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REPORT
110–402

ENERGY STORAGE TECHNOLOGY ADVANCEMENT ACT OF 2007

OCTOBER 22, 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

[To accompany H.R. 3776]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred the bill (H.R. 3776) to provide for a research, development, and demonstration program by the Secretary of Energy to support the ability of the United States to remain globally competitive in energy storage systems for vehicles, stationary applications, and electricity transmission and distribution, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

CONTENTS

		Page
I.	Amendment	2
II.	Purpose of the Bill	4
III.	Background and Need for the Legislation	4
IV.	Hearing Summary	6
V.	Committee Actions	8
VI.	Summary of Major Provisions of the Bill, as Reported	8
VII.	Section-by-Section Analysis (by Title and Section), as Reported	9
VIII.	Committee View	9
IX.	Cost Estimate	12
X.	Congressional Budget Office Cost Estimate	12
XI.	Compliance With Public Law 104–4	13
XII.	Committee Oversight Findings and Recommendations	14
XIII.	Statement on General Performance Goals and Objectives	14
XIV.	Constitutional Authority Statement	14
XV.	Federal Advisory Committee Statement	14
XVI.	Congressional Accountability Act	14
XVII.	Earmark Identification	14
XVIII.	Statement on Preemption of State, Local, or Tribal Law	14

69–006

XIX. Changes in Existing Law Made by the Bill, as Reported 14
XX. Committee Recommendations 14
XXI. Proceedings of the Subcommittee Markup 15
XXII. Proceedings of the Full Committee Markup 29

I. AMENDMENT

The amendments are as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the "Energy Storage Technology Advancement Act of 2007".

SEC. 2. DEFINITIONS.

For purposes of this Act—

(1) the term "Department" means the Department of Energy;

(2) the term "electric drive vehicle" means—

(A) a vehicle that uses an electric motor for all or part of its motive power, including battery electric, hybrid electric, plug-in hybrid electric, fuel cell, and plug-in fuel cell vehicles, and rail transportation vehicles; or

(B) mobile equipment that uses an electric motor to replace an internal combustion engine for all or part of the work of the equipment;

(3) the term "islanding" means a distributed generator or energy storage device continuing to power a location in the absence of electric power from the primary source;

(4) the term "microgrid" means an integrated energy system consisting of interconnected loads and distributed energy resources, including generators and energy storage devices, which as an integrated system can operate in parallel with the utility grid or in an intentional islanding mode;

(5) the term "Secretary" means the Secretary of Energy;

(6) the term "self-healing grid" means a grid that is capable of automatically anticipating and responding to power system disturbances, including the isolation of failed sections and components, while optimizing its own performance and service to customers; and

(7) the term "spinning reserve services" means an amount of electric generating capacity in excess of the amount needed to meet peak electric demand.

SEC. 3. BASIC RESEARCH PROGRAM.

(a) IN GENERAL.—The Secretary shall conduct a basic research program to support the development of energy storage systems for electric drive vehicles, stationary applications, and electricity transmission and distribution, including research on—

(1) materials design;

(2) materials synthesis and characterization;

(3) electrolytes;

(4) surface and interface dynamics;

(5) modeling and simulation; and

(6) thermal behavior and life degradation mechanisms.

(b) FUNDING.—For activities carried out under this section, in addition to funding activities at National Laboratories, the Secretary shall award funds to, and coordinate activities with, a range of stakeholders including the public, private, and academic sectors.

(c) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $50,000,000 for each of the fiscal years 2009 through 2014.

SEC. 4. APPLIED RESEARCH PROGRAM.

(a) IN GENERAL.—The Secretary shall conduct an applied research program on energy storage systems to support electric drive vehicle, stationary application, and electricity transmission and distribution technologies, including research on—

(1) ultracapacitors;

(2) flywheels;

(3) batteries and battery systems (including flow batteries);

(4) compressed air energy systems;

(5) power conditioning electronics;

(6) manufacturing technologies for energy storage systems;

(7) thermal management systems; and

(8) hydrogen as an energy storage medium.

(b) FUNDING.—For activities carried out under this section, in addition to funding activities at National Laboratories, the Secretary shall award funds to, and coordi-

nate activities with, a range of stakeholders including the public, private, and academic sectors.

(c) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $80,000,000 for each of the fiscal years 2009 through 2014.

SEC. 5. ENERGY STORAGE SYSTEMS DEMONSTRATIONS.

(a) IN GENERAL.—The Secretary shall carry out a program of new demonstrations of advanced energy storage systems. These demonstrations shall be regionally diversified and shall expand on the Department's existing technology demonstration program. These demonstrations should include the participation of a range of stakeholders, such as rural electric cooperatives, investor owned utilities, municipally owned electric utilities, energy storage systems manufacturers, electric drive vehicle manufacturers, the renewable energy production industry, State or local energy offices, the fuel cell industry, and universities. Each of the demonstrations shall include one or more of the following objectives:

(1) Energy storage to improve the feasibility of "micro-grids" or "islanding", or the transmission and distribution capability to improve reliability in rural areas.

(2) Integration of an energy storage system with a self-healing grid.

(3) Use of energy storage to improve security to emergency response infrastructure.

(4) Integration with a renewable energy production source, either at the source or away from the source.

(5) Use of energy storage to provide ancillary services, such as spinning reserve services, for grid management.

(6) Advancement of power conversion systems to make them smarter, more efficient, able to communicate with other inverters, and able to control voltage.

(7) Use of energy storage to optimize transmission and distribution operation and power quality, which could address overloaded lines and maintenance of transformers and substations.

(8) Use of advanced energy storage for peak load management of homes, businesses, and the grid.

(9) Use of energy storage devices to fill up nonpeak generation periods for electricity demand to make better use of existing grid assets.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $30,000,000 for each of the fiscal years 2009 through 2014.

SEC. 6. VEHICLE ENERGY STORAGE DEMONSTRATION.

(a) IN GENERAL.—The Secretary shall carry out a program of electric drive vehicle energy storage technology demonstrations. These technology demonstrations shall be conducted through consortia, which may include energy storage systems manufacturers and their suppliers, electric drive vehicle manufacturers, rural electric cooperatives, investor owned utilities, municipal and rural electric utilities, State and local governments, metropolitan transportation authorities, and universities. The program shall demonstrate one or more of the following:

(1) Novel, high capacity, high efficiency energy storage, charging, and control systems, along with the collection of data on performance characteristics such as battery life, energy storage capacity, and power delivery capacity.

(2) Advanced onboard energy management systems, and highly efficient battery cooling systems.

(3) Integration of such systems on a prototype vehicular platform, including with drivetrain systems for passenger, commercial, and nonroad electric drive vehicles.

(4) New technologies and processes that reduce manufacturing costs.

(5) Integration of advanced vehicle technologies with electricity distribution system and smart metering technology.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $30,000,000 for each of the fiscal years 2009 through 2014.

SEC. 7. SECONDARY APPLICATIONS AND DISPOSAL OF ELECTRIC DRIVE VEHICLE BATTERIES.

(a) IN GENERAL.—The Secretary shall carry out a program of research, development, and demonstration of secondary applications of energy storage devices following service in electric drive vehicles, and of technologies and processes for final recycling and disposal of these devices.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $5,000,000 for each of the fiscal years 2009 through 2014.

SEC. 8. COORDINATION AND NONDUPLICATION.

To the maximum extent practicable, the Secretary shall coordinate activities under this Act with other programs and laboratories of the Department and other Federal research programs.

SEC. 9. COST SHARING.

The Secretary shall carry out the programs under sections 6 and 7 in compliance with section 988 (a) through (d) and section 989 of the Energy Policy Act of 2005 (42 U.S.C. 16352(a) through (d) and 16353).

Amend the title so as to read:

A bill to provide for research, development, and demonstration programs in advanced energy storage systems for electric drive vehicles, stationary applications, and electricity transmission and distribution applications, to support the ability of the United States to remain globally competitive in this field, and to promote the efficient delivery and use of energy.

II. PURPOSE OF BILL

The purpose of H.R. 3776 is to provide for research, development, and demonstration programs to accelerate the development of advanced energy storage systems for vehicular, stationary, and electricity transmission and distribution applications, and support the ability of the United States to remain globally competitive in this field.

III. BACKGROUND AND NEED FOR LEGISLATION

Stationary storage technologies

Today, electricity is generated as it is used, with very little being stored for later use. Though this system has worked for decades, it is not an efficient means of managing the electric power supply. Demand for electric power varies greatly throughout the day and throughout the year. Therefore, the electricity supply system must be sized to generate and transmit enough electricity to meet the maximum anticipated demand, or peak demand. The inefficiency of this system becomes evident when considering that peak electricity demand for any given year could be for a very short period of time—a few days or even hours—leaving considerable excess generation capacity. Rather than maintain massive generation systems that are designed around a short-lived peak demand, energy storage technologies would provide a means to stockpile energy for later use, and consequently reduce the need to generate more power during times of peak electricity demand. Optimally, energy storage systems could be charged at night during off-peak consumption hours, and then discharge the energy during times of peak demand. Using existing generation capacity at night time to store energy for use during the day is more efficient, cheaper, helps to equalize the demand load, and ease the strain on the electricity grid.

The expanded use of energy storage would also help to avoid capital intensive upgrades of transmission and distribution facilities, as well as reduce the need to run certain generation plants that may have higher operating costs and/or have a poor emissions profile. Energy storage also can improve electricity reliability and energy security by providing an alternate source of power during an outage of the primary power source.

Advances in energy storage technologies are often regarded as key to increasing the reliability and widespread use of many renewable energy technologies. Renewables such as wind and solar

produce electricity only when wind speeds are high enough and sunlight is bright enough to generate power. Strategically distributed storage would permit electricity from these renewable sources to be stored and used during times of high demand or low resource availability.

Smaller energy storage systems may also be deployed in distributed stationary applications, such as residences or neighborhoods, in order to supply back-up energy and level the load on the electric grid. Advances in smaller energy storage systems, specifically batteries, may also allow for entirely new vehicles such as plug-in hybrid vehicle technologies to enter the mass market.

