carbon dioxide, as well as the cost of transportation and injection of carbon dioxide. The Secretary is required to take necessary actions to provide for the integration of the carbon dioxide captured during the demonstrations with the long-term carbon dioxide sequestration tests. These actions should not delay the implementation of the large-scale sequestration projects. The carbon dioxide capture demonstrations shall meet the cost-share requirements of Section 988(c) of the Energy Policy Act of 2005 or the Secretary shall require that not less than 50 percent of the cost of the demonstration be provided by a non-Federal source.

This section authorizes appropriations of $100,000,000 for each of the fiscal years 2008 through 2011 for research and development and field testing.

This section authorizes appropriations of $140,000,000 for each of fiscal years 2008 through 2011 for carrying out research on large-scale carbon dioxide sequestration demonstrations.

This section authorizes appropriations of $180,000,000 for each of the fiscal years 2009 through 2012 for the demonstrations of carbon dioxide capture technologies.

Section 3. Review of large-scale programs

Authorizes the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized. Not later than January 1, 2012, the Secretary is directed to transmit to the Congress a report on the results of such review and oversight.

Section 4. Safety research

Section 4 authorizes the Assistant Administrator for Research and Development of the Environmental Protection Agency to conduct a research program to determine the procedures that may be necessary to protect public health, safety, and the environment from potential impacts associated with capture, injection, and sequestration of greenhouse gases in subterranean reservoirs. Authorizes $5,000,000 for each fiscal year to carry out this research program.

Section 5. Geological sequestration training and research

Directs the Secretary of Energy to enter into an arrangement with the National Academy of Sciences to undertake a study that defines an interdisciplinary program to train a workforce to support the nation's capability to capture and sequester carbon dioxide from anthropogenic sources, and develops curricula for undergraduate and graduate studies that lead to degrees in geological sequestration science. The study will establish guidelines for universities wishing to implement geological sequestration science pro-

grams and make recommendations on the budget needed to implement the grant program also authorized in this section. The Secretary is directed to submit a report to Congress providing the results of the National Academy of Sciences study.

Authorizes $1,000,000 for fiscal year 2008 to carry out this section.

Authorizes the Secretary of Energy, through the National Energy Technology Laboratory, to establish a competitive grant program through which institutions of higher education can apply for four-year grants to support salary and startup costs for newly designated faculty positions in an integrated geological carbon sequestration science program and internships for graduate students in geological sequestration science. The grants are renewable for up to two additional three-year terms and encouraged to interface with the research of the Regional Carbon Sequestration Partnerships operated by the Department of Energy to provide internships and practical training in carbon capture and geological sequestration. Authorizes such sums as necessary to carry out the grant program.

Section 6. University based Research and Development grant program

Requires the Secretary of the Department of Energy to establish a university Research and Development program aimed at studying carbon dioxide capture and sequestration using all different coal types in conjunction with enhanced oil and mineral recovery. Five grant projects are authorized with at least two of the grants being awarded to rural and/or agricultural based institutions that offer interdisciplinary programs in the area of environmental science to study carbon capture and sequestration in conjunction with the enhance recovery of oil and other elemental and mineral recovery. The bill authorizes $10,000,000 to carry out this university grant program.

VIII. Committee Views

It is the view of the Committee that the research, development, testing and demonstration of carbon dioxide capture and sequestration technologies should be accelerated if we are going to implement policies to reduce our greenhouse gas emissions and mitigate global warming. The United States has an abundant supply of coal and it provides usable energy at a cost much less than energy from oil and natural gas. Given the abundance and low cost of coal, it is expected that coal will continue to be used to meet our nation's energy needs for the foreseeable future. Unfortunately, coal-fired power plants also contribute significantly to anthropogenic carbon dioxide emissions. Balancing our energy needs with our environmental goals will require continued federal investment to address the technical challenges associated with strategies aimed to stabilize and reduce greenhouse gas emissions.

The Committee believes the deployment of CCS (carbon capture and storage) technologies on a large-scale is a desirable path forward to mitigate CO_2 emissions, and that research and development programs should be accelerated to achieve this goal. H.R. 1933 extends and better defines the research and development and field verification testing that must be conducted to help ensure

large-scale CCS strategies can be performed in a manner which protects human health and safety and the environment.

The Committee recognizes we have been using injection technologies for years for enhanced oil and gas recovery. However, the risks associated with enhanced oil recovery and permanent sequestration of power plant and industrial CO_2 may be different. Conducting large-scale tests of carbon dioxide sequestration and monitoring will help us to better understand the behavior of the CO_2—will it stay put and if not, how will it leak and how fast will it leak. It is the Committee's view that large-volume sequestration tests will help to develop and demonstrate practices for site selection, operation, monitoring, and closure of large sequestration facilities. The seven regional large-scale sequestration demonstrations in a variety of geologic reservoirs are aimed to determine the capability of this CO_2 mitigation strategy.

Section 2 of the bill aims to integrate the carbon dioxide capture demonstrations with the large-scale carbon dioxide sequestration program. The large-scale sequestration projects are defined as "the injection of more than 1,000,000 metric tons of carbon dioxide annually, or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability to continuously inject quantities on the order of several million metric tons of industrial carbon dioxide annually for a large number of years". The Department of Energy is considering a range of sources for the CO_2 including coal-fired power plants, natural gas processing facilities, refineries, ethanol plants and natural CO_2 deposits. The Committee believes the carbon dioxide captured during the technology demonstrations should be used in the large-scale sequestration projects. This is much preferred to a CO_2 capture demonstration program that tests the capture technologies but ultimately releases the carbon dioxide back into the atmosphere. The Secretary of Energy is directed to give preference to procurement of carbon dioxide from industrial sources and particularly coal-fired electric generation facilities because they are the largest emitters of CO_2. The carbon dioxide capture demonstrations are authorized to begin in fiscal year 2009 and the sequestration program is authorized to begin in 2008. The Department of Energy is already taking steps to move forward with large-scale containment of CO_2 and anticipates operating integrated large-scale injection and capture projects in later years. Additional funding for demonstrating the three main categories of capture technologies (pre-combustion, post-combustion and oxyfuel-combustion) is intended to accelerate the commercialization of the most promising technologies. Again, it is the Committee's view that the capture and sequestration demonstration programs should be integrated as rapidly as possible to gain the best operational experience of CCS technologies.

The funding levels for the research, development and demonstration of CCS technologies are based upon information in the MIT report, *The Future of Coal.* CCS technologies offer great promise in the effort to stabilize greenhouse gas emissions. The Intergovernmental Panel on Climate Change estimates that CCS could contribute up to 55 percent of the atmospheric greenhouse gas concentration mitigation effort worldwide. The Committee believes these funding levels are an essential public investment if we are to approach this goal.

It is the Committee's view that the Environmental Protection Agency should undertake research to facilitate the development of necessary procedures and regulations to protect public health, safety, and the environment from impacts that may be associated with capture, injection, and sequestration of large volumes of greenhouse gases in subterranean reservoirs. EPA has authority to regulate underground injection of carbon dioxide for the purposes of geologic sequestration under the Safe Drinking Water Act (42 U.S.C. 300h et seq.). The Act requires that underground injection does not endanger drinking water sources.

The Agency issued a final guidance in March 2007 on using the Class V experimental technology well classification for pilot geologic sequestration projects (UIC Program Guidance UICPG #83). This guidance was prepared jointly by the Office of Water and the Office of Air and Radiation, and these offices have taken the lead within the Agency on efforts related to carbon dioxide sequestration. The Committee recognizes the key role the Office of Research and Development plays in support of these regulatory program offices. The Committee believes the Administrator of the Office of Research and Development should work in consultation with the regulatory offices to provide information to support development of any monitoring or additional regulations that may be needed to ensure that carbon dioxide sequestration proceeds in a manner that is protective of the environment and public health. The Committee does not anticipate or intend that any research conducted by EPA will slow down the progress of research to determine the feasibility of underground injection of large volumes of CO_2.

It is the Committee's view that the National Academy of Sciences is the appropriate entity to undertake a study that would define an interdisciplinary program in geology, engineering, hydrology, environmental science and other related disciplines that would support the nation's capability to capture and sequester carbon dioxide from anthropogenic sources. A Department of Energy competitive grant program designed to help cover the salary and startup costs for colleges and universities implementing integrated geological carbon sequestration science programs would help to ensure we have the properly trained workforce to continue to advance CCS technologies. Both the NAS study and the Department of Energy grant program would build off the NAS report: *Rising Above the Gathering Storm.* This report describes a need for greater federal investment in research to create new industries and enhance old ones. The report highlights the need to invest in energy research, development and demonstration to identify better technologies for improving energy efficiency. It also recommends research designed to establish ways to use our abundant coal resources in a manner that does not result in negative impacts on regional air quality as a good investment of public resources. Section 5 of H.R. 1933 adopts these recommendations.

The Committee also sees the benefits in establishing a second university-based research and development grant program to study carbon capture and sequestration in conjunction with the recovery of oil and other enhanced elemental and mineral recovery. Regions of the country have indigenous untapped natural resources such as bromine that could be used commercially with additional research. Bromine is used in making fumigants, flame-proofing agents, water

purification compounds, dyes, medicines, and sanitizers. Additional research conducted in strategic regions of the country, could yield other commercial applications for untapped natural resources.

IX. Additional Views on H.R. 1933

ADDITIONAL VIEWS OF REPRESENTATIVES RALPH M. HALL, F. JAMES SENSENBRENNER, JR., MICHAEL T. McCAUL, PHIL GINGREY, TODD AKIN, TOM FEENEY, BOB INGLIS, RANDY NEUGEBAUER AND ADRIAN SMITH

Representative McCaul (TX) offered an amendment to H.R. 1933 to improve the legislation by adding coal-to-liquids (CTL) facilities to the list of industrial and electric generation coal facilities that are eligible sources of carbon dioxide for the large-scale sequestration demonstrations in the bill. A recorded vote on this amendment revealed the support of most Members of the minority for technology supporting transforming coal-to-liquid. The amendment was voted down by the majority.

The German discovered Fischer-Tropsch (FT) process for converting coal into manufactured liquid hydrocarbon fuels was discovered by Franz Fischer and Hans Tropsch in 1923. Today the technologies required to produce large-scale supplies of clean liquid fuels from coal are no longer in the exploratory phase in laboratories. These technologies are in use around the world today. South Africa relies on coal liquefaction to provide a substantial amount of transportation fuel. China, India, Indonesia and the Philippines have all made substantial investments in coal liquefaction plants.

While there are no current coal-to-liquid facilities in the United States at the time, according to the U.S. Department of Energy, companies, local governments and American Indian tribes have announced plans to build the nation's first 16 coal-to-liquids plants. A recent study by Princeton University's Environmental Institute estimates that fuel-cycle greenhouse gas emissions of gasified coal are 47 pounds of CO_2 per gallon, compared to 26 pounds per gallon for crude oil-derived hydrocarbon fuel, making these facilities a potentially large source of carbon dioxide for the large-scale sequestration demonstrations.

I would like to point out that when carbon capture-and-sequestering technology is added, fuel-cycle emissions of coal-based oil could be cut almost in half. Thus, the net emissions from CTL fuel produced at a refinery with carbon-capture technology would be just 8 percent more than the emissions from petroleum diesel, the Princeton researchers found. It makes sense that if we're going to build these plants that we should ensure that the CO_2 emitted from them will be able to be put to good use by furthering our understanding of the fate of carbon dioxide as it is sequestered.

I urge my colleagues to consider the value of this technology as we move the United States away from dependence on foreign sources of energy.

RALPH M. HALL.
TODD AKIN.
MICHAEL T. MCCAUL.
RANDY NEUGEBAUER.
TOM FEENEY.
JIM SENSENBRENNER.
PHIL GINGREY.
BOB INGLIS.
ADRIAN SMITH.

X. Cost Estimate

A cost estimate and comparison prepared by the Director of the Congressional Budget Office under section 402 of the Congressional Budget Act of 1974 has been timely submitted to the Committee on Science and Technology prior to the filing of this report and is included in Section XI of this report pursuant to House Rule XIII, clause 3(c)(3).

H.R. 1933 does not contain new budget authority, credit authority, or changes in revenues or tax expenditures. Assuming that the sums authorized under the bill are appropriated, H.R. 1933 does authorize additional discretionary spending, as described in the Congressional Budget Office report on the bill, which is contained in Section X of this report.

XI. Congressional Budget Office Cost Estimate

H.R. 1933—Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007

Summary: H.R. 1933 would authorize appropriations primarily to expand the Department of Energy's (DOE's) carbon sequestration development program. Carbon sequestration refers to methods of storing carbon emissions that result from the use of fossil fuels. Activities under the bill would include demonstration and grant programs to develop and test carbon dioxide capture and sequestration technologies to reduce emissions from electric power plants. Assuming appropriation of the authorized and necessary amounts, CBO estimates that implementing H.R. 1933 would cost $58 million in 2008 and $1.3 billion over the 2008–2012 period. Enacting H.R. 1933 would not affect direct spending or revenues.

H.R. 1933 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would benefit state and local governments.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 1933 is shown in the following table. The costs of this legislation fall within budget function 270 (energy).

	By fiscal year, in millions of dollars—					
	2007	2008	2009	2010	2011	2012
SPENDING SUBJECT TO APPROPRIATION						
DOE Carbon Capture and Sequestration Program:						
Budget Authority [1]	100	35	0	0	0	0
Estimated Outlays	65	67	45	19	10	7
Proposed Changes:						
DOE Carbon Sequestration and Capture:.						
Authorization Level	0	205	420	420	420	180
Estimated Outlays	0	51	198	303	367	328
DOE Grant Programs:.						
Estimated Authorization Level	0	10	2	2	3	4
Estimated Outlays	0	3	3	4	3	3

	By fiscal year, in millions of dollars—					
	2007	2008	2009	2010	2011	2012
EPA Safety Research Program:.						
Authorization Level	0	5	5	5	5	5
Estimated Outlays	0	3	5	5	5	5
DOE Reporting Requirement:.						
Authorization Level	0	1	0	0	0	0
Estimated Outlays	0	1	0	0	0	0
Total Changes:.						
Estimated Authorization Level	0	221	427	427	428	189
Estimated Outlays	0	58	206	312	375	336
Spending Under H.R. 1933:						
Estimated Authorization Level	100	256	427	427	428	189
Estimated Outlays	65	125	251	331	385	343

Note: DOE = Department of Energy; EPA = Environmental Protection Agency.
[1] The 2007 level is the amount appropriated for that year for the Office of Fossil Energy's carbon sequestration program. The 2008 level is the amount authorized under current law.

Basis of estimate: For this estimate, CBO assumes that H.R. 1933 will be enacted near the end of fiscal year 2007 and that the entire amounts authorized and estimated to be necessary will be appropriated for each fiscal year. Estimated outlays are based on historical spending patterns for similar programs.

H.R. 1933 would authorize the appropriation of $221 million in 2008 and $1.7 billion over the 2008–2012 period for specific DOE and EPA programs. In addition, CBO estimates that a university grant program to study the storage of carbon in geologic features would cost $6 million over the 2009–2012 period. Assuming appropriation of the necessary amounts, CBO estimates that implementing H.R. 1933 would cost $58 million in fiscal year 2008 and $1.3 billion over the 2008–2012 period. As described below, most of those amounts would be used for carbon sequestration and capture research and demonstration program. (That is, the removal of carbon from fossil fuel combustion emissions and its permanent storage).

DOE Carbon Sequestration and Capture Research and Demonstration Programs

H.R. 1933 would authorize the appropriation of $240 million (of which $35 million was already authorized in Public Law 109–58) in 2008 and $1.6 billion over the 2008–2012 period for research and demonstration programs. Specifically, the bill would authorize $100 million annually for fiscal years 2008 through 2011 for general carbon capture and storage research and field testing, and $140 million annually (over the same period) for programs to demonstrate the sequestration of carbon. The bill would authorize the appropriation of $180 million a year over the 2009–2012 period for demonstration programs to test technologies for carbon dioxide capture at industrial sources. CBO estimates that appropriation of specified amounts would result in discretionary spending of $51 million in 2008 and $1.3 billion over the 2008–2012 period.

DOE Grant Programs

H.R. 1933 would create two new grant programs. The first would award funds to colleges and universities to create programs to study the sequestration of carbon in geologic features. Based on the cost of other DOE grant programs, CBO estimates that the pro-

gram would cost $6 million over the 2009–2012 period. (Because of a 2008 reporting requirement, described below, grants would be awarded beginning in fiscal year 2009.) The second program would award five grants to colleges and universities to study carbon capture and sequestration technologies involving various types of coal. H.R. 1933 would authorize the appropriation of $10 million for this purpose.

EPA Safety Research Program

The bill also would authorize the appropriation of $5 million annually for an EPA research program to determine necessary procedures to protect public safety and health and the environment from the adverse effects associated with the storage of greenhouse gases in subterranean reservoirs. Assuming appropriation of the authorized amounts, CBO estimates that this program would cost $3 million in 2008 and $23 million over the 2008–2012 period.

DOE Reporting Requirement

H.R. 1933 would authorize the appropriation of $1 million in fiscal year 2008 for the National Academy of Sciences to conduct a study to define a national interdisciplinary carbon capture program and other activities.

Intergovernmental and private-sector impact: H.R. 1933 contains no intergovernmental or private-sector mandates as defined in UMRA and would create several research and grant programs benefitting state and local governments. Any costs to those governments, including matching funds, would be incurred voluntarily.

Estimate prepared by: Federal Costs: Leigh Angres: Impact on State, Local, and Tribal Governments: Neil Hood; Impact on the Private Sector: Amy Petz.

Estimate approved by: Peter H. Fontaine, Deputy Assistant Director for Budget Analysis.

XII. Compliance With Public Law 104–4

H.R. 1933 contains no unfunded mandates.

XIII. Committee Oversight Findings and Recommendations

The oversight findings and recommendations of the Committee on Science and Technology are reflected in the body of this report.

XIV. Statement on General Performance Goals and Objectives

Pursuant to clause (3)(c) of House Rule XIII, the goal of H.R. 1933 is to advance carbon capture and storage research, development, and demonstration by reauthorizing and improving the carbon capture and storage research, development, and demonstration program of the Department of Energy.

XV. Constitutional Authority Statement

Article I, section 8 of the Constitution of the United States grants Congress the authority to enact H.R. 1933.

XVI. Federal Advisory Committee Statement

H.R. 1933 does not establish nor authorize the establishment of any advisory committee.

XVII. Congressional Accountability Act

The Committee finds that H.R. 1933 does not relate to the terms and conditions of employment or access to public services or accommodations within the meaning of section 102(b)(3) of the *Congressional Accountability Act* (Public Law 104–1).

XVIII. Earmark Identification

H.R. 1933 does not contain any congressional earmarks, limited tax benefits, or limited tariff benefits as defined in clause 9(d), 9(e), or 9(f) of rule XXI.

XIX. Statement on Preemption of State, Local, or Tribal Law

This bill is not intended to preempt any state, local, or tribal law.

XX. Changes in Existing Law Made by the Bill, as Reported

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italics, existing law in which no change is proposed is shown in roman):

ENERGY POLICY ACT OF 2005

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) * * *

(b) Table of Contents.—The table of contents for this Act is as follows:

Sec. 1. Short title; table of contents.

* * * * * * *

TITLE IX—RESEARCH AND DEVELOPMENT

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Subtitle F—Fossil Energy

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[Sec. 963. Carbon capture research and development program.]

Sec. 963. Carbon capture and storage research, development, and demonstration program.

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TITLE IX—RESEARCH AND DEVELOPMENT

* * * * * * *

Subtitle F—Fossil Energy

* * * * * * *

SEC. 963. CARBON CAPTURE [RESEARCH AND DEVELOPMENT] *AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION* PROGRAM.