Energy storage technologies for vehicles

Concerns about energy independence and climate change have caused a renewed interest in enhancing the role of electricity in the transportation sector. The benefits of this have been seen to some degree in the rise in popularity of Hybrid Electric Vehicles (HEV) because of their high fuel efficiency and lower emissions. Switching vehicles' primary energy source from petroleum-based fuels to electric batteries reduces overall consumption of conventional liquid fuels. Additionally, several recent studies have shown that, regardless of its source, electricity used as a vehicle fuel reduces greenhouse gas emissions. However, greater electrification of the vehicles sector is constrained by the technological limits of energy storage technologies used in conventional hybrids, specifically the Nickel Metal Hydride (NiMH) batteries.

Plug-In Hybrid Electric Vehicles (PHEVs) are seen by some as the next logical step towards greater electrification of the transportation sector, and the eventual move towards market acceptance of all-electric drive vehicles. PHEVs allow for electricity to be used as an additional or even primary source of power for a vehicle, with a secondary role for the gasoline engine as a back-up power system. Advocates claim that 100 miles per gallon would be reasonable for PHEVs, approximately twice the gasoline mileage of today's hybrids. However, current NiMH batteries for conventional hybrids are not optimal for this application.

While significant technological advances are still likely in NiMH, and even the ubiquitous Lead Acid batteries, many in the industry believe the future of PHEVs depends on breakthroughs in new battery technologies, such as the lithium ion (Li-Ion) batteries. To expand the use of electricity in the vehicles sector, batteries must be smaller, lighter, more powerful, higher energy and cheaper—all of which require considerable research and development. Achieving these needed breakthroughs will require meaningful federal support and public-private partnerships with a range of stakeholders.

Enhanced federal research and development of advanced energy storage technologies offers a number of economic, environmental and security benefits including greater efficiency and reliability in the electricity delivery system, better integration of renewable energy supplies into the electric grid, and less reliance on conventional transportation fuels. However, significant challenges remain in developing these technologies and establishing a viable domestic supply chain. H.R. 3776 authorizes the Department of Energy to conduct research and development programs on energy storage technologies, and expands this research to the demonstration of

promising storage technologies and the manufacturing methods to allow for their production in the U.S.

IV. HEARING SUMMARY

The Energy and Environment Subcommittee held a hearing on Wednesday, October 3, 2007 to hear testimony on the discussion draft of the bill from the following witnesses:

Panel One:

- Ms. Patricia Hoffman, Deputy Director, Research and Development, U.S. Department of Energy Office of Electricity Delivery and Energy Reliability
- Mr. Brad Roberts, Chairman, Electricity Storage Association
- Mr. Larry Dickerman, Director, Distribution Engineering Services for American Electric Power
- Mr. Tom Key, Technical Leader, Renewable and Distributed Generations, Electric Power Research Institute

Panel Two:

- Ms. Lynda Ziegler, Sr. Vice President for Customer Services, Southern California Edison
- Ms. Denise Gray, Director, Hybrid Energy Storage Systems, General Motors
- Ms. Mary Ann Wright, Vice President and General Manager, Hybrid Systems for Johnson Controls, Director of Advanced Power Solutions, a Johnson Controls and Saft joint venture

Witnesses at the hearing testified that the United States presently is not a leader in the development of energy storage technologies, and industry must look to overseas companies for component parts that were oftentimes invented here at home. It was pointed out that the success of these overseas companies is due in large part to intensive R&D and commercialization support from their respective governments, and that a similar effort is required in the U.S. The public-private partnerships stemming from the federal government's investment in research, development and demonstration programs will help to propel the United States into a globally competitive position. A robust domestic manufacturing base and supply chain for this advanced technology sector will also have the positive effect of creating high-wage manufacturing jobs in the U.S. By increasing the domestic capacity of this advanced technology sector, manufacturers will have greater access to necessary components for accelerating advanced storage technologies into the marketplace.

The first panel focused on stationary energy storage systems and how these technologies can be successfully integrated into the electric grid or installed alone at a residential or commercial or industrial site to function as a separate power supply. The witnesses underscored the ability of storage systems to provide public benefits such as greater power reliability and security and better integration of renewable energy sources such as wind and solar into the electric grid, since energy from these sources is otherwise available only intermittently.

Ms. Hoffman, Deputy Director of Research and Development and Acting Chief Operating Officer for the Office of Electricity Delivery and Energy Reliability at the U.S. Department of Energy (DOE) testified that energy storage technologies paired with an advanced electric grid would accelerate the integration of renewable sources

of energy into the grid as well as foster demand response practices where customers' appliances respond to price signals provided by electric utilities facilitating better control of electricity costs by the end user. She further discussed the benefits of energy storage for improving power quality and reliability by reducing transmission congestion and providing ancillary services such as spinning reserve services needed to meet peak electric demand.

However, Ms. Hoffman pointed out that approximately a mere 2.5 percent of the total electric power currently delivered in the United States passes through energy storage systems and to date is largely limited to pumped hydroelectric storage. She also stated that the Department recognizes the need to continue basic research into energy storage materials and systems and during questions remarked that the demonstration programs in the bill complement the Department's activities in this area and do not duplicate its efforts.

Ms. Hoffman offered that DOE acknowledges that energy storage technologies hold much promise for the transportation sector as well. She testified that plug-in hybrid electric vehicles will help to transition the nation away from exclusive dependence on oil for transportation fuel, and it is important to understand how such vehicles could impact the electric system.

Mr. Roberts, Chairman of the Electricity Storage Association, underscored the benefits of energy storage technology by describing the usefulness of storage systems during power outages caused by natural and manmade disasters. He recommended expanding the scope of government funding for storage programs that interact with the grid and providing adequate resources for conducing demonstrations of energy storage technologies which enhance the electric grid.

Mr. Dickerman, Director of Distribution Engineering Services at American Electric Power, agreed and emphasized the need for federal investment incentives to accelerate the widespread deployment of energy storage technologies. Mr. Dickerman also discussed his company's ongoing investment in deploying energy storage on its system using an advanced battery technology. He explained energy storage could be used to reduce peak load on equipment, provide backup energy to improve security and reliability, and enhance the use of wind generation at times of high demand.

Mr. Key, Technical Leader for Renewables and Distributed Generation at the Electric Power Research Institute, underscored the ability of energy storage technologies to support renewable energy sources that avoid emissions of harmful pollutants and to involve customers in the management of their electricity use. He also acknowledged that these technologies are expensive and siting and permitting can be difficult. He closed by recognizing that energy storage technologies will be essential in meeting the growing demand for electricity from sources that address our environmental challenges.

The second panel focused on energy storage technologies for vehicles. Ms. Zeigler, Senior Vice President for Customer Services, Southern California Edison testified that a study conducted by the Electric power Research Institute and the Natural Resources Defense Council found that widespread adoption of plug-in hybrids could reduce annual emissions of greenhouse gases by more than

450 million metric tons by 2050, or the equivalent of removing 82 million passenger cars from the road. Advances in electric car batteries would also help to reduce our dependence on foreign oil supplies and overall improve vehicle efficiencies. Electricity is the only alternative transportation fuel with a national infrastructure in place today. Consequently, plug-ins hybrids could also serve as a temporary energy power supply for homes and businesses, helping customers avoid high electricity costs during times of peak demand.

Ms. Gray, Director of Hybrid Energy Storage Systems at General Motors Corporation, described the different types of battery technologies, additional research needed to develop vehicles that meet a range of consumer demands, and the difficulties of allocating limited company resources across a range of alternative technologies such as hydrogen fuel cells, advanced diesel, and flexible fuel vehicles. She traces much of the current success introducing hybrids in the U.S. auto market to public-private partnership between industry and the Department of Energy.

Mrs. Wright, Vice President and General Manger for Hybrid Systems Power Solutions, Johnson Controls spoke to the environmental benefits of plug-in electric vehicles, but cautioned that continued federal investment in technology research and demonstrations is needed to overcome significant economic barriers. In addition, investment in a national manufacturing base and infrastructure would facilitate collaboration among the stakeholders to achieve widespread deployment of these technologies in the marketplace at a price consumers can afford. Ms. Wright's written testimony includes a list of commercialization barriers and key enabling countermeasures. Among those, direct federal collaborations between battery manufacturers and other lower tier suppliers is cited as key to overcoming a range of technical challenges.

V. SUMMARY OF COMMITTEE ACTIONS

On October 9, 2007, Representative Bart Gordon introduced H.R. 3776, The Energy Storage Technology Advancement Act of 2007.

The Subcommittee on Energy and Environment met to consider H.R. 3776 on October 10, 2007, with no amendments to the bill.

Mr. McNerney moved that the Subcommittee favorably report the bill, H.R. 3776, to the Full Committee on Science and Technology. The motion was agreed to by a voice vote.

VI. SUMMARY OF MAJOR PROVISIONS OF THE BILL

H.R. 3776 authorizes $130 million for basic and applied energy storage research programs at the Department of Energy for each fiscal year 2009 through 2014, and sets guidelines for activities of the programs. The basic research is authorized at $50 million for each fiscal year and the applied research is authorized at $80 million for each fiscal year. In addition, the bill authorizes the Secretary of Energy to carry out 6 demonstrations of stationary storage technologies aimed at accomplishing goals such as improving security for emergency response infrastructure, addressing management of overloaded lines and improving reliability of the electricity supply in rural communities. The second demonstration program focuses on the application of energy storage technologies in the vehicles sector. Such demonstration efforts will seek to advance onboard energy management and cooling systems, reduce manufac-

turing costs and integrate transportation technologies with the electricity distribution system and smart metering technology. Finally, H.R. 3776 includes a 50/50 federal and non-federal cost share arrangement for both the stationary and vehicular demonstration programs.

VII. SECTION-BY-SECTION ANALYSIS OF THE BILL, AS REPORTED

Section 1. Short title

"Energy Storage Technology Advancement Act of 2007"

Sec. 2. Definitions

Sec. 3. Energy storage system program

Authorizes program for research, development and demonstration of energy storage systems to be carried out by the Secretary of Energy.

Sec. 4. Basic research program

Authorizes basic research in areas such as materials, electrolytes, and thermal behavior. $50 million authorized for each of the fiscal years 2009–2014.