(a) IN GENERAL.—The Secretary shall carry out a 10-year carbon capture [research and development] *and storage research, development, and demonstration* program to develop carbon dioxide [capture technologies on combustion-based systems] *capture and storage technologies related to electric power generating systems* for use—

(1) * * *

* * * * * * *

(b) OBJECTIVES.—The objectives of the program under subsection (a) shall be—

(1) * * *

* * * * * * *

(3) to increase the efficiency of the overall system to reduce the quantity of carbon dioxide emissions released from the system per megawatt generated; [and]

(4) in accordance with the carbon dioxide capture program, to promote a robust carbon sequestration program and continue the work of the Department, in conjunction with the private sector, through regional carbon sequestration partnerships[.]*; and*

(5) to expedite and carry out large-scale testing of carbon sequestration systems in a range of geological formations that will provide information on the cost and feasibility of deployment of sequestration technologies.

[(c) AUTHORIZATION OF APPROPRIATIONS.—From amounts authorized under section 961(b), the following sums are authorized for activities described in subsection (a)(2):

[(1) $25,000,000 for fiscal year 2006;

[(2) $30,000,000 for fiscal year 2007; and

[(3) $35,000,000 for fiscal year 2008.]

(c) PROGRAMMATIC ACTIVITIES.—

(1) FUNDAMENTAL SCIENCE AND ENGINEERING RESEARCH AND DEVELOPMENT AND DEMONSTRATION SUPPORTING CARBON CAPTURE AND STORAGE TECHNOLOGIES.—

(A) IN GENERAL.—The Secretary shall carry out fundamental science and engineering research (including laboratory-scale experiments, numeric modeling, and simulations) to develop and document the performance of new approaches to capture and store carbon dioxide, or to learn how to use carbon dioxide in products to lead to an overall reduction of carbon dioxide emissions.

(B) PROGRAM INTEGRATION.—The Secretary shall ensure that fundamental research carried out under this paragraph is appropriately applied to energy technology development activities and the field testing of carbon sequestration and carbon use activities, including—

(i) development of new or advanced technologies for the capture of carbon dioxide;

(ii) development of new or advanced technologies that reduce the cost and increase the efficacy of the compression of carbon dioxide required for the storage of carbon dioxide;

(iii) modeling and simulation of geological sequestration field demonstrations;

(iv) quantitative assessment of risks relating to specific field sites for testing of sequestration technologies; and

(v) research and development of new and advanced technologies for carbon use, including recycling and reuse of carbon dioxide.

(2) FIELD VALIDATION TESTING ACTIVITIES.—

(A) IN GENERAL.—The Secretary shall promote, to the maximum extent practicable, regional carbon sequestration partnerships to conduct geologic sequestration tests involving carbon dioxide injection and monitoring, mitigation, and verification operations in a variety of candidate geological settings, including—

(i) operating oil and gas fields;

(ii) depleted oil and gas fields;

(iii) unmineable coal seams;

(iv) deep saline formations;

(v) deep geologic systems that may be used as engineered reservoirs to extract economical quantities of heat from geothermal resources of low permeability or porosity;

(vi) deep geologic systems containing basalt formations; and

(vii) high altitude terrain oil and gas fields.

(B) OBJECTIVES.—The objectives of tests conducted under this paragraph shall be—

(i) to develop and validate geophysical tools, analysis, and modeling to monitor, predict, and verify carbon dioxide containment;

(ii) to validate modeling of geological formations;

(iii) to refine storage capacity estimated for particular geological formations;

(iv) to determine the fate of carbon dioxide concurrent with and following injection into geological formations;

(v) to develop and implement best practices for operations relating to, and monitoring of, injection and storage of carbon dioxide in geologic formations;

(vi) to assess and ensure the safety of operations related to geological storage of carbon dioxide;

(vii) to allow the Secretary to promulgate policies, procedures, requirements, and guidance to ensure that the objectives of this subparagraph are met in large-scale testing and deployment activities for carbon capture and storage that are funded by the Department of Energy; and

(viii) to support Environmental Protection Agency efforts, in consultation with other agencies, to develop a scientifically sound regulatory framework to enable commercial-scale sequestration operations while safeguarding human health and underground sources of drinking water.

(3) LARGE-SCALE CARBON DIOXIDE SEQUESTRATION TESTING.—

(A) IN GENERAL.—The Secretary shall conduct not less than 7 initial large-volume sequestration tests, not including the FutureGen project, for geological containment of carbon dioxide (at least 1 of which shall be international in scope) to validate information on the cost and feasibility of commercial deployment of technologies for geological containment of carbon dioxide.

(B) DIVERSITY OF FORMATIONS TO BE STUDIED.—In selecting formations for study under this paragraph, the Secretary shall consider a variety of geological formations across the United States, and require characterization and modeling of candidate formations, as determined by the Secretary.

(C) SOURCE OF CARBON DIOXIDE FOR LARGE-SCALE SEQUESTRATION DEMONSTRATIONS.—In the process of any acquisition of carbon dioxide for sequestration demonstrations under subparagraph (A), the Secretary shall give preference to purchases of carbon dioxide from industrial and coal-fired electric generation facilities. To the extent feasible, the Secretary shall prefer test projects from industrial and coal-fired electric generation facilities that would facilitate the creation of an integrated system of capture, transportation and storage of carbon dioxide. Until coal-fired electric generation facilities, either new or existing, are operating with carbon dioxide capture technologies, other industrial sources of carbon dioxide should be pursued under this paragraph. The preference provided for under this subparagraph shall not delay the implementation of the large-scale sequestration tests under this paragraph.

(D) DEFINITION.—For purposes of this paragraph, the term "large-scale" means the injection of more than 1,000,000 metric tons of carbon dioxide annually, or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability continuously to inject quantities on the order of several million metric tons of industrial carbon dioxide annually for a large number of years.

(4) LARGE-SCALE DEMONSTRATION OF CARBON DIOXIDE CAPTURE TECHNOLOGIES.—

(A) IN GENERAL.—The Secretary shall carry out at least 3 and no more than 5 demonstrations, that include each of the technologies described in subparagraph (B), for the large-scale capture of carbon dioxide from industrial sources of carbon dioxide, at least 2 of which are facilities that generate electric energy from fossil fuels. Candidate facilities for other demonstrations under this paragraph shall include facilities that refine petroleum, manufacture iron or

steel, manufacture cement or cement clinker, manufacture commodity chemicals, and ethanol and fertilizer plants. Consideration may be given to capture of carbon dioxide from industrial facilities and electric generation carbon sources that are near suitable geological reservoirs and could continue sequestration. To ensure reduced carbon dioxide emissions, the Secretary shall take necessary actions to provide for the integration of the program under this paragraph with the long-term carbon dioxide sequestration demonstrations described in paragraph (3). These actions should not delay implementation of the large-scale sequestration tests authorized in paragraph (3).

(B) TECHNOLOGIES.—The technologies referred to in subparagraph (A) are precombustion capture, post-combustion capture, and oxycombustion.

(C) SCOPE OF AWARD.—An award under this paragraph shall be only for the portion of the project that carries out the large-scale capture (including purification and compression) of carbon dioxide, as well as the cost of transportation and injection of carbon dioxide.

(5) PREFERENCE IN PROJECT SELECTION FROM MERITORIOUS PROPOSALS.—In making competitive awards under this subsection, subject to the requirements of section 989, the Secretary shall give preference to proposals from partnerships among industrial, academic, and government entities.

(6) COST SHARING.—Activities under this subsection shall be considered research and development activities that are subject to the cost-sharing requirements of section 988(b), except that the Federal share of a project under paragraph (4) shall not exceed 50 percent.

(d) AUTHORIZATION OF APPROPRIATIONS.—

(1) IN GENERAL.—There are authorized to be appropriated to the Secretary for carrying out this section, other than subsection (c)(3) and (4)—

(A) $100,000,000 for fiscal year 2008;
(B) $100,000,000 for fiscal year 2009;
(C) $100,000,000 for fiscal year 2010; and
(D) $100,000,000 for fiscal year 2011.

(2) SEQUESTRATION.—There are authorized to be appropriated to the Secretary for carrying out subsection (c)(3)—

(A) $140,000,000 for fiscal year 2008;
(B) $140,000,000 for fiscal year 2009;
(C) $140,000,000 for fiscal year 2010; and
(D) $140,000,000 for fiscal year 2011.

(3) CARBON CAPTURE.—There are authorized to be appropriated to the Secretary for carrying out subsection (c)(4)—

(A) $180,000,000 for fiscal year 2009;
(B) $180,000,000 for fiscal year 2010;
(C) $180,000,000 for fiscal year 2011; and
(D) $180,000,000 for fiscal year 2012.

* * * * * * *

XXI. Committee Recommendations

On June 27, 2007, the Committee on Science and Technology favorably reported H.R. 1933, as amended, by a voice vote and recommended its passage by the House of Representatives.

XXII. PROCEEDINGS OF THE MARKUP BY THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT ON H.R. 1933, THE DEPARTMENT OF ENERGY CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 2007

THURSDAY, JUNE 21, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:10 p.m., in Room 2318 of the Rayburn House Office Building, Hon. Nick Lampson [Chairman of the Subcommittee] presiding.

Chairman LAMPSON. The Subcommittee on Energy and Environment will come to order. Pursuant to notice, the Subcommittee on Energy and Environment meets to consider the following measures: H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007;* H.R. 2774, the *Solar Energy Research and Advancement Act of 2007;* and H.R. 2773, the *Biofuels Research and Development Enhancement Act.*

We will now proceed with the markup beginning with opening statements, and I will begin.

Energy is not something most Americans have thought about since the oil embargo of the 1970s. Gas and electricity were cheap, environmental issues were not a concern and we did not appreciate our increased vulnerability to unstable foreign energy supplies. Consequently, energy stayed out of the legislative spotlight for many years.

The Congress passed significant energy legislation in 2005 in response to rising fuel prices and increased concerns about energy security. Since then the growing public awareness and acceptance of climate change compels us to take further actions on energy. Today this committee is taking yet another step to increase federal investment in energy technologies that we know will lessen the environmental impact of our energy use, decrease our reliance on foreign fuels and still maintain the quality of life we enjoy today.

First on the agenda is H.R. 1933 by Representative Udall which sets out the next steps in DOE's carbon mitigation strategies. In addition to continuing the Department's research on carbon dioxide

management, the bill authorizes large-scale demonstrations of carbon sequestration technologies through partnerships with industrial, academic and government entities. An amendment by Mr. Udall will add demonstrations of carbon capture technology as well. Because we will continue to use our abundant resources of coal to meet our energy needs for the foreseeable future, it is critical that we demonstrate an integrated system of capture, transportation and storage of carbon dioxide at a large scale.

Next we will take H.R. 2774, the *Solar Energy and Advancement Act of 2007,* introduced by Congresswoman Giffords. This bill creates a research and development program on energy storage technology for concentrating solar power plants which allows for the use of solar energy even when the sun isn't shining. It also asks the DOE to conduct studies on how best to integrate concentrating solar plants with the grid and ways to reduce water usage in these plants. I know the Congresswoman also plans to introduce an amendment today that creates a solar workforce program, and this will further improve the bill and I look forward to hearing what my distinguished colleague has to say about it soon.

And finally, the Subcommittee will consider my bill, H.R. 2773, the *Biofuels Research and Development Enhancement Act.* This bill attempts to better coordinate and compile information from federal biofuels research programs, focus some of the biofuels research on infrastructure needs and efficiency of biorefinery technologies, study some of the continuing challenges facing broader use of biofuels, and increase the funding levels for biofuels research.

For each of these bills, the Subcommittee has held hearings examining the various technical barriers and possible pathways for these technologies. Many of the amendments that will be offered today result from the advice and input provided by the witnesses at these hearings. Today the Subcommittee should report meaningful legislation that will bring us one step closer to their consideration on the House Floor in July. I urge support for all of these bills and I look forward to working with all of you as we move these bills forward to Full Committee next week.

[The prepared statement of Chairman Lampson follows:]

PREPARED STATEMENT OF CHAIRMAN NICK LAMPSON

Energy is not something most Americans have thought about since the oil embargo in the 1970's. Gas and electricity were cheap, environmental issues were not a concern, and we did not appreciate our increased vulnerability to unstable foreign energy supplies. Consequently "Energy" stayed out of the legislative spotlight for many years.

The Congress passed significant energy legislation in 2005 in response to rising fuel prices and increased concerns about energy security. Since then, the growing public awareness and acceptance of climate change compels us to take further actions on energy. Today this committee is taking yet another step to increase federal investment in energy technologies that we know will lessen the environmental impact of our energy use, decrease our reliance on foreign fuels, and still maintain the quality of life we enjoy today.

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An amendment by Mr. Udall will add demonstrations of carbon capture technology as well. Because we will continue to use our abundant resources of coal to meet our energy needs for the foreseeable future, it is critical that we demonstrate

an INTEGRATED system of capture, transportation, and storage of carbon dioxide at a large scale.

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It also asks the DOE to conduct studies on how to best integrate concentrating solar plants with the grid, and ways to reduce water usage in these plants. I know the Congresswoman also plans to introduce an amendment today that creates a solar workforce program. This will further improve the bill, and I look forward to hearing what my distinguished colleague has to say about it soon.

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Chairman LAMPSON. I now recognize Mr. Inglis, the Ranking Member, to present his opening remarks.

Mr. INGLIS. Thank you, Mr. Chairman, and I look forward to this markup.

The bills we mark up today are reflections of the commitment we have made to move away from our dependence on foreign oil and toward solutions that make both economic and environmental sense.

Renewable energy sources give us the opportunity to end our dependence on fossil fuels like oil and coal. In the meantime though, we will use a lot of oil and a lot of coal. That is why we must work to make sure especially that our coal consumption is as emission-free and energy efficient as possible, bringing benefits to both industry and to the environment.

Carbon capture and storage technologies hold significant promise for reducing carbon emissions. H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act,* will fund demonstration projects that integrate these technologies. The aim is that the research and experience gained from these projects will help bring down the cost of implementing carbon-reducing technologies in the private sector.

As I mentioned earlier, the ultimate goal is energy sources that are renewable and emission-free. H.R. 2774, the *Solar Research and Advancement Act,* and H.R. 2773, the *Biofuels Research and Development Act,* are two steps in that direction. Biofuels and solar energy should be sources of energy for us, and I am looking forward to promoting research programs that will make these alternatives commercially viable.

Thank you again, Mr. Chairman, and I look forward to working with you to advance these pieces of legislation.

[The prepared statement of Mr. Inglis follows:]

PREPARED STATEMENT OF REPRESENTATIVE BOB INGLIS

Thank you for holding this markup, Mr. Chairman.

The bills we're marking up today are reflections of the commitment we have made to move away from our dependence on foreign oil, and toward solutions that make both economic and environmental sense.

Renewable energy sources give us the opportunity to end our dependence on fossil fuels like oil and coal. In the meantime we'll use lots of coal. That's why we must work to make sure that our coal consumption is as emission-free and energy efficient as possible, bringing benefits to both industry and the environment.

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As I mentioned earlier, the ultimate goal is energy sources that are renewable and emission-free. H.R. 2774, the *Solar Research and Advancement Act,* and H.R. 2773, the *Biofuels Research and Development Act,* are two steps in that direction. Biofuels and solar energy should be sources of energy for us, and I'm looking forward to promoting research programs that will make these alternatives commercially viable.

Thank you again, Mr. Chairman, and I look forward to working with you to advance this legislation.

Chairman LAMPSON. Thank you, Mr. Inglis.

Without objection, Members may place statements in the record at this point.

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Good Morning. Thank you, Mr. Chairman, for holding today's markup on H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007.*

First, I would like to commend Congressman Udall for his leadership on this issue and for developing this important legislation which builds upon the authorizations for carbon capture and sequestration (CCS) initiatives of the *Energy Policy Act of 2005.* I am pleased to be a co-sponsor of H.R. 1933 and I strongly support the gentleman from Colorado's bill to provide adequate funding for research, development (R&D), and demonstration programs for CCS technology. Technology has successfully overcome multiple environmental challenges to coal. According to the Electric Power Research Institute (EPRI), emissions of nitrogen-oxide, sulfur-dioxide, and other air pollutants from new coal-fired power plants have been reduced by more than 90 percent over the past three decades, as the technology has advanced. That is why I have been a strong advocate for clean coal technology. Emissions from coal plants can be reduced with advanced technology and I support the use of coal in an environmentally responsible manner.

Our subcommittee held a hearing in May to examine advanced clean coal technologies, such as CCS. We learned from the witness panel that additional R&D and large scale demonstrations need to be carried out in order to ensure that the technology works. In addition, the cost of CCS using current available technology is very high and there are significant integration and engineering considerations that need to be addressed. According to analyses by EPRI and the Coal Utilization Research Council (CURC), once substantial investments are made, the cost of CCS becomes manageable, and ultimately coal-based electricity with CCS can be cost competitive with other low-carbon generation technologies. However, current funding for R&D and demonstration programs of carbon capture and sequestration technology is inadequate. I am concerned that the longer we delay in developing the capability to deploy CCS technologies to be used at a commercial scale, the longer we will wait for substantial reductions in CO_2. In other words, we are not taking the necessary steps to reduce greenhouse gas emissions. The reality is that the U.S. is not going to stop using coal. We have at least a 250-year supply and according to the Energy Information Administration, the consumption of coal for electricity generation is expected to increase by 63 percent by 2030. Clean coal technologies is one part of an economy-wide solution to addressing climate change. We need to invest more in coal R&D, and especially in demonstration of commercial-scale CCS systems. That is why this legislation is critical to ensuring the continued use of coal in this country. I urge my colleagues to support H.R. 1933.

Chairman LAMPSON. We will now consider H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007,* and I yield to Mr. Udall for five minutes to describe his bill.

Mr. UDALL. Thank you, Mr. Chairman, for yielding to me. If I might, I would ask unanimous consent to include my entire statement in the record.

Chairman LAMPSON. So ordered.

Mr. UDALL. In the interest of brevity and moving the process along, I would just like to thank the Chairman and the Ranking Member for bringing the bill to the Subcommittee today. I think the Chairman's statement as well as the Ranking Member's statement outlined in important detail what H.R. 1933 would accomplish, and Mr. Chairman, with that I would yield back any time I have remaining and look forward to a little more detail in my comments on the manager's amendment that will follow.

[The prepared statement of Mr. Udall follows:]

PREPARED STATEMENT OF REPRESENTATIVE MARK UDALL

Thank you, Chairman Lampson, for bringing this bill up for markup today.

Early this year, I introduced H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007.*

As we all know, we have vast coal resources in the United States and these resources can help alleviate our dependence on foreign sources of energy. However, current coal energy generation produces large amounts of greenhouse gas emissions, which are contributing to climate change.

Carbon sequestration is the solution to this problem, yet current technology cannot capture and store the large amounts of carbon dioxide that we must remove from power plant emissions to mitigate climate change.

My bill will address this issue by improving and expanding the Department of Energy's Carbon Capture and Storage Research and Development Program. This research, development, and demonstration effort will spur the development of needed capture and storage technology.

Specifically, the bill authorizes seven large-volume sequestration tests for geological containment of carbon dioxide. These technology demonstrations will occur in a range of geological conditions and include stringent monitoring to determine that the emissions are not re-entering the atmosphere.

An important part of these demonstrations is that the Federal Government will not be working alone on these projects—the bill specifically encourages the participation of State, industry, and academic groups, ideally through the Regional Sequestration Partnerships.

Coal is an important part of our current energy portfolio and it will remain so for many years to come. We need this legislation to help us continue to support our domestic energy industry while also addressing the climate change challenge.

I ask my colleagues to support this important legislation.

Chairman LAMPSON. Thank you, Mr. Udall.

I recognize Mr. Inglis to present any remarks on the bill.

Mr. INGLIS. Mr. Chairman, in the interest of brevity too I would pass on that opportunity and look forward to moving along here.