Sec. 5. Applied research program

Authorizes applied research in areas such as batteries, other energy storage technologies, and new manufacturing technologies for these devices. $80 million authorized for each of the fiscal years 2009–2014.

Sec. 6. Energy storage systems demonstrations

Authorizes 6 large scale demonstrations of electricity storage to meet specific goals such as integrating renewable energy technologies into electric power supply. Such sums authorized for each of the fiscal years 2009–2014.

Sec. 7. Transportation energy storage demonstrations

Authorizes demonstrations in areas such as advanced vehicle battery technologies and related components, and new manufacturing technologies for these devices. Such sums authorized for each of the fiscal years 2009–2014.

Sec. 8. Cost sharing

Requires cost sharing to be carried out in accordance with EPACT 2005 section 988.

VIII. COMMITTEE VIEWS

It is the Committee view that advancing the field of energy storage technologies brings with it significant environmental, economic and security-related benefits, and it is critical that a robust energy storage technology industry is developed in the U.S. Advanced storage devices allow for better and more efficient management of our electricity delivery system, increased use of renewable energy sources, decreased emissions of carbon dioxide and other harmful pollutants, and less reliance on foreign imports to meet our transportation fuel needs. To ensure progress in this field, it is the Committee view that significant breakthroughs must be realized

through a program of basic and applied research, development and demonstration, and that federal investment is necessary for the United States to become a world leader in developing and manufacturing these technologies.

The basic research areas outlined in Section 3 are based primarily on recommendations resulting from an April 2007 workshop conducted by the Department of Energy's Office of Science entitled "Basic Research Needs for Electrical Energy Storage". While the legislation specifically lists a number of areas of research in the area of energy storage, it is not the intent of the Committee to limit the Department's overall battery research program, especially in light of interest in areas such as research on ion-exchange materials and catalysts.

Sections 3 and 4 both include language directing the Secretary of Energy to coordinate activities and award funds to a range of stakeholders in the public, private and academic sectors, in addition to work at the national laboratories. The Committee believes that funding for this research should not be done solely at the national laboratories. The university community and the private sector should also be funded to do this work.

The Committee believes the success of these technologies ultimately depends upon their widespread adoption in the marketplace. A key step in that process is the conduct of demonstration projects. It is the Committee view that implementation of diverse demonstrations projects could provide valuable information about the potential efficiency gains and economic benefits of broad deployment of energy storage systems. Section 5 of the bill lays out a number of suggested objectives for the Department of Energy's demonstration of energy storage systems, but it is not the intent of the Committee to limit the accomplishments of the demonstration program. The Committee recognizes that more than one objective could be achieved through a single demonstration project.

Generally, it is the Committee view that energy storage systems can help to transform the electric delivery system in the United States by increasing reliability, stability and resiliency of the grid. The Committee believes it is important to conduct some demonstrations of energy storage technologies designed to improve reliability of electricity supplies in rural parts of the country. The Committee also sees value in demonstrations of storage technologies in ensuring that our emergency response infrastructure, including water treatment plants and hospitals, can continue operations during natural disasters or manmade disruptions to the electric power supply.

The Committee believes that deployment of energy storage technologies applied in load centers or areas with concentrated populations, would relieve congestion during peak demand periods, and would be essential to help address timing and need for infrastructure upgrades. The Committee also views energy storage systems as a key technology to provide ancillary services to the grid such as spinning reserve services and frequency regulation.

As part of the effort to modernize our electric infrastructure, it is the Committee view that federal resources should be spent to demonstrate the integration of renewable energy onto the grid through energy storage systems. These systems would allow renewable energy sources such as wind and solar to provide a steadier

and more reliable stream of energy as they would no longer be dependant on periods when the wind is blowing and the sun is shining in order to contribute energy to the electric grid. The Committee finds that energy storage systems will foster better performance of the electric utility infrastructure by optimizing electricity generation. Energy storage technologies would reduce the need to generate more power during times of peak electricity demand by using our generation capacity at night during nonpeak demand and storing energy for use during the day. This energy management practice could also prevent the need to run generation facilities with high operational costs or poor emissions profiles. This would be more efficient, less costly, and help to equalize the demand load while reducing emissions of greenhouse gases.

The Committee believes the Department of Energy's work to advance energy storage technologies should take into consideration the challenges of ensuring that these technologies can be adopted by energy production operators and/or deployed by other private and public parties. The Department should consider seeking solutions to reduce technical barriers that may prohibit the use of energy storage technologies. It is the Committee view that the Department's programmatic efforts should look to solve design hurdles when feasible so that the technologies successfully demonstrated could be deployed without significant delay.

In regard to energy storage technologies for vehicular applications, the Committee recognizes that large-scale demonstrations utilizing government and utility vehicle fleets are useful in testing electric drive vehicles in a variety of conditions and use-patterns, and that these fleets provide added public visibility that eases commercialization. However, the program as described in the section is intended to focus on demonstration of the energy storage systems in particular, and their related components. It is the view of the Committee that, in addition to public-private partnerships with Original Equipment Manufacturers (OEMs), special attention should be paid to direct coordination with battery manufacturers and second tier suppliers.

The Committee believes it is important to quickly develop means to handle electric drive vehicle batteries after their use in vehicles. The expansion of the hybrid vehicle market will result in a significant number of batteries that could be diverted to other uses, recycled, or otherwise disposed of. A very large majority of conventional lead-acid vehicle batteries are recycled or otherwise re-used, limiting the environmental impacts from their disposal. The Committee supports an R&D program that would characterize the potential environmental impact of these batteries, and develop technologies and processes for recycling and disposal of these devices. The Committee believes there may be a range of stationary applications for which a used vehicle battery is well-suited, and research and development of these options can lead to significant reductions in the cost to consumers. Section 7 directs the Secretary to carry out a program of research, development and demonstration program for secondary applications and disposal of electric drive vehicle batteries.

IX. 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. 3776 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. 3776 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.

X. CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

OCTOBER 19, 2007.

Hon. BART GORDON,
Chairman, Committee on Science and Technology,
House of Representatives, Washington, DC.

DEAR MR. CHAIRMAN: The Congressional Budget Office has prepared the enclosed cost estimate for H.R. 3776, the Energy Storage Technology Advancement Act of 2007.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is Leigh Angres.

Sincerely,

PETER R. ORSZAG.

Enclosure.

H.R. 3776—Energy Storage Technology Advancement Act of 2007

Summary: H.R. 3776 would authorize the appropriation of $195 million a year over the 2009–2014 period for the Department of Energy's (DOE's) energy storage research activities. Assuming appropriation of the authorized amounts, CBO estimates that implementing H.R. 3776 would cost $638 million over the 2008–2012 period and about $530 million after 2012. Enacting H.R. 3776 would not affect direct spending or revenues.

H.R. 3776 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, or tribal governments.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 3776 is shown in the following table. The costs of this legislation fall within budget function 250 (general science, space, and technology).

	By fiscal year, in millions of dollars—				
	2008	2009	2010	2011	2012
CHANGES IN SPENDING SUBJECT TO APPROPRIATION [a]					
Basic Research for Energy Storage Technology:					
Authorization Level	0	50	50	50	50
Estimated Outlays	0	23	43	48	50
Applied Research for Energy Storage Technology:					
Authorization Level	0	80	80	80	80
Estimated Outlays	0	36	68	76	80
Energy Storage Systems Demonstration Programs:					
Authorization Level	0	30	30	30	30

	By fiscal year, in millions of dollars—				
	2008	2009	2010	2011	2012
Estimated Outlays	0	14	26	29	30
Vehicle Energy Storage Demonstration Programs:					
Authorization Level	0	30	30	30	30
Estimated Outlays	0	14	26	29	30
Secondary Applications of Electric Drive Vehicle:					
Authorization Level	0	5	5	5	5
Estimated Outlays	0	2	4	5	5
Total Changes:					
Authorization Level	0	195	195	195	195
Estimated Outlays	0	89	167	187	195

[a] A full-year 2008 appropriation for the Department of Energy has not yet been provided.
Note: Under the bill, an additional $195 million a year would be authorized in 2013 and 2014.

Basis of estimate: For this estimate, CBO assumes that H.R. 3776 will be enacted during fiscal year 2008 and that the entire amounts authorized will be appropriated for each fiscal year.

H.R. 3776 would authorize the appropriation of $195 million a year over the 2009–2014 period for DOE's energy storage research programs in such areas as electric drive vehicles and electricity transmission and distribution.

The bill would specifically authorize the appropriation of $50 million a year through 2014 to award grants to the public, private, and academic sectors to support research in such areas as surface and interface dynamics and thermal behavior (i.e., how a system burns). Under the bill, another $80 million annually would be authorized to be appropriated for applied research on batteries, compressed air energy systems, and ultracapacitors.

H.R. 3776 would also authorize the appropriation of $60 million a year through 2014 for energy storage demonstration programs. Of that amount, $30 million a year would be authorized to be appropriated for electricity storage demonstration programs to research the integration of renewable energy sources into the electric power supply and the use of advanced energy storage for peak load management of homes and businesses. Another $30 million a year would be authorized to be appropriated for vehicle energy storage demonstration programs to advance the use of electricity in the transportation sector.

Based on the historical spending patterns of DOE research and development programs, CBO estimates that implementing H.R. 3776 would cost $638 million over the 2008–2012 period and about $530 million after 2012.

Intergovernmental and private-sector impact: H.R. 3776 contains no intergovernmental or private-sector mandates as defined in UMRA. The bill would authorize several new research and demonstration programs for electric energy storage that would benefit state and local governments. Any costs they might incur, 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: Theresa Gullo, Deputy Assistant Director for Budget Analysis.

XI. COMPLIANCE WITH PUBLIC LAW 104–4

H.R. 3776 contains no unfunded mandates.

XII. 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.

XIII. STATEMENT ON GENERAL PERFORMANCE GOALS AND OBJECTIVES

Pursuant to clause (3)(c) of House Rule XIII, the goal of H.R. 3776 is to provide for research, development, and demonstration programs to accelerate the development of advanced energy storage systems for vehicular, stationary, and electricity transmission and distribution applications, and support the ability of the United States to remain globally competitive in this field.

XIV. CONSTITUTIONAL AUTHORITY STATEMENT

Article I, section 8 of the Constitution of the United States grants Congress the authority to enact H.R. 3776.

XV. FEDERAL ADVISORY COMMITTEE STATEMENT

H.R. 3776 does not establish nor authorize the establishment of any advisory committee.

XVI. CONGRESSIONAL ACCOUNTABILITY ACT

The Committee finds that H.R. 3776 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).

XVII. EARMARK IDENTIFICATION

H.R. 3776 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.

XVIII. STATEMENT ON PREEMPTION OF STATE, LOCAL, OR TRIBAL LAW

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

XIX. CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

H.R. 3776, as reported, makes no changes in existing law.

XX. COMMITTEE RECOMMENDATIONS

On June 27, 2007, the Committee on Science and Technology favorably reported H.R. 3776, as amended, by a voice vote and recommended its passage by the House of Representatives.

XXI. PROCEEDINGS OF THE MARKUP BY THE SUBCOMMITTEE ON ENERGY AND ENVIRONMENT ON H.R. 3776, THE ENERGY STORAGE TECHNOLOGY ADVANCEMENT ACT OF 2007

WEDNESDAY, OCTOBER 10, 2007

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

The Subcommittee met, pursuant to call, at 2:06 p.m., in Room 2318 of the Rayburn House Office Building, Hon. Nick Lampson [Chairman of the Subcommittee] presiding.

Chairman LAMPSON. Good afternoon. This Committee 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. 3776, the *Energy Storage Technology Advancement Act of 2007;* H.R. 3775, the *Industrial Energy Efficiency Research and Development Act of 2007;* and H.R. 1834, the *National Ocean Exploration Program Act.* We will now proceed with the markup, beginning with opening statements, and I will begin.

Today the Subcommittee will consider three bills.

The first is the *Energy Storage Technology Advancement Act,* introduced yesterday by Chairman Gordon. As we learned in the hearing last week, an aggressive research program to accelerate the development of batteries and other energy-storing technologies is essential to achieving greater energy efficiency and emission reduction in the utility and transportation sectors. Chairman Gordon's bill, which incorporates many features of an energy bill introduced earlier in the Congress by Ranking Member Hall, will ensure that we move these import technologies forwards and support a vigorous domestic industrial capability in this areas.

The second bill is the *Industrial Energy Efficiency Research and Development Act.* I introduced this legislation yesterday after circulating a discussion draft of the bill at the end of September. If we want to maintain a competitive, domestic industrial economy, we must find ways to enable energy-intensive industries to become more energy efficient and to diversify the fuel and raw materials they use to manufacture their products. Competition for energy and material is increasing and driving up prices for these inputs. The Industrial Technology Program at the Department of Energy has been working in partnership with industries across the county to achieve these important goals, but we still must do more.

And finally, we will consider H.R. 1834, introduced by our colleague on the Natural Resources Committee, Representative Saxton. The *National Ocean Exploration and National Undersea Research Program Act* will expand our knowledge of the oceans and provide basic information about the vast resources of the seas. The ocean and coastal areas of our nation support significant economic activity in a wide variety of area, but in many respects, the oceans remain a mystery with many areas unexplored. Representative Saxton's legislation provides the National Oceanic and Atmospheric Administration with the authorities and direction to support a vigorous ocean-exploration program. We will continue to work with our colleagues on the Natural Resources Committee to move this legislation forward.

I urge the Members of the Subcommittee to support all three of these bills, and I look forward to continue working with all of you as these will go forward.

[The prepared statement of Chairman Lampson follows:]

PREPARED STATEMENT OF CHAIRMAN NICK LAMPSON

Good afternoon.

Today the Subcommittee will consider three bills. The first is the *Energy Storage Technology Advancement Act* introduced yesterday by Chairman Gordon. As we learned in the hearing last week, an aggressive research program to accelerate the development of batteries and other energy storing technologies is essential to achieving greater energy efficiency and emission reductions in the utility and transportation sectors.

Chairman Gordon's bill, which incorporates many features of an energy bill introduced earlier in this Congress by Ranking Member Hall, will ensure that we move these important technologies forward and support a vigorous domestic industrial capability in this area.

The second bill is the *Industrial Energy Efficiency Research and Development Act.* I introduced this legislation yesterday after circulating a discussion draft of the bill at the end of September.

If we want to maintain a competitive, domestic industrial economy we must find ways to enable energy-intensive industries to become more energy efficient and to diversify the fuel and raw materials they use to manufacture their products. Competition for energy and materials is increasing and driving up prices for these inputs. The Industrial Technology Program at the Department of Energy has been working in partnership with industries across the country to achieve these important goals, but we must do more.

Finally, we will consider H.R. 1834 introduced by our Colleague on the Natural Resources Committee, Rep. Saxton. The *National Ocean Exploration and National Undersea Research Program Act* will expand our knowledge of the oceans and provide basic information about the vast resources of the seas.

The ocean and coastal areas of our nation support significant economic activity in a wide variety of areas. But in many respects, the oceans remain a mystery with many areas unexplored. Rep. Saxton's legislation provides the National Oceanic and Atmospheric Administration with the authorities and direction to support a vigorous ocean exploration program. We will continue to work with our colleagues on the Natural Resources Committee to move this legislation forward.

I urge the Members of the Subcommittee to support all three of these bills, and I look forward to continue working with all of you as these bills go forward.

Chairman LAMPSON. And I recognize Mr. Inglis to present his opening remarks.

Mr. INGLIS. Thank you, Mr. Chairman. I look forward to this markup, and today we will mark up two bills that address two vital needs in pursuit of our energy security: energy efficiency and energy storage.

The Department of Energy's Industrial Technologies Program has a successful track record of helping U.S. manufactures trans-

late research and development into efficient, cost-saving technologies. By reauthorizing this program, the *Industrial Energy Efficiency Research and Development Act,* H.R. 3775, will support our nation's industries in achieving energy efficiency while remaining economically competitive. It is very important that we direct this program to prioritize its efficiency efforts, targeting industry sectors, not individual businesses, where we can attain the best emissions reductions for our buck.

While energy efficiency reduces our total consumption of foreign oil and gas, energy-storage progress will encourage development of clean, renewable energy sources. H.R. 3776, the *Energy Storage Technology Advancement Act,* can help promote consistent and stable energy supply from renewable sources. That is a big hurdle, but it is one we can't clear soon enough.

Finally, we shall be marking up the bill H.R. 1834, the *National Ocean Exploration Program Act.* Marine scientists tell us that we haven't come close to tapping the resources available to us in and under our oceans. I hope that the bill we markup today steers research dollars to those fact-finding projects so that we might, one day, reap the benefits of our hidden oceanic resources.

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

[The prepared statement of Mr. Inglis follows:]

PREPARED STATEMENT OF REPRESENTATIVE BOB INGLIS

Thank you for holding this markup, Mr. Chairman.

Today we'll mark up two bills that address two vital needs in our pursuit of energy security: energy efficiency and energy storage.

The Department of Energy's Industrial Technologies Program (ITP) has a successful track record of helping U.S. manufacturers translate research and development into efficient, cost-saving technologies. By reauthorizing this program, the *Industrial Energy Efficiency Research and Development Act* (H.R. 3775) will support our nation's industries in achieving energy efficiency while remaining economically competitive. It is very important that we direct this program to prioritize its efficiency efforts, targeting industry sectors (not individual businesses) where we can attain the best emissions reductions for our buck

While energy efficiency reduces our total consumption of foreign oil and gas, energy storage progress will encourage development of clean, renewable energy sources. H.R. 3776, the *Energy Storage Technology Advancement Act* can help promote consistent and stable energy supply from renewable sources. That's a big hurdle, but it's one we can't clear soon enough.

Finally, we'll be marking up the H.R. 1834, the *National Ocean Exploration Program Act.* Marine scientists tell us that we haven't come close to tapping the resources available to us in and under our oceans. I hope that the bill we markup today steers research dollars to those "fact-finding" projects, so that humanity might one day reap the benefits of our hidden oceanic resources.

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.

We will now consider H.R. 3776, the *Energy Storage Technology Advancement Act of 2007.*

I yield to the distinguished Chair of the Science and Technology Committee, Mr. Gordon, for five minutes to describe his bill.

Chairman GORDON. Mr. Chairman, I think you did a good job earlier, and since you have a full agenda, I will waive that right, but I would like to say thank you, to you, to Ranking Member Inglis, to the Members of this committee and to your staff. I don't

think there has been a more productive subcommittee in Congress. You have really knocked it out this year, and I know it has been a fast pace for all of you, and I thank you for that. The last two energy bills, in the midst of the final discussion with energy, will make us more relevant on those two subjects, and I also compliment you on reaching out to Mr. Saxton, not a Member of this committee, but a good idea is a good idea, and I am glad that you could include that.

Chairman LAMPSON. Thank you, Mr. Chairman. I appreciate that very much, and I will recognize Mr. Inglis to present any remarks on the bill.

Mr. INGLIS. Mr. Chairman, just to make sure this clear on the record, it appears that the version in front of us today has a bill number added to it, which was not in the discussion draft circulated. I want to make sure that the version we are using is identical to the introduced version, in order to prevent any confusion moving forward. Is the October 4, 2007, 2:05 p.m., version identical to the version that was introduced?

Chairman LAMPSON. It is.

Mr. INGLIS. Thank you, Mr. Chairman.

Chairman LAMPSON. Does anyone else wish to be recognized on this legislation? Ms. Biggert.

Ms. BIGGERT. Thank you, Mr. Chairman, I move to strike the last word.

Chairman LAMPSON. You are recognized for five minutes.

Ms. BIGGERT. Thank you. I just wanted to offer a suggestion, and hopefully, this is something we can work on between now and the Full Committee markup. After reviewing an early draft of this bill, scientists at Argonne pointed out that hydrogen can be an energy-storage medium, just like compressed air or flywheels. Solar, wind, and renewable could be used to produce hydrogen through electrolysis, hydrogen that is later used by fuel cells to produce electricity, and that is why they recommended that we include hydrogen systems in the Applied Energy Storage Research Program created in Section 5 of this bill.