Chairman LAMPSON. Thank you very much. Does anyone else wish to be recognized? Does anyone wish to be recognized?

I ask unanimous consent that the bill is considered as read and open to amendment at any point and that Members proceed with the amendments in order of the roster. Without objection, so ordered.

The first amendment on the roster is a manager's amendment offered by the gentleman from Colorado. Mr. Udall, are you ready with your amendment?

Mr. UDALL. Mr. Chairman, I do have an amendment at the desk.

Chairman LAMPSON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933 offered by Mr. Udall of Colorado.

Chairman LAMPSON. I ask unanimous consent to dispense with the reading. Without objection, so ordered. And I recognize the gentleman from Colorado for five minutes to explain the amendment.

Mr. UDALL. Thank you, Mr. Chairman. The manager's amendment makes a number of technical and substantive changes to H.R. 1933. Let me take a brief moment to describe the substantive changes. The amendment adds a new section to the bill authorizing at least three but no more than five demonstrations of carbon dioxide capture technologies. It further includes an authorization for funding these carbon dioxide capture demonstrations at a total of no more than $180 million per year for four years starting in fiscal year 2009. Second, my amendment increases the funding level for the large-scale carbon dioxide sequestration demonstrations to $140 million per year for four years beginning in fiscal year 2008.

The amendment further defines what size projects would be eligible as large-scale injection projects. The basic measurement would be projects involving at least one million tons but the Secretary would have discretion to adjust this in appropriate cases. The revised section also encourages integrating the storage technology demonstrations with the capture technology demonstrations. This is intended to provide operational experience with an integrated system of capture, transportation and storage of carbon dioxide at scale. The amendment authorizes the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized. The amendment also authorizes the assistant administration of the Office of Research and Development of the EPA to conduct a research program and what procedures may be necessary to protect public health, safety and the environment from impacts that may be associated with the separation and sequestration of greenhouse gases. I would like to underscore that this is a research program and the EPA office does not issue regulations.

Finally, the amendment includes $100 million annually for fiscal years 2008 through 2012 to fund the Department of Energy's fundamental R&D at the laboratory scale. This funding will allow for continued examination of new approaches on carbon dioxide capture and sequestration.

Mr. Chairman, I think the amendment improves the bill significantly and I would urge my colleagues to support the amendment. Thank you, and I yield back any time I have remaining.

[The prepared statement of Mr. Udall follows:]

PREPARED STATEMENT OF REPRESENTATIVE MARK UDALL

Mr. Chairman. I have an amendment at the desk.

Thank you Mr. Chairman. My manager's amendment makes a number of technical and substantive changes to H.R. 1933. I will take a brief moment to describe the substantive changes.

The amendment adds a new section to the bill authorizing at least three, but no more than five, demonstrations of carbon dioxide capture technologies.

It further includes are authorization for funding these carbon dioxide capture demonstrations a total of no more than $180 million per year for four years starting in Fiscal Year 2009.

Second, my amendment increases the funding level for the large-scale carbon dioxide sequestration demonstrations to $140 million per year for four years beginning in Fiscal Year 2008.

The amendment further defines what size projects would be eligible as large-scale injection projects. The basic measurement would be projects involving at least one million tons, but the Secretary would have discretion to adjust this in appropriate cases.

The revised section also encourages integrating the storage technology demonstrations with the capture technology demonstrations. This is intended to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale.

My amendment authorizes the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized.

My amendment authorizes the Assistant Administrator of the Office of Research and Development of EPA to conduct a research program on what procedures may be necessary to protect public health, safety and the environment from impacts that may be associated with sequestration of greenhouse gases.

I would like to underscore that this is a **research program and this EPA office does not issue regulations.**

Finally, my amendment includes $100 million annually for fiscal years 2008 through 2011 to fund the Department of Energy's fundamental R&D at the laboratory scale. This funding will allow for continued examination of new approaches on carbon dioxide capture and sequestration.

Mr. Chairman, I think my amendment improves the bill significantly and I urge my colleagues to support the amendment. Thank you.

Chairman LAMPSON. Thank you, Mr. Udall.

Is there further discussion on the amendment? Further discussion on the amendment?

Mr. INGLIS. Mr. Chairman, just a couple of questions for Mr. Udall or Counsel or someone. One is, in the new scale on large-scale demonstration of carbon dioxide capture technologies, what is the award money used for?

Mr. UDALL. Counsel, would you like to respond?

The COUNSEL. Could you repeat that again?

Mr. INGLIS. Yeah, it is the—in the large-scale demonstration of carbon dioxide capture technologies, that new section, there is award money, and the question is, what is the—what can the award money be used for? Can it be used to purchase carbon capture technology? What part of the process is considered capture and how much is—how is the cost determined and basically what about the federal share to be used to purchase the carbon from the company?

The COUNSEL. The federal share of this particular section will be a 50/50 cost share and that is described right below that.

Mr. INGLIS. That is because it is carbon capture, right?

The COUNSEL. The carbon capture——

Mr. INGLIS. The sequestration is 80/20?

The COUNSEL. Correct. That is correct. And then in regard to your question about what the award would be for, that is largely at the discretion of the Secretary but they could use it to apply to the purchase of the carbon or for the technologies.

Mr. INGLIS. And then the second question, in the manager's amendment, the cost share for the large-scale sequestration testing and deployment differs from the cost share for the large-scale demonstration of CO_2 capture technologies. I am working here to try to understand the need for the cost share to be different for each. Can you maybe explain, Counsel or someone, what is—why those are treated differently?

Mr. UDALL. Counsel.

The COUNSEL. Sure. In section 988 of EPAct '05, the cost sharing provisions, the research and development is under one section and the demonstration and commercial application is under a separate section with different cost share arrangements. However, the section for demonstrations also has room for the Secretary to reduce that non-federal share, you know, at his or her discretion.

Mr. UDALL. So I guess we are comfortable with that. Does the gentleman have concerns about those ratios?

Mr. INGLIS. We are mostly just trying to make sure we understand how it works.

Mr. UDALL. My impression is, this is based on other similar relationships and arrangements, and as Counsel suggested, the Secretary has quite a bit of discretion, particularly on the higher end here when you have an 80 percent government funding, 20 percent match, to move that around if that seems to make sense, given the circumstances.

Mr. INGLIS. I am sorry. We are learning as we go—or I am—and so generally what I am trying to understand is the difference between the awards. Do the differences have to do with the difference between capture and sequestration, capture being a more demonstrated technology already, such that you don't need a subsidy; whereas, if you are talking about sequestration, there is a lot more research to be done on that? I think this is the concept.

Mr. UDALL. If I could——

Mr. INGLIS. I would be happy to yield.

Mr. UDALL. Yes, I think you are yielding to me, aren't you? The capture technology is less advanced than the sequestration technology. We had a hearing that was very illustrative and informative and it was one of the take-aways I had after that concluded which is that we have a much better idea of how we sequester. We are not quite as clear about how we capture. You can capture on the front end. You can capture through the process itself and then you can capture at the back end, so we want to provide more support to those efforts to industry and to the researchers and I think that is why this ratio is the way you see it here. And I would invite Counsel to—I would yield back, of course, to the gentleman but Counsel may be able to add more information to that.

Mr. INGLIS. I think my time has expired.

Chairman LAMPSON. Mr. Inglis, we will extend if you have more questions, so continue.

Mr. INGLIS. Yeah, I guess I am—I think I am still confused as to whether it is capture or sequestration which is more difficult to get to and which one are we therefore subsidizing more.

The COUNSEL. The R&D piece on the sequestration is looking at what we can anticipate putting large volumes of the carbon dioxide into the ground and so that is the R&D element of it. Does it stay put; if not, and we are looking at if not, what does that mean? And we are looking at how we are going to monitor and analyze that. So that is the R&D piece of the injection. And then the capture falls under we are actually going to demonstrate existing technologies that have been used at a smaller pilot scale.

Chairman LAMPSON. I can add something to that. This was worked out on the basis of a formula. The provision was worked

out in H.R. 610, which was the Science Committee provision under Republican Chairman Boehlert, and the language is the same.

Mr. INGLIS. Well, it must be good then. I yield back.

Chairman LAMPSON. Thank you very much, Mr. Inglis.

Is there further discussion the amendment? Any further discussion on the amendment? If no, the vote occurs on the amendment. All in favor say aye. Those opposed, say no. The ayes have it and the amendment is agreed to.

The second amendment on the roster is an amendment offered by the gentleman from Illinois, Mr. Costello. Are you ready to proceed with your amendment?

Mr. COSTELLO. Mr. Chairman, I am, and I have an amendment at the desk.

Chairman LAMPSON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933 offered by Mr. Costello of Illinois.

Chairman LAMPSON. I ask unanimous consent to dispense with the reading. Without objection, so ordered. I recognize the gentleman for five minutes to explain the amendment.

Mr. COSTELLO. Mr. Chairman, thank you, and I will not take the entire five minutes. I will try and be brief.

The purpose of the amendment is that it instructs the National Academy of Science to conduct a study that develops guidelines and proposals for colleges and universities for students interested in geological sequestration science. It also requires the Secretary of the Department of Energy and the National Energy Technology Laboratory to establish a competitive grant program for colleges and universities to encourage faculty to teach undergraduates and graduates about carbon sequestration science and to offer internships for graduate students in geological sequestration science. I have been working with the National Energy Technology Laboratory and the National Academies to draft this amendment. The reason why the amendment is necessary is that there has never been a study done on this subject, and in order to address carbon emissions from coal plants, we need scientific experts with trained experience in the geological sequestration science field. Many universities and colleges have reduced capabilities for instruction in the geology actually of fossil fuels and energy resources since the enactment of the *Clean Air Act,* and the purpose of this amendment of course is to have the universities and colleges go back into the business of training people in the field. If in fact as we are, it is obviously the intention of the Congress to increase funding for carbon capture and sequestration research and development and demonstration, we should in fact develop instructional programs at colleges and universities to increase the number of undergraduates and graduates capable of supporting this sequestration science, and I would again compliment our colleague, Mr. Udall, for his legislation. I believe that my amendment makes the legislation more attractive and in fact will further the development of students and professors in the subsequent science and I——

Mr. UDALL. Will the gentleman yield?

Mr. COSTELLO. I would be happy to yield.

Mr. UDALL. I just want to make it clear for the Committee's benefit that I think this is an excellent amendment, and I thank the gentleman for offering it.

I yield back.

Chairman LAMPSON. Is there further discussion on the amendment? If no, the vote occurs on the amendment. All in favor say aye. Those opposed say no. The ayes have it and the amendment is agreed to.

Are there any other amendments? Any other amendments? Hearing none, the vote is on the bill, H.R. 1933, the *Department of Energy Carbon Capture and Storage*——

Mr. INGLIS. Mr. Chairman, I wonder if we need to roll that vote since we—do we have to? I guess we do, don't we? I don't think we have enough people here.

Chairman LAMPSON. Pursuant to Rule 2T, further proceedings on the matter are postponed under further notice from the Chair.

Thank you, Mr. Inglis.

Now, we will return to unfinished business and the next vote will be on H.R. 1933. Are there other amendments to H.R. 1933? Hearing none, the vote is on the bill, H.R. 1933, the *Department of Energy Carbon Capture and Storage Research Development, and Demonstration Act of 2007,* as amended. All those in favor will say aye. Those opposed will say no. In the opinion of the Chair, the ayes have it.

I recognize Ms. Woolsey for a motion.

Ms. WOOLSEY. Mr. Chairman, I move that the Subcommittee favorably report H.R. 1933 as amended to the Full Committee. Furthermore, I move that staff be instructed to prepare the Subcommittee legislative report and make necessary technical and conforming changes to the bill as amended in accordance with the recommendations of the Subcommittee.

Chairman LAMPSON. The question is on the motion to report the bill favorably. Those in favor of the motion will signify by saying aye. Those opposed, no. The ayes have it and the bill is favorably reported.

I want to thank the Members for their attendance, and this concludes our Subcommittee markup. We stand adjourned.

[Whereupon, at 4:10 p.m., the Subcommittee was adjourned.]

Appendix:

H.R. 1933, Section-by-Section Analysis, Amendment Roster

I

110TH CONGRESS
1ST SESSION

H. R. 1933

To amend the Energy Policy Act of 2005 to reauthorize and improve the carbon capture and storage research, development, and demonstration program of the Department of Energy, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

APRIL 18, 2007

Mr. UDALL of Colorado introduced the following bill; which was referred to the Committee on Science and Technology

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A BILL

To amend the Energy Policy Act of 2005 to reauthorize and improve the carbon capture and storage research, development, and demonstration program of the Department of Energy, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007".

SEC. 2. CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAM.

(a) AMENDMENTS.—Section 963 of the Energy Policy Act of 2005 (42 U.S.C. 16293) is amended—

(1) in the section heading, by striking "**RESEARCH AND DEVELOPMENT**" and inserting "**AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION**";

(2) in subsection (a)—

(A) by striking "research and development" and inserting "and storage research, development, and demonstration"; and

(B) by striking "capture technologies on combustion-based systems" and inserting "capture and storage technologies related to energy systems";

(3) in subsection (b)—

(A) in paragraph (3), by striking "and" at the end;

(B) in paragraph (4), by striking the period at the end and inserting "; and"; and

(C) by adding at the end the following:

"(5) to expedite and carry out large-scale testing of carbon sequestration systems in a range of geological formations that will provide information on

the cost and feasibility of deployment of sequestration technologies.''; and

(4) by striking subsection (c) and inserting the following:

''(c) PROGRAMMATIC ACTIVITIES.—

''(1) ENERGY RESEARCH AND DEVELOPMENT UNDERLYING CARBON CAPTURE AND STORAGE TECHNOLOGIES.—

''(A) IN GENERAL.—The Secretary shall carry out fundamental science and engineering research (including laboratory-scale experiments, numeric modeling, and simulations) to develop and document the performance of new approaches to capture and store carbon dioxide.

''(B) PROGRAM INTEGRATION.—The Secretary shall ensure that fundamental research carried out under this paragraph is appropriately applied to energy technology development activities and the field testing of carbon sequestration activities, including—

''(i) development of new or improved technologies for the capture of carbon dioxide;

"(ii) modeling and simulation of geological sequestration field demonstrations; and

"(iii) quantitative assessment of risks relating to specific field sites for testing of sequestration technologies.

"(2) FIELD VALIDATION TESTING ACTIVITIES.—

"(A) IN GENERAL.—The Secretary shall promote, to the maximum extent practicable, regional carbon sequestration partnerships to conduct geologic sequestration tests involving carbon dioxide injection and monitoring, mitigation, and verification operations in a variety of candidate geological settings, including—

"(i) operating oil and gas fields;

"(ii) depleted oil and gas fields;

"(iii) unmineable coal seams;

"(iv) saline formations; and

"(v) deep geologic systems that may be used as engineered reservoirs to extract economical quantities of heat from geothermal resources of low permeability or porosity.

"(B) OBJECTIVES.—The objectives of tests conducted under this paragraph shall be—

"(i) to develop and validate geophysical tools, analysis, and modeling to monitor, predict, and verify carbon dioxide containment;

"(ii) to validate modeling of geological formations;

"(iii) to refine storage capacity estimated for particular geological formations;

"(iv) to determine the fate of carbon dioxide concurrent with and following injection into geological formations;

"(v) to develop and implement best practices for operations relating to, and monitoring of, injection and storage of carbon dioxide in geologic formations;

"(vi) to assess and ensure the safety of operations related to geological storage of carbon dioxide; and

"(vii) to allow the Secretary to promulgate policies, procedures, requirements, and guidance to ensure that the objectives of this subparagraph are met in large-scale testing and deployment activities for car-

bon capture and storage that are funded by the Department of Energy.

"(3) LARGE-SCALE TESTING AND DEPLOYMENT.—

"(A) IN GENERAL.—The Secretary shall conduct not less than 7 initial large-volume sequestration tests for geological containment of carbon dioxide (at least 1 of which shall be international in scope) to validate information on the cost and feasibility of commercial deployment of technologies for geological containment of carbon dioxide.

"(B) DIVERSITY OF FORMATIONS TO BE STUDIED.—In selecting formations for study under this paragraph, the Secretary shall consider a variety of geological formations across the United States, and require characterization and modeling of candidate formations, as determined by the Secretary.

"(4) PREFERENCE IN PROJECT SELECTION FROM MERITORIOUS PROPOSALS.—In making competitive awards under this subsection, subject to the requirements of section 989, the Secretary shall give preference to proposals from partnerships among industrial, academic, and government entities.

"(5) COST SHARING.—Activities under this subsection shall be considered research and development activities that are subject to the cost-sharing requirements of section 988(b).

"(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this section—

"(1) $90,000,000 for fiscal year 2007;

"(2) $105,000,000 for fiscal year 2008; and

"(3) $120,000,000 for fiscal year 2009.".

(b) TABLE OF CONTENTS AMENDMENT.—The item relating to section 963 in the table of contents for the Energy Policy Act of 2005 is amended to read as follows:

"Sec. 963. Carbon capture and storage research, development, and demonstration program.".

○

SECTION-BY-SECTION ANALYSIS OF H.R. 1933,
DEPARTMENT OF ENERGY CARBON CAPTURE AND STORAGE RESEARCH,
DEVELOPMENT, AND DEMONSTRATION ACT OF 2007

Section 1. Short Title.

"Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007."

Section 2. Carbon Capture and Storage Research, Development, and Demonstration Program.

Amends Section 963 of the *Energy Policy Act of 2005* to include large-scale testing of carbon sequestration systems in a range of geological formations that will provide information on the cost and feasibility of deployment of sequestration technologies.

The Secretary is authorized to carry out fundamental science and engineering research to develop and document the performance of new approaches to capture and store carbon dioxide. The fundamental research shall be applied to energy technology development activities and the field testing of carbon sequestration activities. The objectives are to develop the best tools for analysis, modeling, monitoring, prediction and verification of carbon dioxide containment.

Requires the Secretary to promote regional carbon sequestration partnerships to conduct geologic sequestration field testing of the capture technologies and the injection and monitoring practices in a variety of geologic settings including operating oil and gas field, depleted oil and gas fields, unmineable coal seams, saline formation, and deep geologic systems to extract heat from geothermal resources.

The field tests are aimed at advancing and validating geophysical tools, analysis and modeling used to monitor, predict, and verify carbon dioxide containment. The Secretary is authorized to promulgate policies, procedures, requirements and guidance to ensure that large-scale testing and deployment activities for carbon capture and storage implement the best practices available for achieving safe carbon dioxide management.

In addition, the bill authorizes seven large-volume sequestration tests for geological containment of carbon dioxide. The Secretary shall select meritorious proposals on a competitive basis giving preference to proposals from partnerships among industrial, academic, and government entities. The Secretary shall consider a variety of geological formations across the United States and require characterization and modeling of candidate formations, as determined by the Secretary.

The activities under this section shall be considered research and development and meet the cost-sharing requirements of Section 988(b) of EPACT '05—the Secretary shall require not less than 20 percent of the cost of a research or development activity to be provided by a non-federal source.

The bill authorizes $90 million for fiscal year 2007, $105 million for fiscal year 2008 and $120 million for fiscal year 2009.

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
SUBCOMMITTEE MARKUP
June 21, 2007

H.R. 1933 – *the Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007*

AMENDMENT ROSTER

No.	Sponsor	Description	Results
1	Mr. Udall	Manager's amendment authorizes demonstrations of carbon dioxide capture technologies; authorizes the National Academy of Sciences to review the injection program to ensure its benefits are maximized; authorizes an EPA research program associated with sequestration of greenhouse gases; authorizes appropriations for DOE's fundamental R&D at the laboratory scale; and makes technical and conforming changes.	Agreed to by voice vote.
2	Mr. Costello	Adds a new section authorizing a study by the National Academy of Sciences into workforce and education programs that may be needed to support carbon capture and sequestration and establishes a competitive grant program for higher institutions to support integrated geological carbon sequestration programs and internships in sequestration science.	Agreed to by voice vote.