I think this is a good suggestion that the Committee should consider, and it would appear to be consistent with other provisions in the bill. For instance, the fuel-cell industry is listed as one of the stakeholders eligible to participate in the energy-storage system demonstration, authorized by Section 6 of the bill. It only makes sense that we include hydrogen as one of the energy-storage mediums that should be the focus of the applied energy-storage R&D program.

I would ask if the Chairman would work with me between now and the Full Committee markup to figure out how best to include hydrogen systems in the research program created by the bill.

Chairman GORDON. If the gentlelady will yield, this committee has been very interested in hydrogen. Ranking Member Inglis and Lipinski have an H–Prize bill, and we have encouraged that research at the Department of Energy, and they are doing a lot research there. Certainly, this is first impression, this discussion now, but we would like to hear your thoughts, and anything that can be productive. We would like to make a good bill, you know, a better bill, so we would love to hear your thoughts on it.

Ms. BIGGERT. All right. I thank you, and I would——

Chairman GORDON. If I could, I will say one more thing. I also want to thank Ranking Member Hall. A lot of what we are doing here is based on his good advice and suggestions from earlier, so he has played a large role in this bill, and I yield back.

Ms. BIGGERT. Thank you. I appreciate your comments and would yield back the balance of my time.

Chairman LAMPSON. Thank you, Ms. Biggert. Does anyone else wish to be recognized? Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman, I just want to put my strong support in for this bill. It has both basic research and applied research at the federal level, which is very important. Energy storage will make us more competitive, but it will also help us end our dependence on foreign oil by making broad use of renewable energy that is intermittent and will provide us the tools to deal with global warming. So I think it is a very important step in the right direction, and I strongly support it.

Chairman LAMPSON. Thank you. I understand you are involved in some of that stuff, learning more about it.

Anyone else wish to be recognized? If not, 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, it is so ordered.

No amendments? All right. Seeing how there are no—well, let me ask. Are there any amendments anyone has? Hearing none, the vote is on the bill H.R. 3776, *Energy Storage Technology Advancement of 2007*. All those in favor, say aye. Those opposed, no. In the opinion of the Chair, the ayes have it.

I recognize Mr. McNerney to offer a motion.

Mr. MCNERNEY. Mr. Chairman, I move that the Committee favorably report H.R. 3776 to the Full Committee. Furthermore, I move that the staff be instructed to prepare the Subcommittee legislative report and make necessary technical and conforming changes to the bill, in accordance with the recommendations of the Subcommittee.

Chairman LAMPSON. Now, 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.

Without objection, the motion to reconsider is laid upon the table. Subcommittee Members may submit additional or Minority views on the measure.

I want to thank the Members for their attendance. This concludes our Subcommittee markup. We are adjourned. Thank you.

[Whereupon, at 2:25 p.m., the Subcommittee was adjourned.]

Appendix:

H.R. 3776, Section-by-Section of Draft Legislation

I

110TH CONGRESS
1ST SESSION

H. R. 3776

To provide for a research, development, and demonstration program by the Secretary of Energy to support the ability of the United States to remain globally competitive in energy storage systems for vehicles, stationary applications, and electricity transmission and distribution.

IN THE HOUSE OF REPRESENTATIVES

OCTOBER 9, 2007

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

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A BILL

To provide for a research, development, and demonstration program by the Secretary of Energy to support the ability of the United States to remain globally competitive in energy storage systems for vehicles, stationary applications, and electricity transmission and distribution.

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 ''Energy Storage Technology Advancement Act of 2007''.

SEC. 2. DEFINITIONS.

For purposes of this Act—

(2) the term "Secretary" means the Secretary of Energy.

(1) the term "Department" means the Department of Energy; and

SEC. 3. ENERGY STORAGE SYSTEM PROGRAM.

The Secretary shall carry out a research, development, and demonstration program to support the ability of the United States to remain globally competitive in energy storage systems for vehicles, stationary applications, and electricity transmission and distribution.

SEC. 4. BASIC RESEARCH PROGRAM.

(a) IN GENERAL.—The Secretary shall conduct a basic research program to support the development of energy storage systems for vehicles, stationary applications, and electricity transmission and distribution, including research on—

(1) materials design;

(2) materials synthesis and characterization;

(3) electrolytes;

(4) surface and interface dynamics;

(5) modeling and simulation; and

(6) thermal behavior and life degradation mechanisms.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for car-

rying out this section $50,000,000 for each of the fiscal years 2009 through 2014.

SEC. 5. APPLIED RESEARCH PROGRAM.

(a) IN GENERAL.—The Secretary shall conduct an applied research program on energy storage systems to support vehicle, stationary application, and electricity transmission and distribution technologies, including research on—

(1) ultracapacitors;

(2) flywheels;

(3) batteries and battery systems (including flow batteries);

(4) compressed air energy systems;

(5) power conditioning electronics;

(6) manufacturing technologies for energy storage systems; and

(7) thermal management systems.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section $80,000,000 for each of the fiscal years 2009 through 2014.

SEC. 6. ENERGY STORAGE SYSTEMS DEMONSTRATIONS.

(a) IN GENERAL.—The Secretary shall carry out 6 new demonstrations of advanced energy storage systems. These demonstrations shall be regionally diversified and

shall expand on the Department's existing technology demonstration program. These demonstrations should include the participation of a range of stakeholders, including rural electric cooperatives, investor owned utilities, municipally owned electric utilities, energy storage systems manufacturers, vehicle manufacturers, the renewable energy production industry, State or local energy offices, the fuel cell industry, and universities. Each of the following objectives shall be included in at least one of the technology demonstrations under this subsection:

(1) Energy storage to improve the feasibility of "micro-grids" or "islanding", or the transmission and distribution capability to improve reliability in rural areas.

(2) Integration of an energy storage system with self-healing circuits.

(3) Use of energy storage to improve security to emergency response infrastructure.

(4) Integration with a renewable energy production source, either at the source or away from the source.

(5) Use of energy storage to provide ancillary services, such as frequency response or spinning reserve services, for grid management.

(6) Advancement of power conversion systems to make them smarter, more efficient, able to communicate with other inverters, and able to control voltage.

(7) Use of energy storage to optimize transmission and distribution operation and power quality, which could address overloaded lines and maintenance of transformers and substations.

(8) Use of advanced energy storage for peak shaving of homes, businesses, or grid.

(9) Use of energy storage devices such as plug-in hybrid vehicles to fill up the night time valley for electricity demand to make better use of existing grid assets.

(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary for carrying out this section such sums as may be necessary for each of the fiscal years 2009 through 2014.

SEC. 7. VEHICLE ENERGY STORAGE DEMONSTRATION.

(a) IN GENERAL.—The Secretary shall carry out a program of vehicle energy storage technology demonstrations. These technology demonstrations shall be conducted through consortia, which may include energy storage systems manufacturers and their suppliers, vehicle manufacturers, rural electric cooperatives, investor owned utilities,

1 municipal and rural electric utilities, State and local gov-
2 ernments, metropolitan transportation authorities, and
3 universities. The program shall demonstrate one or more
4 of the following:

5 (1) Novel, high capacity, high efficiency energy
6 storage, charging, and control systems, along with
7 the collection of data on performance characteristics
8 such as battery life, energy storage capacity, and
9 power delivery capacity.

10 (2) Advanced onboard energy management sys-
11 tems, highly efficient battery cooling systems.

12 (3) Integration of such systems on a prototype
13 vehicular platform.

14 (4) New technologies and processes that reduce
15 manufacturing costs.

16 (5) Integration of advanced vehicle technologies
17 with electricity distribution system and smart meter-
18 ing technology.

19 (b) AUTHORIZATION OF APPROPRIATIONS.—There
20 are authorized to be appropriated to the Secretary for car-
21 rying out this section such sums as may be necessary for
22 each of the fiscal years 2009 through 2014.

23 **SEC. 8. COST SHARING.**

24 The Secretary shall carry out the programs under
25 sections 6 and 7 in compliance with section 988 (a)

1 through (d) of the Energy Policy Act of 2005 (42 U.S.C.
2 16352(a) through (d)).

SECTION-BY-SECTION OF THE DRAFT LEGISLATION

Energy Storage Technology Advancement Act of 2007

Section 1—Short Title

"Energy Storage Technology Advancement Act of 2007"

Section 2—Definitions

Section 3—Energy Storage System Program

Authorizes program for research, development and demonstration of energy storage systems to be carried out by the Secretary of Energy.

Section 4—Basic Research Program

Authorizes basic research in areas such as materials, electrolytes, and thermal behavior. $50 million authorized for each of the fiscal years 2009–2014.

Section 5—Applied Research Program

Authorizes applied research in areas such as batteries, other energy storage technologies, and new manufacturing technologies for these devices. $80 million authorized for each of the fiscal years 2009–2014.

Section 6—Energy Storage Systems Demonstrations

Authorizes six large scale demonstrations of electricity storage to meet specific goals such as integrating renewable energy technologies into electric power supply. Such sums authorized for each of the fiscal years 2009–2014.

Section 7—Transportation Energy Storage Demonstrations

Authorizes demonstrations in areas such as advanced vehicle battery technologies and related components, and new manufacturing technologies for these devices. Such sums authorized for each of the fiscal years 2009–2014.

Section 8—Cost Sharing

Requires cost sharing to be carried out in accordance with EPACT 2005 section 988.

XXII. PROCEEDINGS OF THE FULL COMMITTEE MARKUP ON H.R. 3776, THE ENERGY STORAGE TECHNOLOGY ADVANCEMENT ACT OF 2007

TUESDAY, OCTOBER 16, 2007

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

The Committee met, pursuant to call, at 10:07 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Bart Gordon [Chairman of the Committee] presiding.

Chairman GORDON. Good morning, everyone. Pursuant to notice the Committee on Science and Technology meets to consider the following measures; H.R. 3776, the *Energy Storage Technology Advancement Act of 2007,* and H.R. 3775, the *Industrial Energy Efficiency Research and Development Act of 2007.*

We will put the Committee on notice. We originally also were going to deal with a bill from Mr. Sexton today, but apparently it is not ready, and we will be doing it next week. So I assume everybody is working, and we will get that ready to go.

We will now proceed with the markup, and I will begin with a brief statement. Today the Science and Technology Committee will consider two bills. The first is the *Energy Storage Technology Advancement Act,* H.R. 3776, and I would like to thank my friend, Ranking Member Hall, for his interest in this important issue and the work he and his staff have put into the bill.

H.R. 3776 includes provisions from a bill Mr. Hall introduced earlier this year, and I am glad we could incorporate that into it.

I will offer a Manager's amendment to H.R. 3776, which makes some technical changes and other improvements to the bill, and I would like to thank Mr. Hall, Ms. Biggert, Mr. Inglis, and their staffs for working with us to develop the amendment.

The second bill we will markup today is the *Industrial Energy Efficiency Research and Development Act,* H.R. 3775.

H.R. 3775 was introduced by Energy and Environment Subcommittee Chairman Nick Lampson. I understand Chairman Lampson and Ranking Member Inglis have worked together on a Manager's amendment that will make several changes to the introduced legislation.

And I am glad to see the Committee tackle such and important and under-served area as this, and I know Mr. Lampson has worked hard with the industry, universities, DOE, and the minority to make this a good bill.

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

[The prepared statement of Chairman Gordon follows:]

PREPARED STATEMENT OF CHAIRMAN BART GORDON

Today, the Science and Technology Committee will consider two bills.

The first is the *Energy Storage Technology Advancement Act,* H.R. 3776 which I introduced last week.

I would like to thank my friend from Texas, Ranking Member Hall, for his interest in this important issue and the work he and his staff put into this bill. H.R. 3776 includes provisions from a bill Mr. Hall introduced earlier this year, and I am glad we could incorporate them.

Advancing the field of energy storage technologies brings with it several environmental, economic and security-related benefits, and it is critical that the U.S. build up and maintain a competitive industrial capability in this sector.

Establishing an aggressive research program to is vital to advancing the development and deployment of energy storage technologies for use in electric drive vehicles and stationary applications that improve operation of our electricity delivery system.

I will offer a Manager's amendment to H.R. 3776 which makes some technical changes and other improvements to the bill. I would like to thank Mr. Hall, Mrs. Biggert, Mr. Inglis and their staffs for working with us to develop the amendment.

The second bill we will markup today is the *Industrial Energy Efficiency Research and Development Act,* H.R. 3775.

H.R. 3775 was introduced by Energy and Environment Subcommittee Chairman Nick Lampson. I understand Chairman Lampson and Ranking Member Inglis have worked together on a Manager's amendment that will make several changes to the introduced legislation.

I am glad to see the Committee tackle such an important and under-served area as this, and I know Mr. Lampson has worked hard with industry, universities, DOE, and the Minority to make this a good bill.

Mr. HALL. Thank you, Mr. Chairman, and I would like to add my support to the two bills that we are marking up today. Both of them work towards efficiently using our country's energy resources.

The *Industrial Energy Efficiency Research and Development Act* will reinforce the good work the Department of Energy is currently doing in the Industrial Technologies Program to help American companies lower their use of energy in the production of their products and in the running of their plants and their businesses, which is very important.

The *Energy Storage Technology Advancement Act* will also help our country use energy more efficiently in that it establishes a program at the Department of Energy to develop energy storage devices for stationary and vehicular applications.

This will allow our country to utilize renewable energy sources to the maximum extent possible and allow for traditional generation to become even more efficient as energy storage devices will reduce the need for inefficient and expensive power plants to be ramped up during times of high energy demand.

The bill, Mr. Chairman, will also help pave the way toward the development of plug-in hybrid vehicles by furthering research on the storage system necessary to make the vehicles a viable, widespread transportation option.

I introduced similar energy storage legislation earlier this year. Mr. Chairman, I really want to thank you for including a lot of my language in the version that is before us today.

And I yield back my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Mr. Chairman, I would like to add my support to the two bills we are marking up today. Both of them work towards efficiently using our country's energy resources. The *Industrial Energy Efficiency Research and Development Act* will reinforce the good work the Department of Energy is currently doing in the Industrial Technologies Program to help American companies lower their use of energy in the production of their products and in the running of their plants and businesses.

The *Energy Storage Technology Advancement Act* will also help our country use energy more efficiently in that it establishes a program at the Department of Energy to develop energy storage devices for stationary and vehicular applications. This will allow our country to utilize renewable energy sources to the maximum extent possible and allow for traditional generation to become even more efficient as energy storage devices will reduce the need for inefficient and expensive power plants to be ramped up during times of high energy demand. The bill will also help pave the way toward the development of plug-in hybrid vehicles by furthering research on the storage systems necessary to make the vehicles a viable, widespread transportation option.

I introduced similar energy storage legislation earlier this year, and I would like to thank Chairman Gordon for including much of my language in this version before us today.

I yield back the balance of my time.

Chairman GORDON. Thank you, Mr. Hall, and now without objection Members may place statements in the record at this point.

We will now consider H.R. 3776, *Energy Storage Technology Advancement Act of 2007.* I yield myself five minutes to describe the bill.

As we learned at the Subcommittee hearing, advances in energy storage technologies offer a number of economic, environmental, and security benefits, including greater efficiency and reliability of the electricity delivery system, better integration of renewable energy supplies and less reliance on conventional transportation fuels.

My bill authorizes basic and applied energy storage research programs of the Department of Energy which largely adopts language from a bill Mr. Hall introduced earlier this year. The basic research is authorized at $50 million for each fiscal year and applied research is authorized at $80 million for each fiscal year.

In addition, the bill authorizes a program of demonstrations of stationary energy storage technologies, with goals such as improving security for emergency response infrastructure, addressing management of overloaded lines, and improving liability of energy supply in rural communities.

The second demonstration program focuses on advancements in storage technologies for vehicles, with additional focus on on-board energy management and cooling systems, ways to reduce manufacturing costs, and integration of vehicles with the electricity grid and smart metering technology.

Finally H.R. 3776 includes a 50/50 federal, non-federal cost arrangement for both stationary and vehicular demonstration programs.

I believe this is a good bill because it authorizes important research and development programs on energy storage technologies and expands on this research to demonstrate promising storage technologies which have potential to significantly change how we manage our energy consumption while diversifying our energy supplies. And I ask for your support on its passage.

I now recognize Mr. Hall to present any remarks that he might have on the bill.

Mr. HALL. I can't find what they have written for me to say.

Chairman GORDON. Well, that was a very good summary.

Does anyone else wish to be recognized?

Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman. I just want to say that I see this as a very important part of our energy future. We need to do a couple of things here. We need to break our dependence on foreign oil, and we need to develop new sources of energy. We need to cut down greenhouse gas emissions, and this will help us in all three of those endeavors.

So I give strong support for this bill, and I urge my colleagues to do the same.

Chairman GORDON. Would anyone else like to be recognized?

I will say for the ones of you that were not at the hearing, this really is great potential, and I am excited that we can be a part of this.

Also, that we are getting this out early enough, and I know that we have pressed staff on both sides, but we are getting this out early enough that I think it could be part of an energy bill later on, and it will be a very good part of that.

So 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 the Chairman's amendment offered by the Chair. The Clerk will report the amendment.

The CLERK. Amendment to H.R. 3776 offered by Mr. Gordon of Tennessee.

Chairman GORDON. I ask unanimous consent to dispense with the reading.

Without objection, so ordered.

I recognize myself for five minutes to explain the amendment.

My amendment makes a number of technical changes that includes some additional definitions to clarify the bill. For example, the amendment broadens the purpose section of the bill so that it more accurately reflects the full scope of the bill. In carrying out the research activities in the bill, the Department is instructed to fund work with industry and academia, in addition to work in the National labs.

The amendment also strikes a specific number of demonstration projects in Section 6 as suggested by the Department of Energy, leaving the number of projects carried out at the discretion of the Secretary of Energy. In addition, the amendment creates a research program focused on secondary applications and disposal of used batteries from electric vehicles.

The amendment also adds a new section to assure that the Secretary coordinates the Department's activities under this bill with other relevant Department and federal research programs. It requires a merit review process in accordance with the 2005 *Energy Policy Act.*

Finally, the amendment specifically authorizes $30 million for both demonstration programs and again, I would like to thank Mr.

Hall, Ms. Biggert, Mr. Inglis, and their staffs for work on this amendment, as I do believe passage makes H.R. 3776 a better bill and urge my colleagues to support this amendment.

Is there further discussion on the amendment?

Mr. HALL. Mr. Chairman.

Chairman GORDON. Yes. Mr. Hall is recognized.

Mr. HALL. I certainly see the Manager's amendment strives to make improvements as you have pointed out, and we support these improvements.

Chairman GORDON. Thank you, Mr. Hall. Let me once again say your earlier work was a great help in the base product here, and this, if anything, this clearly is a very much of a joint bipartisan bill, and I appreciate the way our staffs have worked together on it.

Is there anyone else have any comments?

If no, the vote occurs on the amendment. All in favor, say aye. Those opposed, no. The ayes have it. The amendment is agreed to.

The second amendment on the roster is offered by the gentleman from South Carolina, Mr. Inglis. Are you prepared to proceed? Mr. Inglis is well represented, so Ms. Biggert, are you ready to proceed?

The Clerk will report the amendment.

The CLERK. Amendment to H.R. 3776 offered by Mr. Inglis of South Carolina and Ms. Biggert of Illinois.

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.

The staff will make a note of that. Larry, we need to get that fixed. Thanks.

Ms. BIGGERT. Thank you, Mr. Chairman, and thank you for working with Mr. Inglis and me on this amendment.

As I mentioned at the Subcommittee markup of this bill last week, I asked scientists at Argonne National Lab to review an early draft of this bill, and they pointed out that hydrogen can be an efficient energy storage medium just like compressed air or flywheels. Solar wind and renewables could be used to produce hydrogen through electrolysis, hydrogen that is later used by fuel cells to produce electricity.

Based on their recommendation this amendment would enable the Department of Energy to support research related to the use of hydrogen as an energy storage medium through the Applied Energy Storage Research Program created in Section 5 of this bill.

At the same time we have made sure this research is focused on hydrogen as an energy storage medium and doesn't duplicate work already underway as part of the Department's Hydrogen and Fuel Cell Programs. Hydrogen has so much potential to not only transform how we produce and use energy but also how we store energy.

This amendment recognizes that potential and makes an investment in the research and development needed to realize that potential.