AMENDMENT TO H.R. 1933

OFFERED BY MR. UDALL OF COLORADO

Page 2, lines 16 and 17, strike "energy systems" and insert "electric power generating systems".

Page 3, lines 6 through 8, strike "ENERGY RESEARCH AND DEVELOPMENT UNDERLYING CARBON CAPTURE AND STORAGE TECHNOLOGIES" and insert "FUNDAMENTAL SCIENCE AND ENERGY RESEARCH AND DEVELOPMENT AND DEMONSTRATION SUPPORTING CARBON CAPTURE AND STORAGE TECHNOLOGIES".

Page 3, line 14, insert ", or convert carbon dioxide into products that lead to overall reduction of carbon dioxide emissions" after "store carbon dioxide".

Page 3, line 20, insert "and carbon use" after "sequestration".

Page 3, line 21, strike "improved" and insert "advanced".

Page 4, lines 1 and 4, redesignate clauses (ii) and (iii) as clauses (iii) and (iv), respectively.

Page 3, after line 23, insert the following new clause:

1 "(ii) development of new or improved
2 technologies that reduce the cost and in-
3 crease the efficacy of the compression of
4 carbon dioxide required for the storage of
5 carbon dioxide;".

Page 4, line 3, strike "and".

Page 4, line 6, strike the period and insert "; and".

Page 4, after line 6, insert the following new clause:

6 "(v) research and development of new
7 and improved technologies for carbon use,
8 including recycling and reuse of carbon di-
9 oxide.".

Page 4, line 19, amend clause (iv) to read as follows:

10 "(iv) deep saline formations;

Page 4, line 24, strike the period and insert "; and".

Page 4, after line 24, insert the following new clause:

11 "(vi) deep geologic systems containing
12 basalt formations.".

Page 5, line 20, strike "and".

Page 6, line 2, strike the period and insert "; and".

Page 6, after line 2, insert the following new clause:

1 "(viii) to support Environmental Pro-
2 tection Agency efforts, in consultation with
3 other agencies, to develop a scientifically
4 sound regulatory framework to enable com-
5 mercial-scale sequestration operations
6 while safeguarding human health and un-
7 derground sources of drinking water.".

Page 6, line 3, insert "SEQUESTRATION" after "LARGE-SCALE".

Page 6, line 7, insert ", not including the FutureGen project," after "sequestration tests".

Page 6, line 20, and page 7, line 1, redesignate paragraphs (4) and (5) as paragraphs (5) and (6), respectively.

Page 6, after line 19, insert the following:

8 "(C) SOURCE OF CARBON DIOXIDE FOR
9 LARGE-SCALE SEQUESTRATION DEMONSTRA-
10 TIONS.—Preference should be given to carbon
11 dioxide captured from coal-fired electric gener-
12 ating plants when practical, but this preference
13 shall not delay the implementation of the large-
14 scale sequestration tests under this paragraph.

1 The Secretary shall also give preference to pur-
2 chases of carbon dioxide at market value from
3 industrial and electric generation coal facilities.
4 To the extent feasible, the Secretary shall pre-
5 fer test projects from industrial and electric
6 generation coal facilities that capture, trans-
7 port, and sequester carbon dioxide in an inte-
8 grated system. Until electric generation coal fa-
9 cilities, either new or existing, are operating
10 with carbon dioxide capture technologies, other
11 sources of carbon dioxide should be pursued
12 under this paragraph.
13 "(D) DEFINITION.—For purposes of this
14 paragraph, the term 'large-scale' means the in-
15 jection of more than 1,000,000 metric tons of
16 carbon dioxide annually, or a scale that demon-
17 strably exceeds the necessary thresholds in key
18 geologic transients to validate the ability con-
19 tinuously to inject quantities on the order of
20 several million metric tons of industrial carbon
21 dioxide annually for a large number of years.
22 "(4) LARGE-SCALE DEMONSTRATION OF CAR-
23 BON DIOXIDE CAPTURE TECHNOLOGIES.—
24 "(A) IN GENERAL.—The Secretary shall
25 carry out at least 3 and no more than 5 dem-

1 onstrations, including, precombustion capture,
2 post-combustion capture, and oxycombustion,
3 for the large-scale capture of carbon dioxide
4 from industrial sources of carbon dioxide, in-
5 cluding facilities that generate electric energy
6 from fossil fuels, refine petroleum, manufacture
7 iron or steel, manufacture cement or cement
8 clinker, manufacture commodity chemicals, and
9 ethanol and fertilizer plants. Consideration may
10 be given to capture of carbon dioxide from in-
11 dustrial facilities and electric generation carbon
12 sources that are near suitable geological res-
13 ervoirs and could continue sequestration.
14 "(B) SCOPE OF AWARD.—An award under
15 this paragraph shall be only for the portion of
16 the project that carries out the large-scale cap-
17 ture (including purification and compression) of
18 carbon dioxide, as well as the cost of transpor-
19 tation and injection of carbon dioxide.

Page 7, line 4, insert ", except that the Federal share of a project under paragraph (4) shall not exceed 50 percent" after "section 988(b)".

Page 7, lines 5 through 10, strike subsection (d) and insert the following new subsection:

"(d) AUTHORIZATION OF APPROPRIATIONS.—

"(1) IN GENERAL.—There are authorized to be appropriated to the Secretary for carrying out this section, other than subsection (c)(4)—

"(A) $240,000,000 for fiscal year 2008;

"(B) $240,000,000 for fiscal year 2009;

"(C) $240,000,000 for fiscal year 2010; and

"(D) $240,000,000 for fiscal year 2011.

"(2) CARBON CAPTURE.—There are authorized to be appropriated to the Secretary for carrying out subsection (c)(4)—

"(A) $180,000,000 for fiscal year 2009;

"(B) $180,000,000 for fiscal year 2010;

"(C) $180,000,000 for fiscal year 2011; and

"(D) $180,000,000 for fiscal year 2012.".

At the end of the bill, add the following new sections:

SEC. 3. REVIEW OF LARGE-SCALE PROGRAMS.

The Secretary of Energy shall enter into an arrangement with the National Academy of Sciences for an independent review and oversight, beginning in 2011, of the programs under section 963(c)(3) and (4) of the Energy Policy Act of 2005, as added by section 2 of this Act, to

1 ensure that the benefits of such programs are maximized.
2 Not later than January 1, 2012, the Secretary shall trans-
3 mit to the Congress a report on the results of such review
4 and oversight.

5 **SEC. 4. SAFETY RESEARCH.**

6 (a) PROGRAM.—The Assistant Administrator for Re-
7 search and Development of the Environmental Protection
8 Agency shall conduct a research program to determine
9 procedures necessary to protect public health, safety, and
10 the environment from impacts that may be associated with
11 capture, injection, and sequestration of greenhouse gases
12 in subterranean reservoirs.

13 (b) AUTHORIZATION OF APPROPRIATIONS.—There
14 are authorized to be appropriated for carrying out this sec-
15 tion $5,000,000 for each fiscal year.

AMENDMENT TO H.R. 1933
OFFERED BY MR. COSTELLO OF ILLINOIS

At the end of the bill, insert the following new section:

1 **SEC. 3. GEOLOGICAL SEQUESTRATION TRAINING AND RE-**
2 **SEARCH.**
3 (a) STUDY.—
4 (1) IN GENERAL.—The Secretary of Energy
5 shall enter into an arrangement with the National
6 Academy of Sciences to undertake a study that—
7 (A) defines an interdisciplinary program in
8 geology, engineering, hydrology, environmental
9 science, and related disciplines that will support
10 the Nation's capability to capture and sequester
11 carbon dioxide from anthropogenic sources;
12 (B) addresses undergraduate and graduate
13 education, especially to help develop graduate
14 level programs of research and instruction that
15 lead to advanced degrees with emphasis on geo-
16 logical sequestration science;
17 (C) develops guidelines for proposals from
18 colleges and universities with substantial capa-
19 bilities in the required disciplines that wish to

1 implement geological sequestration science pro-
2 grams that advance the Nation's capacity to ad-
3 dress carbon management through geological
4 sequestration science; and
5 (D) outlines a budget and recommenda-
6 tions for how much funding will be necessary to
7 establish and carry out the grant program
8 under subsection (b).
9 (2) REPORT.—Not later than 1 year after the
10 date of enactment of this Act, the Secretary of En-
11 ergy shall transmit to the Congress a copy of the re-
12 sults of the study provided by the National Academy
13 of Sciences under paragraph (1).
14 (3) AUTHORIZATION OF APPROPRIATIONS.—
15 There are authorized to be appropriated to the Sec-
16 retary for carrying out this subsection $1,000,000
17 for fiscal year 2008.
18 (b) GRANT PROGRAM.—
19 (1) ESTABLISHMENT.—The Secretary of En-
20 ergy, through the National Energy Technology Lab-
21 oratory, shall establish a competitive grant program
22 through which colleges and universities may apply
23 for and receive 4-year grants for—
24 (A) salary and startup costs for newly des-
25 ignated faculty positions in an integrated geo-

1 logical carbon sequestration science program;
2 and
3 (B) internships for graduate students in
4 geological sequestration science.
5 (2) RENEWAL.—Grants under this subsection
6 shall be renewable for up to 2 additional 3-year
7 terms, based on performance criteria, established by
8 the National Academy of Sciences study conducted
9 under subsection (a), that include the number of
10 graduates of such programs.
11 (3) INTERFACE WITH REGIONAL GEOLOGICAL
12 CARBON SEQUESTRATION PARTNERSHIPS.—To the
13 greatest extent possible, geological carbon sequestra-
14 tion science programs supported under this sub-
15 section shall interface with the research of the Re-
16 gional Carbon Sequestration Partnerships operated
17 by the Department of Energy to provide internships
18 and practical training in carbon capture and geologi-
19 cal sequestration.
20 (4) AUTHORIZATION OF APPROPRIATIONS.—
21 There are authorized to be appropriated to the Sec-
22 retary for carrying out this subsection such sums as
23 may be necessary.

XXIII. PROCEEDINGS OF THE FULL COMMITTEE MARKUP ON H.R. 1933, THE DEPARTMENT OF ENERGY CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 2007

WEDNESDAY, JUNE 27, 2007

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Committee met, pursuant to call, at 10:08 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Bart Gordon [Chairman of the Committee] presiding.

Chairman GORDON. The Committee will come to order.

Pursuant to notice, the Committee on Science and Technology meets to consider the following measures: H.R. 906, the *Global Change Research and Data Management Act of 2007;* H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007;* H.R. 2773, the *Biofuels Research and Development Enhancement Act;* and H.R. 2774, the *Solar Energy Research and Investment Act of 2007.*

I know that we have a lot of other markups going on today, so we are going to try to proceed, but I would like to make a couple of announcements at first. Now, some of the Members have been interested in the trip we are going to be taking, the fact-finding trip we are taking to Greenland the weekend of July the 19th. We should know today about—we have a plane, but we still have concern about in-country travel, because we can't use our plane there, because of the lengths of the runway. We should know more about that today, so we will know the size and the number of folks that we can take.

Also, you have received a letter through your office, but I will remind you, in case you didn't know, that there is going to be a climate change meeting of the UN Framework Convention on Climate Change, the parent body that oversees the Kyoto Protocol. It will be held in Bali from December the 3rd to the 14th. There will be important areas of discussion. It will include carbon sequestration, reforestation, avoiding deforestation, and carbon trading. There will be about 10,000 international delegates there. We will not, or as Members, we will not be a credentialed participant, but we will be able to interact with those folks that are there. We will not be taking a Science Committee group as a whole, but we do have some

slots, I think, that will be made available to us, for individuals that would like to go. But again, when you put 10,000 people there, it is going to be crowded, and so, you need to let us know soon.

And finally, I think that we should all say happy birthday to Margaret today. We congratulate her on surviving one more, and hope there will be more to come.

Mr. LAMPSON. And happy anniversary to you and your wife, Mr. Chairman.

Chairman GORDON. Thank you for reminding me. By the way, from 7:00 to 9:00 will be a good time to call votes, because I am not going to be here tonight.

With concern about global climate change, the high gas and electricity prices, and our growing reliance on unstable energy supplying nations, energy has come to the forefront of our constituents' awareness, and has been placed at the top of the Congressional to-do list. Here, on the Science and Technology Committee, we have responded with an aggressive energy agenda. With the addition of four bills, that we are going to mark up today, this committee will contribute an even dozen pieces of bipartisan legislation that made a vital contribution to the national strategy to put U.S. and the world on track to a more sustainable future.

First, we will consider H.R. 906. Mr. Udall and Mr. Inglis, the Ranking Member of the Energy and Environment Subcommittee and co-sponsor of the bill, have worked together to produce this legislation. H.R. 906 re-orients the U.S. Global Change Research Program to produce more policy relevant climate information for regional, State, and local governments, and other groups.

We will then take up H.R. 1933, by Representative Udall, which sets out the next steps in DOE's carbon mitigation strategies. In addition to ongoing research in carbon management, the bill authorizes DOE to conduct demonstrations on large scale Carbon Capture and Storage technologies, through partnerships with industrial, academic, and government entities. Because we will continue to use our abundant resources of coal to meet our energy needs for the foreseeable future, it is critical that we demonstrate an integrated system of capture, transportation, and storage of carbon dioxide, at a scale that encourages industry to start making technological choices.

Next, the Committee will take up a bill by the Chairman of the Energy and Environment Subcommittee, Representative Nick Lampson. H.R. 2773, the *Biofuels Research and Development Enhancement Act,* will better coordinate and compile information from federal biofuels research programs, and focus biofuels research on infrastructure needs and efficiency of biorefinery technologies. H.R. 2773 also provides for the in depth study of several challenges facing broader of biofuels, and increases the funding levels of biofuels research.

Finally, we will consider H.R. 2774, the *Solar Energy Research and Advancement Act of 2007,* introduced by Congresswoman Giffords. This bill creates an R&D program on energy storage technology for concentrating solar plants, which allows for the use of solar energy, even when the sun isn't shining. It also asks DOE to conduct studies on how to best integrate concentrating solar plants within the grid, and ways to reduce water uses in these plants. In

addition, it creates a workforce training program for solar installation and maintenance, which is critical to making solar power a real energy option across the Nation.

For each of these bills, the Energy and Environment Subcommittee held legislative hearings, had markups, where we heard valuable witness testimony, and facilitated good Member discussions on the barriers and possible pathways to these programs. And as you know, we are not alone in this effort. The Energy and Commerce Committee is marking up a series of bills today, at this very moment, and my friend, Congressman Hall, as well as a few of the folks in the Majority, are on both committees, so we are monitoring that, and if you see a dust cloud here at some point, we will be moving to the other committee to make those votes, but I am sure we will be left in good hands here, and we will continue with this markup.

In conclusion, I want to urge my colleagues to support these bills. I know that the Committee's pace has been very aggressive, and it has been difficult at times for all of us. However, I believe the products that have resulted from this process demonstrate the value of this committee, and its bipartisan work reflects the entire membership.

The bottom line is that we are going to have an energy bill in July. The Science Committee is going to, in a bipartisan way, make a major, major contribution with that. There are going to be several other committees that will have bills. We are going to get a reference from most of those, sequential, which we will also put our mark on. Every bill that has come out of this committee has been bipartisan, all but one. We will see what happens today, but so far, all but one has been unanimous, and so, I think everyone on this committee can go home, and claim a great deal of credit for what I think will be not an enormously comprehensive, but a good bill, a step forward, that will pass by a large margin on the House Floor in July.

So now, I recognize Mr. Hall to present his opening remarks.

[The prepared statement of Chairman Gordon follows:]

PREPARED STATEMENT OF CHAIRMAN BART GORDON

With concerns about global climate change, high gas and electricity prices, and our growing reliance on unstable energy-supplying nations, energy has come to the forefront of our constituents' awareness and has been placed at the top of the Congressional "To-Do" list.

Here on the Science and Technology Committee we have responded with an aggressive energy agenda.

With the addition of the four bills we are marking up today, this committee will contribute an even dozen pieces of legislation that make a vital contribution to the national strategy to put the U.S., and the world, on track to a more sustainable future.

First we will consider H.R. 906. Mr. Udall and Mr. Inglis, the Ranking Member of the Energy and Environment Subcommittee and co-sponsor of the bill, have worked together to produce this legislation.

H.R. 906 re-orients the U.S. Global Change Research Program to produce more policy-relevant climate information for regional, State, and local governments and other user groups.

We will then take up H.R. 1933 by Rep. Udall, which sets out the next steps in DOE's carbon mitigation strategies. In addition to ongoing research in carbon management, the bill authorizes DOE to conduct demonstrations of large-scale carbon capture and storage technologies through partnerships with industrial, academic and government entities.

Because we will continue to use our abundant resources of coal to meet our energy needs for the foreseeable future, it is critical that we demonstrate an integrated system of capture, transportation, and storage of carbon dioxide at a scale that encourages industry to start making technology choices.

Next, the Committee will take up a bill by the Chairman of the Energy & Environment Subcommittee, Rep. Nick Lampson. H.R. 2773, the *Biofuels Research and Development Enhancement Act,* will better coordinate and compile information from federal biofuels research programs and focus biofuels research on infrastructure needs and efficiency of biorefinery technologies.

H.R. 2773 also provides for the in-depth study of several challenges facing broader use of biofuels and increases the funding levels for biofuels research.

Finally, we will consider H.R. 2774, the *Solar Energy Research and Advancement Act of 2007,* introduced by Congresswoman Giffords. This bill creates an R&D program on energy storage technology for concentrating solar power plants, which allows for the use of solar energy even when the sun isn't shining.

It also asks DOE to conduct studies on how to best integrate concentrating solar plants with the grid, and ways to reduce water usage in these plants. In addition, it creates a workforce training program for solar installation and maintenance, which is critical to making solar power a real energy option across the country.

For each of these bills the Energy and Environment Subcommittee held legislative hearings and markups where we heard valuable witness testimony and facilitated good Member discussions on the barriers and possible pathways for these programs.

And, as you all may know, we are not alone in this effort today. The Energy and Commerce Committee is also marking up a series of energy bills and I, along with Ranking Member Hall and a few others, may have to excuse myself for votes in that committee.

In conclusion, I urge my colleagues to support these four bills. I know the Committee's pace has been very aggressive and that has been difficult at times for all of us. However, I believe the products that have resulted from this process demonstrate the value of this committee and its work and it reflects well on the entire membership.

I want to thank all the Members for their cooperation and participation.

Mr. HALL. Thank you, Mr. Chairman, and I will try not to take the full length of time, and make one statement. I will be glad, as I am sure you will and others, when this month passes.

I understand that you and your fellow Chairmen and other Members have been working, I guess, under the usual pressure of this first year, to get and report bills out of the Committee, and sometimes, I fear that when we rush things through, we don't get the best end-product we could have, if we had more time to fully vet the language, but I guess we will be working that as we go.

You have done a good job of working with us, and I thank you for that. While I think improvements in the bill before us today are going to occur through amendments to be offered, I think they could be improved further, and I hope we will have other opportunities to do this, as the bill moves to the Floor. It is also my hope and understanding that, going forward, there will be more of an effort to have both sides working together, as we craft legislation to come before this committee. We will have more time. I think this would improve not only the quality of work we produce, but also, the bipartisan way in which they are handled.

With that said, I support and believe it is important to our country's energy future to keep all options on the table, and we strive to do that with the three energy bills before us. One of our greatest challenges as a Nation is energy self-sufficiency. We need to break our dependence on foreign sources of energy from countries we don't trust and who don't trust us. To do that, we need to be honest and practical about what needs to be done to get to that point.