If we can develop technologies to safely, efficiently, and economically store energy so much of our future energy demand could be met without expanding energy supplies or investing in new energy

infrastructure, and I want, again, I want to thank the Chairman for supporting this amendment.

I also want to commend Ranking Member Hall for the energy storage provisions in his Energy for America Bill, which served as a basis for many of the provisions in this bill before us today.

And finally, the Ranking Member of the Energy and Environmental Subcommittee, Mr. Inglis, I am sorry that he is not here, because I know he would, he has a lot to say about hydrogen, and but we both share a strong interest in hydrogen and energy research, and I enjoyed working with him on this amendment.

So I would yield back the balance of my time at this time.

Chairman GORDON. Thank you. 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.

Are there other amendments? If no, then the vote is on the bill, H.R. 3776, as amended. All those in favor, say aye. Opposed, no. In the opinion of the Chair the ayes have it.

I now recognize Mr. Hall for a motion.

Mr. HALL. I move that the Committee favorably report H.R. 3776 as amended to the House with the recommendation the bill is amended. Furthermore, I move that the staff be instructed to prepare the legislative report, 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 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, and the bill is favorably reported.

Without objection the motion to reconsider is laid upon the table. The Members will have two subsequent calendar days in which to submit supplemental, Minority, or additional views on the measure ending Friday, October the 19th 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. 3776, the *Energy Storage Technology Advancement Act of 2007,* as amended.

Without objection, so ordered.

Before we take up the next amendment, with that unanimous consent I would like to just take a moment, because since we have a good number of folks here, the first part of January we intend to have a fact-finding trip to the South Pole. I want to go ahead and give you notes because sometimes this stuff gets through the mail a little bit late.

For those of you that haven't been there, it is really, I think, one of the most memorable experiences and important experiences for this committee. Because there have been a number of folks that have expressed interest, we are limited to only ten bunks, if you will, there at the South Pole. Spouses will be able to go, but they will have to stay in New Zealand at that time, and there will be some other reviews along the way there.

And so because we are limited, we have decided to give first priority to those folks that have not been, and I feel like the Chairman should be a leader in that. I have been, although some time

ago, as I told you. Those were, I guess, ten memorable days with Mr. Sensenbrenner.

Mr. HALL. Mr. Chairman.

Chairman GORDON. Yes, Mr. Hall.

Mr. HALL. I always wanted to go but not much, and I yield my two bunks to Mr. Sensenbrenner.

Chairman GORDON. Well, since I have been, then I am going to be on the wait list, and Mr. Costello will lead that delegation. We are trying to get coordinated with the January schedule, which I know we are all interested in.

Well, I have some insight which doesn't mean that it is accurate, but it is likely that we are going to come back in, I think it is something like the 16th or something. I believe it is the 22nd, Tuesday is the State of the Union, the Monday before that is Martin Luther King Day, so you know, it puts us into that previous week. And so hopefully it will be the latter part of the week.

With that said, we also have limitations on when they can take us down there. Our limitation puts us in that first week in January, which means that there will probably be a travel time over the New Year's Eve, just for you to know. We hopefully will get this out to you very specifically very soon, but I wanted to give you some heads up on that.

Mr. Chandler is always a great resource in suggesting places for this Committee to go. Let me say to all of you that if you have any recommendations or suggestions, what we are, this will be a longer trip, and again, for your purposes, it takes, you know, 10 days to 12 or 13 days. We have been trying to look at those things where you can take long weekends after votes on Thursday, back, you know, on a Monday or Tuesday, which better allows us to get a plane where some of the other committees can take, you know, the August recess. And if you do that, you wait very long to find out whether you can go, and it is hard to make plans.

And I guess Mr. Neugebauer, just to follow up, from what I know on scheduling as we all know we will probably be in session in December, but it looks like it is going to be a Tuesday night to Thursday afternoon, only trying to do conferences, reports, and appropriations.

So that will be somewhat, and hopefully, you know, maybe two weeks. I don't know. That is a whole other matter. If you act right, maybe we can get out sooner.

That is the information that I have. Does anyone have anything they want to relate since we are here in family before we move to the next bill?

Mr. Lampson.

Mr. LAMPSON. Mr. Chairman, you had also mentioned some time ago the possibility of a Science Committee trip to the global warming meeting that is going to be held in December. You want to say something about it and let people be thinking?

Chairman GORDON. Yes. There will be a follow up to global warming hearing. It is going to be in Bali. I think Mr. Sensenbrenner is making plans to go. There, I think there is going to be a leadership plane or two, but we could make arrangements for individuals to go. But let me tell you, they are expecting 10,000 people. Now, I have never been to Bali, but it would seem to me that

10,000 people is a lot of folks over there, so that if you have an interest in this, you need to let us know, and your office has received at least one or two communications. You need to let us know pretty quickly, and again, we are somewhat hostage to how long we are going to be in session.

Let us see. Can someone tell me when that first date is? Okay. The first week, Mr. Sensenbrenner says that it will be, I guess, the first and second week of December, the first week is just sort of the rigmarole, and the second week is when you really get into some of the substance. So it is a little bit awkward in terms of timing, but we will sort of work with anybody on that.

Mr. AKIN. Mr. Chairman.

Chairman GORDON. Yes, Mr. Akin.

Mr. AKIN. Just as a little advertisement, on having been on a fair number of different codels, the very best one I was ever on was the South Pole trip. So if anybody has not done it, there is a bunch of other things to go along with just going to the South Pole and the overall package. If you have any interest in earth science or science at all, it is just a fantastic trip.

Chairman GORDON. Yes. It really opens your eyes. I mean, it is, you will see things you have never seen, and they are very relevant to this committee's jurisdiction.

Let me thank the Members for being here today. This is a good showing. These are two good bills, and they are really going to make us relevant in this, our Energy Bill, and I hope that all of you will go home and take credit for these, because these are well thought-out bipartisan bills. And now the Committee, unless there is, anyone else has any remarks, suggestions for today. If not, the Committee concludes.

[Whereupon, at 10:35 a.m., the Committee was adjourned.]

Appendix:

Subcommittee Markup Report, Amendment Roster

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

REPORT FROM SUBCOMMITTEE MARKUP

OCTOBER 10, 2007

H.R. 3776, the Energy Storage Technology Advancement Act of 2007

I. Purpose

The purpose of this bill is to provide for research, development, and demonstration programs to accelerate the development of advanced energy storage systems for vehicular, stationary, and electricity transmission and distribution applications, and support the ability of the United States to remain globally competitive in this field.

II. Background and Need for Legislation

Stationary Storage Technologies

Today, electricity is generated as it is used, with very little being stored for later use. Though this system has worked for decades, it is not an efficient means of managing the electric power supply. Demand for electric power varies greatly throughout the day and throughout the year. Therefore, the electricity supply system must be sized to generate and transmit enough electricity to meet the maximum anticipated demand, or peak demand. The inefficiency of this system becomes evident when considering that peak electricity demand for any given year could be for a very short period of time—a few days or even hours—leaving considerable excess generation capacity. Rather than maintain massive generation systems that are designed around a short-lived peak demand, energy storage technologies would provide a means to stockpile energy for later use, and consequently reduce the need to generate more power during times of peak electricity demand. Optimally, energy storage systems could be charged at night during off-peak consumption hours, and then discharge the energy during times of peak demand. Using existing generation capacity at night time to store energy for use during the day is more efficient, cheaper, helps to equalize the demand load, and ease the strain on the electricity grid.

The expanded use of energy storage would also help to avoid capital intensive upgrades of transmission and distribution facilities, as well as reduce the need to run certain generation plants that may have higher operating costs and/or have a poor emissions profile. Energy storage also can improve electricity reliability and energy security by providing an alternate source of power during an outage of the primary power source.

Advances in energy storage technologies are often regarded as key to increasing the reliability and widespread use of many renewable energy technologies. Renewables such as wind and solar produce electricity only when wind speeds are high enough and sunlight is bright enough to generate power. Strategically distributed storage would permit electricity from these renewable sources to be stored and used during times of high demand or low resource availability.

Smaller energy storage systems may also be deployed in distributed stationary applications, such as residences or neighborhoods, in order to supply back-up energy and level the load on the electric grid. Advances in smaller energy storage systems, specifically batteries, may also allow for entirely new vehicles such as plug-in hybrid vehicle technologies to enter the mass market.

Energy Storage Technologies for Vehicles

Concerns about energy independence and climate change have caused a renewed interest in enhancing the role of electricity in the transportation sector. The benefits of this have been seen to some degree in the rise in popularity of Hybrid Electric Vehicles (HEV) because of their high fuel efficiency and lower emissions. Switching vehicles' primary energy source from petroleum-based fuels to electric batteries reduces overall consumption of conventional liquid fuels. Additionally, several recent studies have shown that, regardless of its source, electricity used as a vehicle fuel reduces greenhouse gas emissions. However, greater electrification of the vehicles sector is constrained by the technological limits of energy storage technologies used in conventional hybrids, specifically the Nickel Metal Hydride (NiMH) batteries.

Plug-In Hybrid Electric Vehicles (PHEV's) are seen by some as the next logical step towards greater electrification of the transportation sector, and the eventual move towards market acceptance of all-electric drive vehicles. PHEV's allow for electricity to be used as an additional or even primary source of power for a vehicle,

with a secondary role for the gasoline engine as a back-up power system. Advocates claim that 100 miles per gallon would be reasonable for PHEV's, approximately twice the gasoline mileage of today's hybrids. However, current NiMH batteries for conventional hybrids are not optimal for this application.

While significant technological advances are still likely in NiMH, and even the ubiquitous Lead Acid batteries, many in the industry believe the future of PHEV's depends on breakthroughs in new battery technologies, such as the lithium ion (Li-Ion) batteries. To expand the use of electricity in the vehicles sector batteries must be smaller, lighter, more powerful, higher energy and cheaper—all of which require considerable research and development. Achieving these needed breakthroughs will require meaningful federal support and public-private partnerships with a range of stakeholders.