Solar and biofuels are an important source of domestic energy, but they are also limited in their scope. It is important that we

continue to research and develop the resources we know exist domestically, and currently provide reliable, affordable, and clean sources of energy. I look forward to working with the Committee and working with you, Mr. Chairman, in the months ahead, to address this reality, so that Americans can enjoy more energy choices at a lower cost.

I yield back.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Thank you Mr. Chairman. In the interest of time, I will keep my statement brief and say that I will be glad when this month is over. I understand that you and your fellow Chairmen have been working under pressure from the Speaker to report bills out of committee, but I fear that sometimes when things are rushed through, we don't get the best end-products we could have if we had more time to fully vet the language. While I think there are improvements in the bills before us today with the Subcommittee markup last week and the amendments to be offered today, I think that they could still be improved upon, and I hope that we'll have other opportunities to do so. It is also my hope and understanding that going forward, there will be more of an effort to have both sides working together as we craft legislation to come before the Committee. I think this would improve not only the quality of work we produce, but also the bipartisan way in which they are handled.

With that said, I support what we're doing here today. It's important to our country's energy future to keep all options on table, and we continue to do that with the three energy bills before us.

With that I yield back the balance of my time.

Chairman GORDON. Thank you, Mr. Chairman, or rather, thank you, Mr. Hall.

Let me also say that you may not know, but I met privately and personally with the Republican, both the staff from the Members, as well as the Committee staff the other day, to talk about how we can, you know, do what I think is a good job even better. There were compliments in some areas of the consultation. There were suggestions for improvement in the others. I have asked for them to put together models of how they see things done, and good ways that we have done it, and if we haven't done it as well as we would like, so those kind of models, we are going to continue to work together.

I am a new Chairman, there is a lot of new staff, and we are going to get this thing better and better, as we go along, because I truly believe that more consultation gets us a bipartisan bill, a consensus bill, and we are all going to be better off.

So, does anyone else wish to be recognized?

We will now consider H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007*. I yield to the gentleman from—well, before I yield, let me, I just want to say thank you to Jean Fruci for her staff work on this. It was given as an illustration to us as the best practices, in terms of collaboration and so, thank you for that work.

We will now consider H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007*. I yield to the gentleman from Colorado five minutes to describe his bill.

Mr. UDALL. Thank you, Chairman Gordon, for bringing this bill up for markup today.

Coal has been an important source for energy in our country since the Industrial Revolution. Today, coal generates more than 50

percent of our electric power, and as the country with the largest coal reserves in the world, the U.S. will continue to use this plentiful energy source for years to come. Unfortunately, coal burning plants are also a major source of greenhouse gas emissions and other pollutants. As we confront concerns over climate change, one of the greatest challenges we face is how to lower our carbon dioxide emissions, while maintaining our strong economy at the American way of life.

Carbon Capture and Storage (CCS) technology will be critical to addressing that challenge, but we need to work together to fully advance these CCS technologies, and that is why I introduced H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007.*

The legislation will expand and improve the Department of Energy's carbon capture and storage research and demonstration program. It will authorize two separate demonstration programs, with up to five demonstrations for carbon capture, and up to seven demonstrations for large scale carbon dioxide injection and storage.

The storage demonstrations will require a range of geologic settings, to ensure that we are exploring a variety of options, and will include research and development of monitoring and verification systems to determine whether CO_2 is leaking back into the atmosphere or our drinking water supply.

The bill recognizes that demonstrating an integrated CCS system is critical to developing a commercial application system to sequester large amounts of carbon dioxide, but the bill also recognizes that R&D efforts on each cannon should proceed independently until the technology is ready to be integrated.

The language in this bill is based in large part upon the recommendations included in an interdisciplinary study by the Massachusetts Institute of Technology, named *The Future of Coal,* which was released earlier this year. In working to improve the bill, my staff and the Committee staff worked with many stakeholders, including representatives from the coal industry and the environmental community.

We must begin to address the climate change challenge, but we must not cause irreparable harm to our economy and our coal industry in the process. Creating safe, sound, and economical capture and storage strategies is the key, and H.R. 1933 will help get us there.

I would ask my colleagues to support this important legislation, and it is now my pleasure to yield to Chairman Gordon my remaining time.

[The prepared statement of Mr. Udall follows:]

PREPARED STATEMENT OF REPRESENTATIVE MARK UDALL

Thank you, Chairman Gordon, for bringing this bill up for markup today.

Coal has been an important energy source in our country since the Industrial Revolution. Today, coal generates more than 50 percent of our electric power. As the country with the largest coal reserves in the world, the U.S. will continue to use this plentiful energy source for years to come.

Unfortunately, coal burning power plants are also a major source of greenhouse gas emissions and other pollutants. As we confront concerns over climate change, one of the greatest challenges we face is how to lower our carbon dioxide emissions while maintaining our strong economy and the American way of life.

Carbon capture and storage technology will be critical to addressing that challenge, but we need to work together to fully advance these CCS technologies. That's why I introduced H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007.*

This legislation will expand and improve the Department of Energy's carbon capture and storage research and demonstration program. It will authorize two separate demonstration programs, with up to five demonstrations for carbon capture and up to seven demonstrations for large-scale carbon dioxide injection and storage.

The storage demonstrations will require a range of geologic settings to ensure that we are exploring a variety of options and will include research and development of monitoring and verification systems to determine whether CO_2 is leaking back into the atmosphere or our drinking water supply.

The bill recognizes that demonstrating an integrated CCS system is critical to developing a commercial application system to sequester large amounts of carbon dioxide—but the bill also recognizes that the R&D efforts on each can and should proceed independently until the technology is ready to be integrated.

The language in this bill is based in large part upon the recommendations included in an interdisciplinary study by the Massachusetts Institute of Technology, *The Future of Coal,* which was released earlier this year. In working to improve the bill, my staff worked with many stakeholders, including representatives from the coal industry and the environmental community.

We must begin to address the climate change challenge, but we must not cause irreparable harm to our economy and our coal industry in the process. Creating safe, sound and economical capture and storage strategies is the key—and H.R. 1933 will help us get there.

I ask my colleagues to support this important legislation.

Now, I would like to yield to Chairman Gordon.

Chairman GORDON. Thank you, Mr. Udall. Let me thank you for, really, the good work you have put into this legislation.

Coal is our most abundant domestic fossil fuel, and without it, literally, the lights will go out over most of the country. Electric utilities across our nation and throughout the world use coal, and will continue to use coal. Therefore, it is essential that we develop carbon capture techniques that will safely sequester carbon production as a byproduct of coal combustion.

And I know there are a number of Members on both sides of the aisle who have strong interest in conversion of coal to liquids as one solution to reducing our dependency on foreign sources. And let me say that, following up on Mr. Ehlers' comments earlier, this is an expensive venture, and following up on Mr. Hall's comments of earlier, of not doing something before it is ready.

I have real concern that we are not ready, this issue is not ripe, in terms of the coal-to-liquid. We have had some informal, both Member meetings, as well as staff meetings, headed really by Jerry Costello, who has a strong interest in this issue, to learn more about it. We are going to have additional hearings in the fall on the coal-to-liquid issue. I really don't think that this is appropriate now, and I think that if we try to insert an area or an amendment at this time, it will only cause problems for a good bill on sequestration. And as a practical matter, I think it is going to be difficult to have a successful coal-to-liquid program without a good sequestration aspect to it. I think we can do it today. Coal-to-liquid is not ripe, and for that reason, I would hope that we would not pass any amendment that would cause a problem for this one.

And with that, I am, again, I will now ask if anyone else, Dr. Ehlers, is recognized for five minutes.

Mr. EHLERS. Thank you, Mr. Chairman. Earlier this morning, as you mentioned, I gave a magnificent statement about the difficulty of coal, carbon sequestration. Unfortunately, I had not emerged

from my morning stupor and did not realize that the Majority had cleverly switched the order on the agenda, so I ask unanimous consent that my earlier statement be entered in the discussion of this bill, rather than the discussion of the previous bill, which we took up.

Chairman GORDON. Certainly. And Dr. Ehlers, I think everyone knew what the intent of your comments, and your comments, and where they were directed. So, certainly, the unanimous consent is accepted.

Mr. EHLERS. Well, if they noticed that, they probably emerged from their stupor before I did. Thank you very much.

Chairman GORDON. Would you like to continue, reiterate that statement, now that we are here on the bill, and there might be new people here?

Mr. EHLERS. No, if we can just put my statement at the appropriate place in the record. I was just pointing out that carbon sequestration is going to be extremely difficult, and especially, very difficult to make it economically feasible, and that also avoids the major source of carbon, which is the transportation sector.

But for the details, you can go back to my earlier statement. Thank you.

[Mr. Ehlers' earlier statement follows:]

Just a comment, and this is not intended to be negative about the bill, but I think we have to realize that carbon sequestration has very serious limits.

First of all, it is virtually impossible to use it to apply to the transportation sector, which is probably the largest single sector generating carbon dioxide. Secondly, I suspect serious efforts at carbon sequestration are going to be so expensive it is certainly going to make nuclear energy look much more palatable to most people for producing electricity, and that immediately removes a major source of carbon dioxide.

So, I don't want to throw a cloud over this issue, particularly a CO cloud, but I think we have to keep in mind the broad picture that this is going to be a very difficult issue, and although this bill is a good thing to do, don't expect it to solve very many problems.

Thank you.

Chairman GORDON. Without objection, Mr. Hall is recognized.

Mr. HALL. Mr. Chairman, I thank Mr. Udall for introducing the bill. If we are going to continue to use coal, which is our most abundant and affordable domestic resource, our companies that keep this country powered and running are going to need the technology to enable them to capture carbon dioxide and then sequester it.

I would just like to take this opportunity to applaud DOE and the FutureGen Alliance in their continued work on this front. With that, I yield back the balance of my time.

Chairman GORDON. Mr. Costello is recognized.

Mr. COSTELLO. Mr. Chairman, thank you, and Mr. Chairman, let me associate myself with the comments made by Ranking Member Hall concerning the FutureGen Alliance and the FutureGen Program. As you know, both on this committee and other committees in the House, I have strongly supported the FutureGen Project. I think it is a worthwhile project, and I was pleased to see the Administration, their initiative on FutureGen, as well as their commitment on funding for the FutureGen Project.

Let me also associate myself with your remarks concerning both sequestration and coal to liquids. I think everyone is aware that

the leadership in the House has made it clear that coal-to-liquid technology will not be a part of the energy package that will be presented and considered in the House in July.

I am disappointed, frankly, that we are not acting on coal to liquids now. However, I have been meeting with both Chairman Dingell and the Subcommittee Chairman, Chairman Boucher, concerning our commitment to coal to liquids, and we believe that we have a commitment, both from the leadership and from various Committee Chairs in the House, to move forward with a coal-to-liquid initiative later in the year, and I am pleased, Chairman, that you have also made a commitment to work with us on the coal-to-liquid technology in the future.

So, I will associate myself with your remarks, and just say that we all know there is no substitute for coal for the next 25 years or so. I have talked about the difference in cost of using coal versus using natural gas and oil, and what we need to do is to continue to look ahead, to determine how we can enhance the use of coal in a responsible, environmentally friendly way. So, I thank you for your commitment to work with us, both on carbon sequestration and coal to liquids in the future, and we will defer this fight on coal to liquids to another date in the fall.

Chairman GORDON. Hopefully, it won't be a fight. It will be a consensus that we could bring together through more hearings, more information.

Mr. Akin is recognized.

Mr. AKIN. Thank you, Mr. Chairman.

Just not to raise a big squalling fit here or anything, but my sense is that we would be wise, particularly when we are looking at research that we don't know how much things are going to be costing, or how the numbers work out, not to try to choose favorites. I think that that has been a strength of this committee, that we have not chosen favorites. So, we say hey, there is a place for nukes, there is a place for coal, there is a place for solar energy, a place for conservation. I think that that is a strength, because that allows the economy to work, and to choose their own favorites, maybe depending on the region, or depending on different technologies as they develop over time.

I am a little concerned, Mr. Chairman, that what you are doing with this legislation is you are picking favorites. You are saying we like the sequestration, but we don't like liquefaction. Both of those technologies are pretty far out. Both of them appear to be very expensive, but it seems to me we would do better to proceed on a broad front, rather than to try to pick favorites.

I do appreciate the fact that you are willing to look at the liquefaction later in the year, though. Thank you.

Chairman GORDON. Thank you, Mr. Akin. Well, actually, we are following your advice. This bill does not pick favorites. That is why we are not getting into coal to liquids. You will find that sequestration is the foundation of any type of new coal technology. And so, this is a favorite neutral bill. It is developing right now only the base types of research technology that is necessary for any kind of coal use. At a later date, when we start getting more information, then we can get more specific, if we think so. But right now, this is not picking winners or losers.

Does anyone——

Mr. AKIN. Mr. Chairman, do you yield?

Chairman GORDON. Oh, certainly. Yes. Yes.

Mr. AKIN. Because just from an engineering point of view, I am not quite getting what you are saying. If you are taking the coal, and you are going to take the CO_2, you get energy from combining the coal with oxygen. Then, you are going to pump that under the ground.

Now, that isn't the same technology as taking coal, liquefying it, and then burning it somewhere, because then, you would have to pump the CO_2 that comes out of whatever burned it into the ground. So, I don't understand—it doesn't seem to me that sequestration is a step before liquefaction. That doesn't make sense to me.

Chairman GORDON. Not a step before, but a step that goes with. You are not going to see, I don't think, any type of coal-to-liquid process that doesn't have a parallel sequestration element to it.

Mr. AKIN. So, are you saying we are going to have every car that burns some type of liquid, is going to capture the CO_2——

Chairman GORDON. No, I am——

Mr. AKIN.—that is coming out of the tailpipe, and pump that into the ground?

Chairman GORDON. No, the process of going coal-to-liquid will have a sequestration element to that.

Mr. AKIN. I am not sure about the science of that, but thank you anyway for——

Chairman GORDON. Mr. Rohrabacher was, I think, the next to have his hand up, followed by Mr. Bartlett.

Mr. ROHRABACHER. Thank you very much, and I certainly believe that we should be doing what we can to ensure that our coal reserves are part of America's energy future.

However, what we are doing today goes in exactly the opposite and wrong direction. This is aimed—and this is one of the reasons those of us who are so adamant in our opposition to this theory that humankind is causing the climate to change, this is a perfect example of the harm that is being done by the perpetuation of that false theory.

We are fixating ourselves on CO. When we look at coal, when we should be looking at coal, we should be looking at the byproducts that are harmful to human beings. Now, whether it is methane or whether it is the particulates, or whatever comes out of using coal that hurts human beings, that is what we should be focusing on.

Instead, what we are doing, as we are today, is we are focusing on a way to eliminate the coal emission of CO_2. CO_2, which is the basis, of course, this theory that we have too much CO_2 and it is changing the climate, so we fix on that, and we leave the health of human beings behind. And just to point out what I consider to be the absurdity of it all, is CO has never been identified by any source, by any recognizable scientific source, as a threat to the health of human beings, ever. CO_2, in fact, is plant food. The more CO_2 that is in the air, it is good for plants. It actually causes the plants to grow more robustly. Over the world's history, there have been time periods when there is more CO_2 in the air, and the CO_2 that is in the air, let us note this, that if you imagine a football field, the amount of CO_2 in the air is the equivalent of six inches

on the football field. The amount of human contribution to that six inches of the football field is about one half of an inch.

Now, this minuscule amount that is going on, in terms of CO_2, with no discernible impact on the health of human beings, is not what we should be looking at. We want to use coal. We want to make sure we are energy independent, but by spending money, focusing on sequestering CO_2, is exactly the wrong direction to go.

Let me note also that there are ample scientists, from MIT and from major universities throughout the world, who suggest that human beings, you know, yes, we are producing CO_2, but the CO_2 is produced overwhelmingly by nature, and that the warming that has taken place in the last 150 years, which many of us believe is a natural trend caused by the solar activity, as is going on on Mars and all the other planets, that that CO_2 that is being produced is not, of course, a product of global warming, it is being produced by other things, but that more CO_2 happens after warming, rather than creating the warming. And there are a number of major scientists who have pointed this out, and have not been refuted by the scientific community.

So, this particular legislation, which of course we are being told will help us utilize our coal, which I think we should, is exactly going in the wrong direction, and this should be defeated. It is a waste of money, and it is harmful to the health of human beings. While focusing on an idea that we are changing the climate of the planet with CO_2, which is, of course, refuted by very, very prominent scientific authorities.

Thank you very much.

Chairman GORDON. Mr. Bartlett is recognized.

Mr. BARTLETT. Thank you very much, Mr. Chairman. I am an enthusiastic supporter of this bill, but I would like to inject a word of caution, that we not be overly enthusiastic about the contribution that coal will make to our energy future.

It is true we have 250 years of coal at current use rates. If you increase the rate of use only two percent, which doubles by the way in 35 years, four times bigger in 70 years, eight times bigger in 105 years, then that 250 years of coal, that only two percent increase in use rate, shrinks to 85 years. If we now do what Mr. Costello would like to do, and what we will be doing in the future, and convert that to a liquid or to a gas, we will need energy to do that. If you take that energy from the coal to do that, now you have reduced it to 50 years, and if we share this with the world, and today, it is inevitable. There is no way not to share energy with the world, because it moves on a world market, then it shrinks to 12.5 years. So our 250 years of coal at current use rates, if you increase its use only two percent, convert it to a gas or a liquid, and share it, as we must, with the world, that shrinks to 12.5 years.

I am a very enthusiastic supporter of this bill, but I didn't want us to have the illusion that if we are able to sequester CO_2, and therefore, can use coal widely, that that will be the solution to our energy future. It will make a valuable contribution, but a limited contribution.

Thank you.

Mr. UDALL. Mr. Chairman, I do have a manager's amendment pending, but I would say to the gentleman from California, my

good friend, Mr. Rohrabacher, that we will continue to disagree on the utility and the reach of climate change theory, but when we capture carbon, as I understand it, we capture many of the other harmful elements that are present in coal as a solid, whether it be mercury, SO_X, NO_2, and other elements that are harmful to human health, so there is a collateral benefit when we capture carbon, and then sequester what we have captured.

So, I think, in that sense, what we are attempting to do makes good sense when it comes to human health. I would be happy to yield to the gentleman.

Mr. ROHRABACHER. Would the gentleman yield for a question, or would the gentleman yield?

Mr. UDALL. I would be happy to yield to the gentleman.

Mr. ROHRABACHER. To the degree that what you have just stated would be the focus, is to the degree that I could be supportive of what we are trying to do here. To the degree that we are looking at things that will be harmful to people's health, you know, children are going to be breathing this air their whole life, the things that we are putting in the air right now. If the things that you just stated were the target, I would be much more supportive, I would be very supportive of what we are trying to do.

It seems to me that, however, we are just playing into a popular, you know, item of the day, with CO_2, and we do that at the expense of people's health. But however, if we can do both, I would be happy to hear that.

Mr. UDALL. Reclaiming my time. I am certainly a proponent of the no regrets approach to climate change, which is we ought to do all we can now to deal with what we think, and again, I think you and I have a fundamental difference of opinion here, what is a changing climate, and in the process, we generate collateral benefits.

One of the interesting ones that I have heard recently, and I look certainly to your right and further to your right, not politically speaking, but on the dais, Mr. Bartlett and Mr. Ehlers, that there are new liquid fuel technologies that, in effect, capture carbon, and then, that carbon can be used, it is a solid carbon, it is char, can be used to fertilize, and to be part of the agricultural cycle, so that we also, as you know, are very indebted to petroleum products for fertilizer and for production of food in this country.

So, there are some very interesting technologies that I think will emerge——

Mr. ROHRABACHER. Will the gentleman yield for just one moment?

Mr. UDALL. I would be happy to yield.

Mr. ROHRABACHER. So, we are going to be eating it rather than breathing it, and again, indicates that it is not harmful to your health, and I would suggest that is very, coal sequestration is extremely expensive, compared to trying to focus on these other alternatives, which I say, if you are an environmentalist, we want to watch out for the environment so people will live better. I agree with those type of environmentalists, and——

Mr. UDALL. Reclaiming my time. It has been suggested, Mr. Rohrabacher, that human beings are temporary carbon sinks, so

perhaps, that is a reason to eat additional carbon. I don't know. You may have to further study that particular situation.

But Mr. Chairman, we could probably continue this discussion, but I think it would be useful to yield back the remainder of my time.

Chairman GORDON. Thank you, Mr. Udall. I recognize that Mr. Rohrabacher is the father of triplets, and certainly, is concerned about their health, as we are about all of our children's health. The good news is, that this is one of four bills we are having today. We are not just focused solely on this issue. We are going to be talking about biofuels and solar and other types of area that will be good for those triplets that we all want to see grow up well.

So, if there is no other discussion, I ask unanimous consent that the bill is considered as read and open to amendment at any point, and that the Members proceed with the amendments in the order of the roster. Without objection, so ordered.

The first amendment on the roster is a manager's amendment, offered by the gentleman from Colorado, Mr. Udall. Are you ready to proceed with your amendment?

Mr. UDALL. Mr. Chairman, I do have an amendment at the desk.

Chairman GORDON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933, offered by Mr. Udall of Colorado.

Chairman GORDON. I ask unanimous consent to dispense with the reading, and without objection, so ordered.

The gentleman is recognized for five minutes to explain his amendment.

Mr. UDALL. Thank you, Mr. Chairman. I will do my best to be brief here.

There are a number of technical changes that are included in the manager's amendment. I didn't want to go through those, but I wanted to give a brief description of the substantive change to the carbon dioxide capture demonstration program, and I wanted also to clarify the funding levels for the programs in the bill, although I would point out that we have not changed the funding levels.

The amendment, manager's amendment, as a provision of the carbon dioxide capture demonstration section of the bill, to authorize the Secretary of Energy to take actions needed to further integrate the carbon dioxide capture demonstrations with the DOE's large scale CO_2 sequestration program.

Now, this provision comes from discussions with industry and environmental interests, and is intended to encourage the use of CO_2 captured in the demonstrations to supply the large volumes of CO_2 required under the sequestration demonstration program. And I would further add that this provision builds on MIT's report, *The Future of Coal,* that recommends that the U.S. should establish programs to provide operational experience with an integrated system of capture, transportation, and storage. H.R. 1933 moves us toward that goal.

And then, in addition, because we received some questions about the funding levels for basic R&D in the bill, my amendment breaks out the funding categories, and let me just outline those. The basic R&D and field testing would be authorized at $100 million for each of Fiscal Years 2008 through 2011, the carbon sequestration dem-

onstration program is funded at $140 million for each of the Fiscal Years 2008 to 2011, and the carbon dioxide capture demonstration program is funded at $180 million for each of the Fiscal Years from 2009 to 2012.

Again, Mr. Chairman, I want to thank you for moving this important legislation forward, and for co-sponsoring H.R. 1933. Obviously, I think the amendment, the manager's amendment, improves the bill, and I would urge my colleagues to support it.

Chairman GORDON. Is there further discussion on the amendment? If no, the motion is on the amendment. All in favor say aye. Opposed, no. The ayes have it. The amendment is agreed to.

The second amendment on the roster is offered by the gentleman from Utah, Mr. Matheson. Are you ready to proceed with your amendment?

Mr. MATHESON. I am ready, Mr. Chairman. I have an amendment at the desk.

Chairman GORDON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933, offered by Mr. Matheson of Utah.

Chairman GORDON. I ask unanimous consent to dispense with the reading. Without objection, so ordered.

The gentleman is recognized for five minutes to explain his amendment.

Mr. MATHESON. Thank you, Mr. Chairman.

This will be a brief explanation. This amendment is more of a clarification to make sure we consider eligibility for different opportunities for geologic formations for sequestration.

The main candidate, I believe, for sequestration, is going to be depleted oil and gas fields, and there are some unique geologic characteristics to those that are located in high altitude areas. Since I come from the Rocky Mountains, which is a longstanding oil and gas producing region of the country, I thought it was important that we just include an amendment to this legislation that just expands the eligibility for a high altitude oil and gas field to be considered for the testing program. This isn't a mandate, but it just includes that eligibility.

I just thought it would be helpful to clarify that in the legislation, and that is it, Mr. Chairman. If there is anyone who wants to discuss it, otherwise, I will just yield back the balance of my time.

Chairman GORDON. Thank you, Mr. Matheson.

You know, this is again, this is another example of why work by committee is better than work by a few. Mr. Hall just thinks that you get oil and gas from the plains, and didn't think about how altitude, and so, you bring a whole new dimension to this, and again, you make this bill a better bill. Does anyone else wish to be recognized?

If there is no further discussion on the amendment, the vote occurs on the amendment. All in favor, say aye. Aye. Opposed, no. The ayes have it. The amendment is agreed to.

The third amendment on the roster is offered by the gentleman from Arkansas, Mr. Ross. Are you ready to proceed with your amendment?

Mr. ROSS. Mr. Chairman, I have an amendment at the desk.

Chairman GORDON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933, offered by Mr. Ross of Arkansas.

Chairman GORDON. I ask unanimous consent to dispense with the reading. Without objection, so ordered.

The gentleman is recognized for five minutes to explain his amendment.

Mr. ROSS. Mr. Chairman, I want to thank you for bringing the Committee together today to consider this important legislation that provides federal support for the Department of Energy's research and development programs for Carbon Capture and Storage technology.

I think we all know that we have about a 250 year supply of coal in America. There is a lot of debate over whether we will ever be able to fully utilize that in an environmentally friendly manner. I am not here to debate the aspects of that today. I will say this, that the Fayetteville Shale, which is a natural gas find in Arkansas, that is going to surpass the Barnett Shale in Texas in size, no one knew it existed 50 years ago, 20 years ago we couldn't have recovered it in a environmentally friendly manner, 10 years ago, it was too costly to recover, and now, a lot of folks in Arkansas that grew up with very little are making a lot of money as a result of that Fayetteville Shale.

My hope is that over the next years, we will be able to do the same thing with coal, finding a way, not utilizing 1940 or 1950 technology, but utilizing 21st Century technology, to be able to utilize it an environmentally friendly manner, which helps make our nation more energy independent.

My amendment simply does this. It works to help our nation achieve this goal by establishing a research and development grant program for universities and colleges to research Carbon Capture and Sequestration, in conjunction with enhanced oil and mineral recovery.

The amendment authorizes $10 million for the Secretary of Energy to award five grants competitively for projects submitted by universities to research Carbon Capture and Storage, in combination with enhanced oil recovery. This study will help us to determine whether, by injecting and storing the CO_2 underground, can we do that and recover significant quantities of domestic oil, all while addressing global warming.

This amendment will provide universities the tools to research and develop ways to see if, in fact, this can work, and can lead to an environmentally friendly way to utilize the 250 year supply of coal we have in this country. The amendment also designates that at least two of the grants should go to rural or agricultural-based institutions that offer programs in the environmental sciences, to promote diversity among the projects, and ensure that any environmental impacts of this technology are thoroughly examined. Additionally, the reason for this, most coal mines that we know about are not in urban areas. They are in rural areas.

As our nation looks for new sources of energy, I don't believe that we can forget about those that we currently possess. This amendment will simply allow research and development to occur in colleges and universities, to be awarded by the Department of Energy

in a competitive manner, to hopefully find ways to use coal in an environmentally friendly manner, and making America more energy independent.

And with that, Mr. Chairman, I would, that explains my amendment.

Chairman GORDON. Mr. Ross. Does Mr. Hall or anyone else from the Texas delegation wish to respond to the slur of Mr. Ross on the size of Texas?

Mr. HALL. Would the gentleman yield?

Mr. ROSS. Yes.

Mr. HALL. Well, Mr. Ross and I share Texarkana, and while he has a lot of Arkansans who are on the Texas side, I have a lot Texans who are on the Arkansas side. And I hope Mr. Ross doesn't forget that. And my mother was born in Cave City, and I have a good many people that vote in your district. Up to now, they have all voted for you, Mr. Ross.

Chairman GORDON. Let us just say that Arkansas and Texas both share a large portfolio there.

Is there further discussion on the amendment? If no, the vote occurs on the amendment. All in favor, say aye. Opposed, no. The ayes have it. The amendment is agreed to.

The fourth amendment on the roster is offered by the gentlelady from Texas, Ms. Johnson. Are you ready to proceed with your amendment?

Ms. JOHNSON. Thank you, Mr. Chairman. I am ready to proceed. My amendment is at the desk.

Chairman GORDON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933, offered by Ms. Eddie Bernice Johnson of Texas.

Chairman GORDON. I ask unanimous consent to dispense with the reading. Without objection, so ordered.

The gentlelady is recognized for five minutes to explain her amendment.

Ms. JOHNSON. Thank you, Mr. Chairman, for considering this amendment.

Fossil fueled power with electric plants are one of the largest sources of carbon dioxide emissions in the United States, responsible for roughly 40 percent of our country's overall greenhouse gas emissions.

In order to continue using our large supplies of coal and other fossil fuels to power our economy in a carbon constrained world, we must learn to capture the CO_2 emissions from fossil fuel powered electric plants. For this reason, my amendment would revise the bill to place special emphasis on demonstration projects to capture CO_2 from these plants, as opposed to other facilities. I know these plants oh so well. We have got plenty of them up in our area.

The amendment focuses on a new demonstration grant program to develop technologies to capture carbon dioxide emissions from electric power plants. It would require at least two of the projects that demonstrate capture technology to take place at the fossil fuel powered electric facilities. This amendment would ensure that our attention is concentrated on the areas of greatest opportunity, so that we can leverage the lessons learned to have the greatest pos-

sible positive impact throughout our nation's power production system.

I would like to thank the Subcommittee Chair, Mr. Udall, for his collaboration in devising this amendment, and urge my colleagues to support it.

Thank you. I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you, Mr. Chairman, for my amendment to H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007.*

Fossil fuel-powered electric plants are one of the largest sources of carbon dioxide emissions in the United States, responsible for roughly 40 percent of our country's overall greenhouse gas emissions.

In order to continue using our large supplies of coal and other fossil fuels to power our economy in a carbon constrained world, we must learn to capture the CO_2 emissions from fossil fuel powered electric plants.

For this reason, my amendment would revise the bill to place special emphasis on demonstration projects to capture CO_2 from these plants, as opposed to other facilities.

The amendment focuses on a new demonstration grant program to develop technologies to capture carbon dioxide emissions from electric power plants.

It would require at least two of the projects that demonstrate capture technology to take place at fossil-fuel powered electric facilities.

This amendment will ensure that our attention is concentrated on the area of greatest opportunity so that we can leverage the lessons learned to have the greatest possible positive impact throughout our nation's power production system.

I would like to thank Subcommittee Chairman Udall for his collaboration in devising this amendment and urge my colleagues to support it.

I yield back.

Chairman GORDON. Thank you, Ms. Johnson. Any other discussion?

Mr. BILBRAY. Mr. Chairman.

Chairman GORDON. Mr. Bilbray is recognized.

Mr. BILBRAY. Mr. Chairman, I speak in support of the amendment.

And let me just say that I think we look at the history of emission reductions in the last 40, 50 years in this country, and there has been so much talk about mobile sources, automobile emissions, but where the great breakthroughs have happened, the most cost-effective reduction in emissions across this country have been on stationary sources, and stationary sources are the low lying fruit. It is where we should aim for first. It is where we are going to get the biggest bang for the buck, and I would strongly support that we focus on the electric generation facilities, because that is where we going to find the best and the easiest place to make the big improvements, and be not diverted away over on a lot of these mobile sources, that look sexy, but are not going to have the impact in the reductions available that we are going to see in a very short time for stationary sources.

So, I would support the gentlelady's amendment, and I yield back.

Chairman GORDON. Is there further discussion on the amendment? If no, the vote occurs on the amendment. All in favor, say aye. Aye. Opposed, no. The ayes have it. The amendment is agreed to.

The fifth amendment on the roster is offered by the gentleman from Texas, Mr. McCaul. Are you ready to proceed with your amendment?

Mr. MCCAUL. I am, Mr. Chairman. I have an amendment at the desk.

Chairman GORDON. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 1933, offered by Mr. McCaul of Texas.

Chairman GORDON. I ask unanimous consent to dispense with the reading. Without objection, so ordered.

The gentleman is recognized for five minutes to explain his amendment.

Mr. MCCAUL. Thank you, Mr. Chairman. I applaud your efforts on Carbon Capture and Sequestration on this bill.

As Lamar Smith and I know, the University of Texas has been very engaged in this area in research and development. I think it is a very promising area. My amendment clarifies, by adding Coal-To-Liquid (CTL) facilities to the list of facilities that are eligible for the large scale carbon sequestration demonstrations provided for in this bill.

Although there are currently no coal-to-liquid facilities operating in the United States currently, the Department of Energy has informed us that there are at least 16 of these plants being planned by companies, local governments, and Indian tribes. When these facilities become operational, they will naturally become sources of carbon dioxide emissions, and it seems to me if they are going to be emitting carbon dioxide, we ought to be capturing that as well.

Adding Carbon Capture and Sequestration technology could cut these carbon emissions from these facilities almost in half, which would put them in line with the emissions from petroleum-based diesel. The bill before us right now is intended to study the challenges, and develop technology related to safe, large scale sequestration of CO_2. With these new CTL facilities already being planned, it makes good sense to me to add these new sources of large scale CO_2 emissions to the list of sources that qualify for the study under this bill.

And as the Chairman pointed out, this bill should apply to any type of coal use, and I think that would also apply on coal-to-liquid. This is good for human health, as one of the other Members stated earlier. As I look at the definition in the bill, it talks about facilities, and it says consideration must be given to the capture of carbon dioxide from industrial facilities.

It seems to me that a coal-to-liquid facility already falls under this definition in the reading of this bill, and the bill does go further to delineate specific facilities it should apply to, such as electric energy from fossil fuels, refining petroleum, manufacturing iron and steel, manufacturing cement, and chemicals, ethanol, and fertilizer plants. So it seems to me that this simply clarifies the bill, and makes clear that the coal-to-liquid facilities, which are going to built, and which will be emitting carbon dioxide, will be able to capture that carbon dioxide, and protect human health, and further this program.

And with that, I yield back.

Chairman GORDON. Thank you. Let me say to Mr. McCaul, I know this is a very thoughtful amendment, and as I had mentioned earlier, though, we have started the process of trying to educate ourselves more on the coal-to-liquid issue.

I simply think we are not there yet to develop what I would call a consensus and a really thoughtful position here. We are going to have additional hearings, gather more information in the fall. Hopefully, we then, can again bring that consensus around, and I think that your amendment is premature at this time, and would hope that again, the information that we learn from this sequestration will be something that will be what you might call technique neutral, in terms of whatever the use for coal might be in the future.

Mr. HALL. Mr. Chairman. Go ahead.

Chairman GORDON. Well, I guess we should go to Mr. Hall first.

Mr. HALL. I will be very brief.

I think this could help the Chairman and others on that side with their education, maybe just call this a little summer course, you know, getting a head start.

I think it is a good amendment, and briefly, we are going to support it over here. We wish you would accept it, but if you can't accept it, then we will accept the challenge of change.

Chairman GORDON. Mr. Udall is recognized.

Mr. UDALL. Thank you, Mr. Chairman. Judge Hall, I think perhaps we are going to have to forego summer school, but maybe we can pick this up when first semester starts in the fall, is what I heard the Chairman suggesting.

I just want to associate myself with the Chairman's remarks. CTL remains experimental technology, but as we have, I think, made the case, and MIT, in particular, made the case, the need for carbon sequestration technology is much more urgent, and the Chairman underscored that we will address CTL, and I wanted to commend my good friend from Texas, Mr. McCaul, for his interest in this area, and I know we will take the time to better understand how we could apply these technologies at some other time.

But in the context of this piece of legislation, I would urge my colleagues to oppose the amendment. Somewhat reluctantly, but nonetheless, I would ask you to oppose it.

Mr. MATHESON. Mr. Chairman.

Chairman GORDON. Mr. Matheson.

Mr. MATHESON. Move to strike.

Mr. Chairman, I would just like to say that I do think this is an important issue, and I do look forward to this committee taking on a robust effort, as you have discussed, in terms of really studying this issue, because I do think there is interest on both sides of the aisle, to see if we can make this technology work.

I share a lot of the interest that Mr. McCaul has in submitting this amendment, and so, I just appreciate your statement, that you want to take this on in a robust way , and have this committee really dive into this issue, and I think there is interest on both sides of the aisle to really dive in.

Chairman GORDON. If the gentleman would yield.

Mr. MATHESON. Yes.

Chairman GORDON. This committee has not been shy this year in trying to be aggressive in a lot of areas. Mr. Costello came to me earlier this year, and said that he would like for the Science Committee to take the lead in letting Resources, Energy and Commerce, to join us, in terms of a variety of hearings.

We started the process earlier. You know, I think, I believe we are the only committee that has had any kind of hearings, formally or informally, on this issue. And I am not sure where it is going, but I want the Science Committee to be on top of it, and we will take that lead this fall.

Does anyone else wish to be recognized? If not, the vote is on the amendment. All in favor, say aye. Opposed, nay. Nay. In the opinion of the Chair, the nays have it.

Mr. MCCAUL. Mr. Chairman, I ask for recorded vote.

Chairman GORDON. The Clerk will call the roll.

The CLERK. Chairman Gordon.

Chairman GORDON. No.

The CLERK. Chairman Gordon votes no. Mr. Costello.

Mr. COSTELLO. No.

The CLERK. Mr. Costello votes no. Ms. Johnson.

Ms. JOHNSON. No.

The CLERK. Ms. Johnson votes no. Ms. Woolsey.

Ms. WOOLSEY. No.

The CLERK. Ms. Woolsey votes no. Mr. Udall.

Mr. UDALL. No.

The CLERK. Mr. Udall votes no. Mr. Wu.

Mr. WU. No.

The CLERK. Mr. Wu votes no. Mr. Baird.

[No response.]

The CLERK. Mr. Miller.

Mr. MILLER. No.

The CLERK. Mr. Miller votes no. Mr. Lipinski.

Mr. LIPINSKI. No.

The CLERK. Mr. Lipinski votes no. Mr. Lampson.

Mr. LAMPSON. No.

The CLERK. Mr. Lampson votes no. Ms. Giffords.

Ms. GIFFORDS. No.

The CLERK. Ms. Giffords votes no. Mr. McNerney.

Mr. MCNERNEY. No.

The CLERK. Mr. McNerney votes no. Mr. Kanjorski.

[No response.]

The CLERK. Ms. Hooley.

Ms. HOOLEY. No.

The CLERK. Ms. Hooley votes no. Mr. Rothman.

Mr. ROTHMAN. No.

The CLERK. Mr. Rothman votes no. Mr. Honda.

Mr. HONDA. No.

The CLERK. Mr. Honda votes no. Mr. Matheson.

Mr. MATHESON. No.

The CLERK. Mr. Matheson votes no. Mr. Ross.

Mr. ROSS. No.

The CLERK. Mr. Ross votes no. Mr. Chandler.

Mr. CHANDLER. No.

The CLERK. Mr. Chandler votes no. Mr. Carnahan.

Mr. CARNAHAN. No.
The CLERK. Mr. Carnahan votes no. Mr. Melancon.
Mr. MELANCON. No.
The CLERK. Mr. Melancon votes no. Mr. Hill.
Chairman GORDON. Do we need another lesson here? Go ahead, Charlie. Help her one more time.
The CLERK. Mr. Melancon.
Chairman GORDON. Almost. We all have——
The CLERK. I am getting close. Okay. Mr. Hill.
[No response.]
The CLERK. Okay. Mr. Melancon. Thank you.
The CLERK. Mr. Hill.
[No response.]
The CLERK. Mr. Mitchell.
[No response.]
The CLERK. Mr. Wilson.
[No response.]
The CLERK. Mr. Hall.
Mr. HALL. Aye.
The CLERK. Mr. Hall votes aye. Mr. Sensenbrenner.
[No response.]
The CLERK. Mr. Lamar Smith.
Mr. SMITH OF TEXAS. Aye.
The CLERK. Mr. Lamar Smith votes aye. Mr. Rohrabacher.
Mr. ROHRABACHER. Yes.
The CLERK. Mr. Rohrabacher votes aye. Mr. Bartlett.
Mr. BARTLETT. Yes.
The CLERK. Mr. Bartlett votes aye. Mr. Ehlers.
Mr. EHLERS. Aye.
The CLERK. Mr. Ehlers votes aye. Mr. Lucas.
Mr. LUCAS. Aye.
The CLERK. Mr. Lucas votes aye. Ms. Biggert.
Ms. BIGGERT. Aye.
The CLERK. Mrs. Biggert votes aye. Mr. Akin.
[No response.]
The CLERK. Mr. Bonner.
[No response.]
The CLERK. Mr. Finney.
Mr. FINNEY. Aye.
The CLERK. Mr. Finney votes aye. Mr. Neugebauer.
Mr. NEUGEBAUER. Aye.
The CLERK. Mr. Neugebauer votes aye. Mr. Inglis.
Mr. INGLIS. Aye.
The CLERK. Mr. Inglis votes aye. Mr. Reichert.
Mr. REICHERT. No.
The CLERK. Mr. Reichert votes no. Mr. McCaul.
Mr. MCCAUL. Aye.
The CLERK. Mr. McCaul votes aye. Mr. Diaz-Balart.
Mr. DIAZ-BALART. Yes.
The CLERK. Mr. Diaz-Balart votes aye. Mr. Gingrey.
Mr. GINGREY. Aye.
The CLERK. Mr. Gingrey votes aye. Mr. Bilbray.
Mr. BILBRAY. Aye.
The CLERK. Mr. Bilbray votes aye. Mr. Adrian Smith.

Mr. SMITH OF NEBRASKA. Aye.

The CLERK. Mr. Adrian Smith votes aye.

Chairman GORDON. Has Mr. Mitchell been recorded?

The CLERK. Mr. Mitchell is not recorded.

Mr. MITCHELL. No vote, please.

The CLERK. Mr. Mitchell votes no.

Chairman GORDON. Is there anyone else? Mr. Wilson.

The CLERK. Mr. Wilson is not recorded.

Chairman GORDON. I think Mr. Wilson, just—ask him again.

The CLERK. Mr. Wilson.

Mr. WILSON. No.

The CLERK. Mr. Wilson votes no.

Chairman GORDON. Is there——

Mr. HALL. Ask Mr. Melancon again.

Chairman GORDON. Is there anyone else? We want to be sure everybody has a chance to get recognized on this. If not, the Clerk will report the vote.

The CLERK. Mr. Chairman, 22 vote no, 15 Members vote aye.

COMMITTEE ON SCIENCE AND TECHNOLOGY

ROLL CALL 1 BILL H.R. 1933 DATE 6/27/07

AMEND # 5 PASSED ___ DEFEATED ✓ VOICE VOTE ___ WITHDRAW ___

SPONSOR/AMENDMENT Mr. McCaul Amendment #5

MEMBER	AYE	NO	PRESENT	NOT VOTING
Mr. GORDON, Chairman		✓		
Mr. COSTELLO		✓		
Ms. JOHNSON		✓		
Ms. WOOLSEY		✓		
Mr. UDALL		✓		
Mr. WU		✓		
Mr. BAIRD				
Mr. MILLER		✓		
Mr. LIPINSKI		✓		
Mr. LAMPSON		✓		
Ms. GIFFORDS		✓		
Mr. McNERNEY		✓		
Mr. KANJORSKI				
Ms. HOOLEY		✓		
Mr. ROTHMAN		✓		
Mr. HONDA		✓		
Mr. MATHESON		✓		
Mr. ROSS		✓		
Mr. CHANDLER		✓		
Mr. CARNAHAN		✓		
Mr. MELANCON		✓		
Mr. HILL				
Mr. MITCHELL		✓		
Mr. WILSON		✓		
Mr. HALL	✓			
Mr. SENSENBRENNER				
Mr. LAMAR SMITH, TX	✓			
Mr. ROHRABACHER	✓			
Mr. BARLETT	✓			
Mr. EHLERS	✓			
Mr. LUCAS	✓			
Mrs. BIGGERT	✓			
Mr. AKIN				
Mr. BONNER				
Mr. FEENEY	✓			
Mr. NEUGEBAUER	✓			
Mr. INGLIS	✓			
Mr. REICHERT		✓		
Mr. McCAUL	✓			
Mr. DIAZ-BALART	✓			
Mr. GINGREY	✓			
Mr. BILBRAY	✓			
Mr. ADRIAN SMITH, NE	✓			
Vacant				
TOTALS				

Mr. Chairman, 15 Members vote AYE and 22 vote NO

43 / Quorum /15 vote / 22 Report

Revised 5/16/07

Chairman GORDON. Are there other amendments? If no, then the vote is on the bill, H.R. 1933, as amended. All those in favor will say aye. Aye. All opposed, no. In the opinion of the Chair, the ayes have it.

Ms. Johnson is now recognized to offer a motion.

Ms. JOHNSON. Thank you, Mr. Chairman. I move that we report this bill to the Full House, with the recommendation that it pass. I move that the Committee favorably report H.R. 1933, as amended, to the House, with the recommendation that the bill do pass. And further, I move that the staff be instructed to prepare the legislative report, and make necessary technical and conforming changes, and that the Chairman take all necessary steps to bring the bill before the House for consideration.

Chairman GORDON. The question is on the motion to report the bill favorably. Those in favor of the motion will signify by saying aye. Opposed, no. The ayes have it. The bill is favorably reported.

Without objection, the motion to reconsider is laid open the table. Members have two subsequent calendar days in which to submit supplemental, Minority, or additional views on the measure, ending Monday, July the 2nd, at 9:00 a.m.

I move, pursuant to Clause 1 of Rule 22 of the Rules of the House of Representatives that the Committee authorize the Chairman to offer such motions as may be necessary in the House to adopt and pass H.R. 1933, the *Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007,* as amended. Without objection, so ordered.

I thank all of you, the hard core that are still here. We had a good day. Four more bills of a dozen that will go into a good Energy Bill next month, and again, a bipartisan, everybody go home and take credit. Thank you.

[Whereupon, at 1:10 p.m., the Committee was adjourned.]

Appendix:

Subcommittee on Energy and Environment Markup Report, H.R. 1933 as reported, Amendment Roster

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
REPORT FROM SUBCOMMITTEE MARKUP
JUNE 21, 2007

H.R. 1933, THE DEPARTMENT OF ENERGY CARBON CAPTURE AND STORAGE RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 2007

I. Purpose

The Purpose of H.R. 1933 is to amend the *Energy Policy Act of 2005* to reauthorize and improve the carbon capture and storage research, development, and demonstration program of the Department of Energy.

II. Background and Need for Legislation

Approximately 50 percent of the electricity generated in the United States comes from coal. According to Department of Energy's Energy Information Administration (EIA) carbon dioxide emissions in the United States and its territories were 6,008.6 million metric tons (MMT) in 2005. In the United States, most CO_2 is emitted as a result of the combustion of fossil fuels. In particular, the electric power sector accounts for nearly 40 percent of the CO_2 emissions in the U.S., according to EIA. For the foreseeable future, the U.S. will continue to rely on coal to meet our energy demand. With that understanding, the challenge lies in balancing our environmental goals with our energy needs. Taking a sensible approach to address climate change will require technological advancements. The Massachusetts Institute of Technology (MIT) report, *The Future of Coal* (2007), concludes "that CO_2 capture and sequestration (CCS) is the critical enabling technology that would reduce CO_2 emissions significantly while also allowing coal to meet the world's pressing energy needs." (page x)

Crafting a CCS strategy that makes sense for the United States calls for an understanding of the technical challenges that exist with the development, demonstration and deployment of carbon dioxide capture technologies and the development of safe, effective large-scale containment of carbon dioxide. The MIT Report points out that there is no operational experience with carbon capture from coal plants and emphasizes the absence of operational experience with an integrated sequestration operation. The MIT report states that "the priority objective with respect to coal should be the successful large-scale demonstration of the technical, economic, and environmental performance of the technologies that make up all of the major components of a large-scale integrated CCS system—capture, transportation and storage." (page xi) H.R. 1933 follows that recommendation and reauthorizes the Department of Energy's research and development and field testing programs, and specifically authorizes large-scale demonstrations of both carbon dioxide capture technologies and carbon dioxide containment.

III. Subcommittee Actions

On April 18, 2007, Rep. Mark Udall introduced H.R. 1933 which serves as a companion bill to S.962 introduced in the Senate on March 22, 2007 by Sen. Jeff Bingaman. Since introduction, five additional co-sponsors have signed onto the bill.

The Energy and Environment Subcommittee held a hearing on Tuesday, May 15, 2007 to hear testimony on the *Prospects for Advanced Coal Technologies: Efficient Energy Production, Carbon Capture and Sequestration* to gain a better understanding of the programmatic needs at the Department of Energy to address the challenge of climate change. The following five witnesses testified at the hearing:

- Mr. Carl O. Bauer, Director of the Department of Energy's National Energy Technology Laboratory, a national laboratory owned and operated by the Department of Energy. In his current position as Director of NETL, he oversees the implementation of major science and technology development programs to resolve the environmental, supply and reliability constraints of producing and using fossil resources, including advanced coal-fueled power generation, carbon sequestration, and environmental control for the existing fleet of fossil steam plants.
- Dr. Robert L. Finley, Director Energy and Earth Resources Center for Illinois State Geological Survey with specialization in fossil energy resources. He is currently heading a regional carbon sequestration partnership in the Illinois Basin aimed at addressing concerns with geological carbon management.

- Mr. Michael Rencheck, Senior Vice President for Engineering Projects and Field Services at American Electric Power headquartered in Columbus, Ohio. He is responsible for engineering, regional maintenance and shop service organizations, projects and construction, and new generation development. He will discuss ongoing projects at AEP and can talk to plant efficiencies and retrofitting facilities to capture carbon.
- Mr. Stuart Dalton, Director, Generation at the Electric Power Research Institute. His current research activities cover a wide variety of generation options with special focus on emerging generation, coal-based generation, emission controls and CO_2 capture and storage. He also helped to create the EPRI *Coal Fleet for Tomorrow* program.
- Mr. Gardiner Hill, Director of Technology in Alternative Energy Technology, is responsible for BP group-wide aspects of CO_2 Capture and Storage technology development, demonstration and deployment. He also is the BP manager responsible for the BP/Ford/Princeton Carbon Mitigation Initiative at Princeton University as well as the BP manager responsible for the BP/Harvard partnership on the Energy Technology Innovation Project. He posses 20 years of technical and managerial experience which is directly relevant to technology, business and project management.

The Subcommittee on Energy and Environment met to consider H.R. 1933 on June 21, 2007 and consider the following two amendments to the bill:

1. Rep. Udall offered a manager's amendment which made a number of technical and substantive changes to H.R. 1933. The amendment adds a new section to the bill authorizing three, but no more than five, demonstrations of carbon dioxide capture technologies. It further includes an authorization for funding these carbon dioxide capture demonstrations at $180 million per year for four years starting in Fiscal Year 2009. It increases the funding level for the large-scale carbon dioxide sequestration demonstrations to $140 million per year for four years beginning in Fiscal Year 2008. The amendment defines the large-scale demonstrations of carbon dioxide sequestration as one million tons of carbon dioxide annually or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability to continuously inject large quantities of carbon dioxide for a number of years. The amendment encourages the integration of the storage demonstrations with the capture technology demonstrations. This is intended to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale.

   The amendment includes an authorization for the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized. The amendment also authorizes the Assistant Administrator of the Office of Research and Development of EPA to conduct a research program to determine what procedures may be necessary to protect public health, safety and the environment from impacts that may be associated with sequestration of greenhouse gases. Finally, the amendment includes and authorization of appropriation for Fiscal Years 2008, 2009, 2010 and 2011 to fund the Department of Energy's fundamental R&D at the laboratory scale to allow for continued examination of new approaches on carbon dioxide capture and sequestration. The amendment was agreed to by voice vote.

2. Mr. Costello offered an amendment which authorizes a study by the National Academy of Sciences to define an interdisciplinary program to train a workforce to support development and deployment of carbon capture and sequestration. The study will define curricula for undergraduate and graduate programs that would lead to degrees in geological sequestration science. The amendment also establishes a competitive grant program through which institutions of higher education can apply for four-year grants to support start up costs for integrated geological carbon sequestration programs as well as internships for graduate students in geological sequestration science. The amendment was adopted by voice vote.

IV. Summary of Major Provisions of the Bill

H.R. 1933 provides federal support for the Department of Energy in cooperation with its seven Regional Carbon Sequestration Partnership programs to demonstrate both large-volume sequestration tests for geological containment of carbon dioxide and carry out at least three demonstrations of large-scale capture of carbon dioxide.

The bill will provide for the testing of a variety of geological settings for carbon dioxide storage and it will accelerate the demonstration of the three main categories of carbon dioxide capture technologies bringing them closer to commercial application. And, H.R. 1933 aims to integrate the carbon dioxide capture with the large-scale storage demonstration in order to gain the operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale. In addition, the bill provides for the Environmental Protection Agency (EPA) to conduct a research program to determine what procedures may be necessary to protect public health, safety and the environment with regard to the long-term storage of carbon dioxide in geological reservoirs. Also, the bill authorizes the National Academy of Sciences to conduct an independent review and oversight of the carbon dioxide injection program to ensure its benefits are maximized. The bill also authorizes the National Academy of Sciences to define an interdisciplinary program to train a workforce to support the development and deployment of carbon capture and sequestration systems. The bill also establishes a competitive grant program for institutions of higher learning to access start up costs for integrated geological carbon sequestration programs and implement internships for graduate students in geological sequestration science.

V. Section-by-Section Analysis of the Bill, as reported by the Subcommittee

Section 1. Short Title

"Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007."

Section 2. Carbon Capture and Storage Research, Development, and Demonstration Program.

Directs the Secretary of Energy to carry out fundamental science and engineering research to develop and document the performance of new approaches to capture and store carbon dioxide, or convert carbon dioxide into products that lead to overall reduction of carbon dioxide emissions. The fundamental research shall be applied to energy technology development activities and the field testing of carbon sequestration activities.

Requires the Secretary to promote regional carbon sequestration partnerships to conduct geologic sequestration field testing of the capture technologies and the injection and monitoring practices in a variety of geologic settings including operating oil and gas field, depleted oil and gas fields, unmineable coal seams, saline formations, and deep geologic systems to extract heat from geothermal resources.

The field tests are aimed at advancing and validating geophysical tools, analysis and modeling used to monitor, predict, and verify carbon dioxide containment. And, the Secretary is authorized to promulgate policies, procedures, requirements and guidance to ensure that the objectives of the field testing are met in large-scale testing and deployment activities for carbon capture and storage funded by the Department.

In addition, the bill authorizes seven large-volume sequestration tests for geologic containment of carbon dioxide. The Secretary is directed to select meritorious proposals on a competitive basis giving preference to proposals from partnerships among industrial, academic, and government entities. The Secretary is directed to consider a variety of geological formations across the United States and require characterization and modeling of candidate formations. The bill integrates the storage demonstrations with the demonstration of carbon dioxide capture technologies by giving preference to carbon dioxide captured from coal-fired electric generating plants to provide operational experience with an integrated system of capture, transportation, and storage of carbon dioxide at scale. This preference shall not delay the implementation of the large-scale sequestration tests.

H.R. 1933 defines large-scale injection of carbon dioxide as one million tons of carbon dioxide annually or a scale that demonstrably exceeds the necessary thresholds in key geologic transients to validate the ability to continuously inject large quantities of carbon dioxide for a number of years. The large-scale carbon dioxide containment demonstrations shall be considered research and development and meet the cost-sharing requirements of Section 988(b) of *Energy Policy Act of 2005*—the Secretary shall require not less than 20 percent of the cost of a research or development activity to be provided by a non-federal source.

The bill directs the Secretary to carry out three, but no more than five, demonstrations of carbon dioxide capture technologies. These demonstrations should include the three main approaches to carbon dioxide capture: pre-combustion, post-combustion and oxycombustion. Any award under this carbon dioxide capture demonstration program is available only for the portion of the project that carries out

the large-scale capture (including purification and compression) of carbon dioxide, as well as the cost of transportation and injection of carbon dioxide. The carbon dioxide capture demonstrations shall meet the cost-share requirements of Section 988 (c) of the *Energy Policy Act of 2005* or the Secretary shall require that not less than 50 percent of the cost of the demonstration be provided by a non-federal source.

Authorizes appropriations of $240,000,000 for each of the fiscal years 2008 through 2011 for research and field testing as well as the large-scale carbon dioxide containment demonstrations.

Authorizes appropriations of $180,000,000 for each of the fiscal years 2009 through 2012 for the demonstrations of carbon dioxide capture technologies.

Section 3. Review of Large-Scale Programs.

Authorizes the National Academy of Sciences to conduct an independent review and oversight of the injection program to ensure its benefits are maximized. Not later than January 1, 2012, the Secretary is directed to transmit to the Congress a report on the results of such review and oversight.

Section 4. Safety Research.

Authorizes the Assistant Administrator for Research and Development of the Environmental Protection Agency to conduct a research program to determine what procedures may be necessary to protect public health, safety, and the environment from impacts that may be associated with capture, injection, and sequestration of greenhouse gases in subterranean reservoirs. Authorizes $5,000,000 for each fiscal year to carry out this research program.

Section 5. Geological Sequestration Training and Research.

Directs the Secretary of Energy to enter into an arrangement with the National Academy of Sciences to undertake a study that defines an interdisciplinary program to train a workforce to support the Nation's capability to capture and sequester carbon dioxide from anthropogenic sources, and develops curricula for undergraduate and graduate curricula that lead to degrees in geological sequestration science. The study will establish guidelines for universities wishing to implement geological sequestration science programs and make recommendations on the budget needed to implement the grant program also authorized in this section. The Secretary is directed to submit a report to Congress providing the results of the National Academy of Sciences study. Authorizes $1,000,000 for fiscal year 2008 to carry out this section.

Authorizes the Secretary of Energy, through the National Energy Technology Laboratory, to establish a competitive grant program through which institutions of higher education can apply for four-year grants to support salary and startup costs for newly designated faculty positions in an integrated geological carbon sequestration science program and internships for graduate students in geological sequestration science. The grants are renewable for up to two additional three-year terms and encouraged to interface with the research of the Regional Carbon Sequestration Partnerships operated by the Department of Energy to provide internships and practical training in carbon capture and geological sequestration. Authorizes such sums as necessary to carry out the grant program.

H.R. 1933, AS REPORTED BY THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

June 21, 2007

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the ''Department of Energy
3 Carbon Capture and Storage Research, Development, and
4 Demonstration Act of 2007''.

5 **SEC. 2. CARBON CAPTURE AND STORAGE RESEARCH, DE-**
6 **VELOPMENT, AND DEMONSTRATION PRO-**
7 **GRAM.**

8 (a) AMENDMENTS.—Section 963 of the Energy Pol-
9 icy Act of 2005 (42 U.S.C. 16293) is amended—

10 (1) in the section heading, by striking ''**RE-**
11 **SEARCH AND DEVELOPMENT**'' and inserting
12 ''**AND STORAGE RESEARCH, DEVELOPMENT,**
13 **AND DEMONSTRATION**'';

14 (2) in subsection (a)—

15 (A) by striking ''research and develop-
16 ment'' and inserting ''and storage research, de-
17 velopment, and demonstration''; and

18 (B) by striking ''capture technologies on
19 combustion-based systems'' and inserting ''cap-

1 ture and storage technologies related to electric
2 power generating systems";
3 (3) in subsection (b)—
4 (A) in paragraph (3), by striking "and" at
5 the end;
6 (B) in paragraph (4), by striking the pe-
7 riod at the end and inserting "; and"; and
8 (C) by adding at the end the following:
9 "(5) to expedite and carry out large-scale test-
10 ing of carbon sequestration systems in a range of ge-
11 ological formations that will provide information on
12 the cost and feasibility of deployment of sequestra-
13 tion technologies."; and
14 (4) by striking subsection (c) and inserting the
15 following:
16 "(c) PROGRAMMATIC ACTIVITIES.—
17 "(1) FUNDAMENTAL SCIENCE AND ENERGY RE-
18 SEARCH AND DEVELOPMENT AND DEMONSTRATION
19 SUPPORTING CARBON CAPTURE AND STORAGE TECH-
20 NOLOGIES.—
21 "(A) IN GENERAL.—The Secretary shall
22 carry out fundamental science and engineering
23 research (including laboratory-scale experi-
24 ments, numeric modeling, and simulations) to
25 develop and document the performance of new

1 approaches to capture and store carbon dioxide,
2 or convert carbon dioxide into products that
3 lead to overall reduction of carbon dioxide emis-
4 sions.
5 "(B) PROGRAM INTEGRATION.—The Sec-
6 retary shall ensure that fundamental research
7 carried out under this paragraph is appro-
8 priately applied to energy technology develop-
9 ment activities and the field testing of carbon
10 sequestration and carbon use activities, includ-
11 ing—
12 "(i) development of new or advanced
13 technologies for the capture of carbon diox-
14 ide;
15 "(ii) development of new or improved
16 technologies that reduce the cost and in-
17 crease the efficacy of the compression of
18 carbon dioxide required for the storage of
19 carbon dioxide;
20 "(iii) modeling and simulation of geo-
21 logical sequestration field demonstrations;
22 "(iv) quantitative assessment of risks
23 relating to specific field sites for testing of
24 sequestration technologies; and

1 "(v) research and development of new
2 and improved technologies for carbon use,
3 including recycling and reuse of carbon di-
4 oxide.
5 "(2) FIELD VALIDATION TESTING ACTIVI-
6 TIES.—
7 "(A) IN GENERAL.—The Secretary shall
8 promote, to the maximum extent practicable,
9 regional carbon sequestration partnerships to
10 conduct geologic sequestration tests involving
11 carbon dioxide injection and monitoring, mitiga-
12 tion, and verification operations in a variety of
13 candidate geological settings, including—
14 "(i) operating oil and gas fields;
15 "(ii) depleted oil and gas fields;
16 "(iii) unmineable coal seams;
17 "(iv) deep saline formations;
18 "(v) deep geologic systems that may
19 be used as engineered reservoirs to extract
20 economical quantities of heat from geo-
21 thermal resources of low permeability or
22 porosity; and
23 "(vi) deep geologic systems containing
24 basalt formations.

1 "(B) OBJECTIVES.—The objectives of tests
2 conducted under this paragraph shall be—
3 "(i) to develop and validate geo-
4 physical tools, analysis, and modeling to
5 monitor, predict, and verify carbon dioxide
6 containment;
7 "(ii) to validate modeling of geological
8 formations;
9 "(iii) to refine storage capacity esti-
10 mated for particular geological formations;
11 "(iv) to determine the fate of carbon
12 dioxide concurrent with and following in-
13 jection into geological formations;
14 "(v) to develop and implement best
15 practices for operations relating to, and
16 monitoring of, injection and storage of car-
17 bon dioxide in geologic formations;
18 "(vi) to assess and ensure the safety
19 of operations related to geological storage
20 of carbon dioxide;
21 "(vii) to allow the Secretary to pro-
22 mulgate policies, procedures, requirements,
23 and guidance to ensure that the objectives
24 of this subparagraph are met in large-scale
25 testing and deployment activities for car-

1 bon capture and storage that are funded
2 by the Department of Energy; and
3 "(viii) to support Environmental Pro-
4 tection Agency efforts, in consultation with
5 other agencies, to develop a scientifically
6 sound regulatory framework to enable com-
7 mercial-scale sequestration operations
8 while safeguarding human health and un-
9 derground sources of drinking water.
10 "(3) LARGE-SCALE SEQUESTRATION TESTING
11 AND DEPLOYMENT.—
12 "(A) IN GENERAL.—The Secretary shall
13 conduct not less than 7 initial large-volume se-
14 questration tests, not including the FutureGen
15 project, for geological containment of carbon di-
16 oxide (at least 1 of which shall be international
17 in scope) to validate information on the cost
18 and feasibility of commercial deployment of
19 technologies for geological containment of car-
20 bon dioxide.
21 "(B) DIVERSITY OF FORMATIONS TO BE
22 STUDIED.—In selecting formations for study
23 under this paragraph, the Secretary shall con-
24 sider a variety of geological formations across
25 the United States, and require characterization

1 and modeling of candidate formations, as deter-
2 mined by the Secretary.
3 "(C) SOURCE OF CARBON DIOXIDE FOR
4 LARGE-SCALE SEQUESTRATION DEMONSTRA-
5 TIONS.—Preference should be given to carbon
6 dioxide captured from coal-fired electric gener-
7 ating plants when practical, but this preference
8 shall not delay the implementation of the large-
9 scale sequestration tests under this paragraph.
10 The Secretary shall also give preference to pur-
11 chases of carbon dioxide at market value from
12 industrial and electric generation coal facilities.
13 To the extent feasible, the Secretary shall pre-
14 fer test projects from industrial and electric
15 generation coal facilities that capture, trans-
16 port, and sequester carbon dioxide in an inte-
17 grated system. Until electric generation coal fa-
18 cilities, either new or existing, are operating
19 with carbon dioxide capture technologies, other
20 sources of carbon dioxide should be pursued
21 under this paragraph.
22 "(D) DEFINITION.—For purposes of this
23 paragraph, the term 'large-scale' means the in-
24 jection of more than 1,000,000 metric tons of
25 carbon dioxide annually, or a scale that demon-

1 strably exceeds the necessary thresholds in key
2 geologic transients to validate the ability con-
3 tinuously to inject quantities on the order of
4 several million metric tons of industrial carbon
5 dioxide annually for a large number of years.
6 "(4) LARGE-SCALE DEMONSTRATION OF CAR-
7 BON DIOXIDE CAPTURE TECHNOLOGIES.—
8 "(A) IN GENERAL.—The Secretary shall
9 carry out at least 3 and no more than 5 dem-
10 onstrations, including, precombustion capture,
11 post-combustion capture, and oxycombustion,
12 for the large-scale capture of carbon dioxide
13 from industrial sources of carbon dioxide, in-
14 cluding facilities that generate electric energy
15 from fossil fuels, refine petroleum, manufacture
16 iron or steel, manufacture cement or cement
17 clinker, manufacture commodity chemicals, and
18 ethanol and fertilizer plants. Consideration may
19 be given to capture of carbon dioxide from in-
20 dustrial facilities and electric generation carbon
21 sources that are near suitable geological res-
22 ervoirs and could continue sequestration.
23 "(B) SCOPE OF AWARD.—An award under
24 this paragraph shall be only for the portion of
25 the project that carries out the large-scale cap-

1 ture (including purification and compression) of
2 carbon dioxide, as well as the cost of transpor-
3 tation and injection of carbon dioxide.
4 "(5) PREFERENCE IN PROJECT SELECTION
5 FROM MERITORIOUS PROPOSALS.—In making com-
6 petitive awards under this subsection, subject to the
7 requirements of section 989, the Secretary shall give
8 preference to proposals from partnerships among in-
9 dustrial, academic, and government entities.
10 "(6) COST SHARING.—Activities under this sub-
11 section shall be considered research and development
12 activities that are subject to the cost-sharing re-
13 quirements of section 988(b), except that the Fed-
14 eral share of a project under paragraph (4) shall not
15 exceed 50 percent.
16 "(d) AUTHORIZATION OF APPROPRIATIONS.—
17 "(1) IN GENERAL.—There are authorized to be
18 appropriated to the Secretary for carrying out this
19 section, other than subsection (c)(4)—
20 "(A) $240,000,000 for fiscal year 2008;
21 "(B) $240,000,000 for fiscal year 2009;
22 "(C) $240,000,000 for fiscal year 2010;
23 and
24 "(D) $240,000,000 for fiscal year 2011.

1 "(2) CARBON CAPTURE.—There are authorized
2 to be appropriated to the Secretary for carrying out
3 subsection (c)(4)—
4 "(A) $180,000,000 for fiscal year 2009;
5 "(B) $180,000,000 for fiscal year 2010;
6 "(C) $180,000,000 for fiscal year 2011;
7 and
8 "(D) $180,000,000 for fiscal year 2012.".
9 (b) TABLE OF CONTENTS AMENDMENT.—The item
10 relating to section 963 in the table of contents for the En-
11 ergy Policy Act of 2005 is amended to read as follows:

"Sec. 963. Carbon capture and storage research, development, and demonstration program.".

12 **SEC. 3. REVIEW OF LARGE-SCALE PROGRAMS.**

13 The Secretary of Energy shall enter into an arrange-
14 ment with the National Academy of Sciences for an inde-
15 pendent review and oversight, beginning in 2011, of the
16 programs under section 963(c)(3) and (4) of the Energy
17 Policy Act of 2005, as added by section 2 of this Act, to
18 ensure that the benefits of such programs are maximized.
19 Not later than January 1, 2012, the Secretary shall trans-
20 mit to the Congress a report on the results of such review
21 and oversight.

22 **SEC. 4. SAFETY RESEARCH.**

23 (a) PROGRAM.—The Assistant Administrator for Re-
24 search and Development of the Environmental Protection

1 Agency shall conduct a research program to determine
2 procedures necessary to protect public health, safety, and
3 the environment from impacts that may be associated with
4 capture, injection, and sequestration of greenhouse gases
5 in subterranean reservoirs.

6 (b) AUTHORIZATION OF APPROPRIATIONS.—There
7 are authorized to be appropriated for carrying out this sec-
8 tion $5,000,000 for each fiscal year.

9 **SEC. 5. GEOLOGICAL SEQUESTRATION TRAINING AND RE-**
10 **SEARCH.**

11 (a) STUDY.—

12 (1) IN GENERAL.—The Secretary of Energy
13 shall enter into an arrangement with the National
14 Academy of Sciences to undertake a study that—

15 (A) defines an interdisciplinary program in
16 geology, engineering, hydrology, environmental
17 science, and related disciplines that will support
18 the Nation's capability to capture and sequester
19 carbon dioxide from anthropogenic sources;

20 (B) addresses undergraduate and graduate
21 education, especially to help develop graduate
22 level programs of research and instruction that
23 lead to advanced degrees with emphasis on geo-
24 logical sequestration science;

1 (C) develops guidelines for proposals from
2 colleges and universities with substantial capa-
3 bilities in the required disciplines that wish to
4 implement geological sequestration science pro-
5 grams that advance the Nation's capacity to ad-
6 dress carbon management through geological
7 sequestration science; and
8 (D) outlines a budget and recommenda-
9 tions for how much funding will be necessary to
10 establish and carry out the grant program
11 under subsection (b).
12 (2) REPORT.—Not later than 1 year after the
13 date of enactment of this Act, the Secretary of En-
14 ergy shall transmit to the Congress a copy of the re-
15 sults of the study provided by the National Academy
16 of Sciences under paragraph (1).
17 (3) AUTHORIZATION OF APPROPRIATIONS.—
18 There are authorized to be appropriated to the Sec-
19 retary for carrying out this subsection $1,000,000
20 for fiscal year 2008.
21 (b) GRANT PROGRAM.—
22 (1) ESTABLISHMENT.—The Secretary of En-
23 ergy, through the National Energy Technology Lab-
24 oratory, shall establish a competitive grant program

1 through which colleges and universities may apply
2 for and receive 4-year grants for—
3 (A) salary and startup costs for newly des-
4 ignated faculty positions in an integrated geo-
5 logical carbon sequestration science program;
6 and
7 (B) internships for graduate students in
8 geological sequestration science.
9 (2) RENEWAL.—Grants under this subsection
10 shall be renewable for up to 2 additional 3-year
11 terms, based on performance criteria, established by
12 the National Academy of Sciences study conducted
13 under subsection (a), that include the number of
14 graduates of such programs.
15 (3) INTERFACE WITH REGIONAL GEOLOGICAL
16 CARBON SEQUESTRATION PARTNERSHIPS.—To the
17 greatest extent possible, geological carbon sequestra-
18 tion science programs supported under this sub-
19 section shall interface with the research of the Re-
20 gional Carbon Sequestration Partnerships operated
21 by the Department of Energy to provide internships
22 and practical training in carbon capture and geologi-
23 cal sequestration.
24 (4) AUTHORIZATION OF APPROPRIATIONS.—
25 There are authorized to be appropriated to the Sec-

1 retary for carrying out this subsection such sums as
2 may be necessary.

COMMITTEE ON SCIENCE AND TECHNOLOGY
FULL COMMITTEE MARKUP
JUNE 27, 2007

AMENDMENT ROSTER

H.R. 1933, the Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007

No.	Sponsor	Description	Results
1	Mr. Udall	Manager's amendment makes minor/technical changes; clarifies that carbon capture and carbon sequestration activities should be integrated; clarifies funding authorizations.	Agreed to by voice vote.
2	Mr. Matheson	Amends section 2 by adding eligibility for high altitude oil and gas field to the field testing program.	Agreed to by voice vote.
3	Mr. Ross	Adds a new section creating a university R&D program.	Agreed to by voice vote.
4	Ms. Johnson	Amends section 2 by ensuring two of three capture demonstrations are from fossil fuel electric generation plants.	Agreed to by voice vote.
5	Mr. McCaul	Amends section 2 by making eligible coal-to-liquid facilities under the carbon sequestration and capture demonstration programs.	Defeated by roll call vote 22-15.

AMENDMENT TO H.R. 1933

OFFERED BY MR. UDALL OF COLORADO

Page 2, line 17, strike "ENERGY" and insert "ENGINEERING".

Page 3, lines 2 and 3, strike "convert carbon dioxide into products that lead to" and insert "to learn how to use carbon dioxide in products to lead to an".

Page 3, line 15, strike "improved" and insert "advanced".

Page 4, line 2, strike "improved" and insert "advanced".

Page 6, lines 10 and 11, strike "LARGE-SCALE SEQUESTRATION TESTING AND DEPLOYMENT" and insert "LARGE-SCALE CARBON DIOXIDE SEQUESTRATION TESTING".

Page 7, lines 3 through 21, amend subparagraph (C) to read as follows:

1 "(C) SOURCE OF CARBON DIOXIDE FOR
2 LARGE-SCALE SEQUESTRATION DEMONSTRA-
3 TIONS.—In the process of any acquisition of
4 carbon dioxide for sequestration demonstrations

1 under subparagraph (A), the Secretary shall
2 give preference to purchases of carbon dioxide
3 from industrial and coal-fired electric genera-
4 tion facilities. To the extent feasible, the Sec-
5 retary shall prefer test projects from industrial
6 and coal-fired electric generation facilities that
7 would facilitate the creation of an integrated
8 system of capture, transportation and storage
9 of carbon dioxide. Until coal-fired electric gen-
10 eration facilities, either new or existing, are op-
11 erating with carbon dioxide capture tech-
12 nologies, other industrial sources of carbon di-
13 oxide should be pursued under this paragraph.
14 The preference provided for under this subpara-
15 graph shall not delay the implementation of the
16 large-scale sequestration tests under this para-
17 graph.''.

Page 8, lines 10 and 11, strike '', including, precombustion capture, post-combustion capture, and oxycombustion,'' and insert '', that include each of the technologies described in subparagraph (B),''.

Page 8, line 22, insert ''To ensure reduced carbon dioxide emissions, the Secretary shall take necessary actions to provide for the integration of the program under this paragraph with the long-term carbon dioxide seques-

tration demonstrations described in paragraph (3). These actions should not delay implementation of the large-scale sequestration tests authorized in paragraph (3)." after "continue sequestration.".

Page 8, line 23, redesignate subparagraph (B) as subparagraph (C).

Page 8, before line 23, insert the following new subparagraph:

1 "(B) TECHNOLOGIES.—The technologies
2 referred to in subparagraph (A) are
3 precombustion capture, post-combustion cap-
4 ture, and oxycombustion.".

Page 9, line 19, strike "subsection (c)(4)" and insert "subsection (c)(3) and (4)".

Page 9, lines 20 through 24, strike "$240,000,000" each place it appears and insert "$100,000,000".

Page 10, line 1, redesignate paragraph (2) as paragraph (3).

Page 10, before line 1, insert the following new paragraph:

1 "(2) SEQUESTRATION.—There are authorized
2 to be appropriated to the Secretary for carrying out
3 subsection (c)(3)—
4 "(A) $140,000,000 for fiscal year 2008;
5 "(B) $140,000,000 for fiscal year 2009;
6 "(C) $140,000,000 for fiscal year 2010;
7 and
8 "(D) $140,000,000 for fiscal year 2011.

AMENDMENT TO H.R. 1933

OFFERED BY MR. MATHESON OF UTAH

Page 4, line 22, strike ''and''.

Page 4, line 24, strike the period and insert ''; and''.

Page 4, after line 24, insert the following new clause:

1 ''(vii) high altitude terrain oil and gas
2 fields.

AMENDMENT TO H.R. 1933
OFFERED BY MR. ROSS OF ARKANSAS

At the end of the bill, insert the following new section:

1 **SEC. 6. UNIVERSITY BASED RESEARCH AND DEVELOPMENT**
2 **GRANT PROGRAM.**

3 (a) ESTABLISHMENT.—The Secretary of Energy, in
4 consultation with other appropriate agencies, shall estab-
5 lish a university based research and development program
6 to study carbon capture and sequestration using the var-
7 ious types of coal.

8 (b) GRANTS.—Under this section, the Secretary shall
9 award 5 grants for projects submitted by colleges or uni-
10 versities to study carbon capture and sequestration in con-
11 junction with the recovery of oil and other enhanced ele-
12 mental and mineral recovery. Consideration shall be given
13 to areas that have regional sources of coal for the study
14 of carbon capture and sequestration.

15 (c) RURAL AND AGRICULTURAL INSTITUTIONS.—The
16 Secretary shall designate that at least 2 of these grants
17 shall be awarded to rural or agricultural based institutions
18 that offer interdisciplinary programs in the area of envi-
19 ronmental science to study carbon capture and sequestra-

1 tion in conjunction with the recovery of oil and other en-
2 hanced elemental and mineral recovery.
3 (d) AUTHORIZATION OF APPROPRIATIONS.—There
4 are to be authorized to be appropriated $10,000,000 to
5 carry out this section.

AMENDMENT TO H.R. 1933
OFFERED BY MS. EDDIE BERNICE JOHNSON OF TEXAS

Page 8, lines 13 through 15, strike ''including'' and all that follows through ''fossil fuels,'' and insert ''at least 2 of which are facilities that generate electric energy from fossil fuels. Candidate facilities for other demonstrations under this paragraph shall include facilities that''.

AMENDMENT TO H.R. 1933

OFFERED BY Mr McCaul

Page 7, line 12, insert ", including facilities that convert coal to one or more liquid or gaseous transportation fuels" after "coal facilities".

Page 8, line 15, insert "convert coal to one or more liquid or gaseous transportation fuels," after "refine petroleum,".