Enhanced federal research and development of advanced energy storage technologies offers a number of economic, environmental and security benefits including greater efficiency and reliability in the electricity delivery system, better integration of renewable energy supplies into the electric grid, and less reliance on conventional transportation fuels. However, significant challenges remain in developing these technologies and establishing a viable domestic supply chain. H.R. 3776 authorizes the Department of Energy to conduct research and development programs on energy storage technologies, and expands this research to the demonstration of promising storage technologies and the manufacturing methods to allow for their production in the U.S.

III. Subcommittee Actions

The Energy and Environment Subcommittee held a hearing on Wednesday, October 3, 2007 to hear testimony on the discussion draft of the bill from the following witnesses:

Panel One:

- **Ms. Patricia Hoffman,** Deputy Director, Research and Development, U.S. Department of Energy Office of Electricity Delivery and Energy Reliability
- **Mr. Brad Roberts,** Chairman, Electricity Storage Association
- **Mr. Larry Dickerman,** Director, Distribution Engineering Services for American Electric Power
- **Mr. Tom Key,** Technical Leader, Renewable and Distributed Generations, Electric Power Research Institute

Panel Two:

- **Ms. Lynda Ziegler,** Sr. Vice President for Customer Services, Southern California Edison
- **Ms. Denise Gray,** Director, Hybrid Energy Storage Systems, General Motors
- **Ms. Mary Ann Wright,** Vice President and General Manager, Hybrid Systems for Johnson Controls, Director of Advanced Power Solutions, a Johnson Controls and Saft joint venture

On October 9, 2007, Representative Bart Gordon introduced H.R. 3776, the *Energy Storage Technology Advancement Act of 2007.*

The Subcommittee on Energy and Environment met to consider H.R. 3776 on October 10, 2007, with no amendments to the bill.

Mr. McNerney moved that the Subcommittee favorably report the bill, H.R. 3776, to the Full Committee on Science and Technology. The motion was agreed to by a voice vote.

IV. Summary of Major Provisions of the Bill

H.R. 3776 authorizes $130 million for basic and applied energy storage research programs at the Department of Energy for each fiscal year 2009 through 2014, and sets guidelines for activities of the programs. The basic research is authorized at $50 million for each fiscal year and the applied research is authorized at $80 million for each fiscal year. In addition, the bill authorizes the Secretary of Energy to carry out six demonstrations of stationary storage technologies aimed at accomplishing goals such as improving security for emergency response infrastructure, addressing management of overloaded lines and improving reliability of the electricity supply in rural communities. The second demonstration program focuses on the application of energy storage technologies in the vehicles sector. Such demonstration efforts will seek to advance on-board energy management and cooling systems, reduce manufacturing costs and integrate transportation technologies with the electricity distribu-

tion system and smart metering technology. Finally, H.R. 3776 includes a 50/50 federal and non-federal cost share arrangement for both the stationary and vehicular demonstration programs.

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

SECTION 1. SHORT TITLE

"Energy Storage Technology Advancement Act of 2007"

SEC. 2. DEFINITIONS

SEC. 3. ENERGY STORAGE SYSTEM PROGRAM

Authorizes program for research, development and demonstration of energy storage systems to be carried out by the Secretary of Energy.

SEC. 4. BASIC RESEARCH PROGRAM

Authorizes basic research in areas such as materials, electrolytes, and thermal behavior. $50 million authorized for each of the fiscal years 2009–2014.

SEC. 5. APPLIED RESEARCH PROGRAM

Authorizes applied research in areas such as batteries, other energy storage technologies, and new manufacturing technologies for these devices. $80 million authorized for each of the fiscal years 2009–2014.

SEC. 6. ENERGY STORAGE SYSTEMS DEMONSTRATIONS

Authorizes six large scale demonstrations of electricity storage to meet specific goals such as integrating renewable energy technologies into electric power supply. Such sums authorized for each of the fiscal years 2009–2014.

SEC. 7. TRANSPORTATION ENERGY STORAGE DEMONSTRATIONS

Authorizes demonstrations in areas such as advanced vehicle battery technologies and related components, and new manufacturing technologies for these devices. Such sums authorized for each of the fiscal years 2009–2014.

SEC. 8. COST SHARING

Requires cost sharing to be carried out in accordance with EPACT 2005 section 988.

COMMITTEE ON SCIENCE AND TECHNOLOGY
FULL COMMITTEE MARKUP
OCTOBER 16, 2007

AMENDMENT ROSTER

H.R. 3776, Energy Storage Technology Advancement Act of 2007

No.	Sponsor	Description	Results
1	Mr. Gordon	Manager's amendment makes technical corrections, strikes the specific number of demonstration projects in Section 6 and leaves the number up to DOE, creates a research program focused on secondary applications and disposal of used batteries from vehicles, ensures coordination of DOE and other appropriate Federal agencies, and adds specific authorizations for the demonstration programs.	Agreed to by voice vote.
2	Mr. Inglis with Ms. Biggert	Amends section 5 by adding hydrogen to the list of applied research in energy storage.	Agreed to by voice vote.

AMENDMENTS TO H.R. 3776

OFFERED BY MR. GORDON OF TENNESSEE

Page 1, line 6, through page 2, line 4, amend section 2 to read as follows:

1 **SEC. 2. DEFINITIONS.**

2 For purposes of this Act—

3 (1) the term ''Department'' means the Depart-
4 ment of Energy;

5 (2) the term ''electric drive vehicle'' means—

6 (A) a vehicle that uses an electric motor
7 for all or part of its motive power, including
8 battery electric, hybrid electric, plug-in hybrid
9 electric, fuel cell, and plug-in fuel cell vehicles,
10 and rail transportation vehicles; or

11 (B) mobile equipment that uses an electric
12 motor to replace an internal combustion engine
13 for all or part of the work of the equipment;

14 (3) the term ''islanding'' means a distributed
15 generator or energy storage device continuing to
16 power a location in the absence of electric power
17 from the primary source;

18 (4) the term ''microgrid'' means an integrated
19 energy system consisting of interconnected loads and

1 distributed energy resources, including generators
2 and energy storage devices, which as an integrated
3 system can operate in parallel with the utility grid
4 or in an intentional islanding mode;
5 (5) the term ''Secretary'' means the Secretary
6 of Energy;
7 (6) the term ''self-healing grid'' means a grid
8 that is capable of automatically anticipating and re-
9 sponding to power system disturbances, including
10 the isolation of failed sections and components, while
11 optimizing its own performance and service to cus-
12 tomers; and
13 (7) the term ''spinning reserve services'' means
14 an amount of electric generating capacity in excess
15 of the amount needed to meet peak electric demand.

Page 2, lines 5 through 10, strike section 3.

Page 2, line 11, through page 6, line 23, redesignate sections 4 through 8 as sections 3, 4, 5, 6, and 9, respectively.

Page 2, line 14, insert ''electric drive'' after ''storage systems for''.

Page 2, after line 23, insert the following new subsection (and redesignate the subsequent subsection accordingly):

1 (b) FUNDING.—For activities carried out under this
2 section, in addition to funding activities at National Lab-
3 oratories, the Secretary shall award funds to, and coordi-
4 nate activities with, a range of stakeholders including the
5 public, private, and academic sectors.

Page 3, line 6, insert "electric drive" after "systems to support".

Page 3, after line 17, insert the following new subsection (and redesignate the subsequent subsection accordingly):

6 (b) FUNDING.—For activities carried out under this
7 section, in addition to funding activities at National Lab-
8 oratories, the Secretary shall award funds to, and coordi-
9 nate activities with, a range of stakeholders including the
10 public, private, and academic sectors.

Page 3, line 23, strike "6" and insert "a program of".

Page 4, lines 3 and 4, strike "including" and insert "such as".

Page 4, line 6, insert "electric drive" after "systems manufacturers,".

Page 4, lines 8 through 10, strike "following objectives" and all that follows through "this subsection" and

insert ''demonstrations shall include one or more of the following objectives''.

Page 4, line 16, strike ''self-healing circuits'' and insert ''a self-healing grid''.

Page 4, line 23, strike ''frequency response or''.

Page 5, line 10, strike ''shaving of homes, businesses, or grid'' and insert ''load management of homes, businesses, and the grid''.

Page 5, lines 11 and 12, strike ''such as plug-in hybrid vehicles''.

Page 5, line 12, strike ''the night time valley'' and insert ''nonpeak generation periods''.

Page 5, line 17, strike ''such sums as may be necessary'' and insert ''$30,000,000''.

Page 5, line 21, insert ''electric drive'' after ''a program of''.

Page 5, line 24, insert ''electric drive'' after ''their suppliers,''.

Page 6, line 11, insert ''and'' after ''management systems,''.

Page 6, line 13, insert ", including with drivetrain systems for passenger, commercial, and nonroad electric drive vehicles" after "vehicular platform".

Page 6, line 21, strike "such sums as may be necessary" and insert "$30,000,000".

Page 6, after line 22, insert the following new sections:

1 **SEC. 7. SECONDARY APPLICATIONS AND DISPOSAL OF**
2 **ELECTRIC DRIVE VEHICLE BATTERIES.**

3 (a) IN GENERAL.—The Secretary shall carry out a
4 program of research, development, and demonstration of
5 secondary applications of energy storage devices following
6 service in electric drive vehicles, and of technologies and
7 processes for final recycling and disposal of these devices.

8 (b) AUTHORIZATION OF APPROPRIATIONS.—There
9 are authorized to be appropriated to the Secretary for car-
10 rying out this section $5,000,000 for each of the fiscal
11 years 2009 through 2014.

12 **SEC. 8. COORDINATION AND NONDUPLICATION.**

13 To the maximum extent practicable, the Secretary
14 shall coordinate activities under this Act with other pro-
15 grams and laboratories of the Department and other Fed-
16 eral research programs.

Page 7, line 1, insert "and section 989" after "through (d)".

Page 7, line 2, insert "and 16353" after "through (d)".

Amend the title so as to read: "A Bill to provide for research, development, and demonstration programs in advanced energy storage systems for electric drive vehicles, stationary applications, and electricity transmission and distribution applications, to support the ability of the United States to remain globally competitive in this field, and to promote the efficient delivery and use of energy.".

AMENDMENT TO H.R. 3776
OFFERED BY MR. INGLIS OF SOUTH CAROLINA AND MRS. BIGGERT OF ILLINOIS

Page 3, line 16, strike "and".

Page 3, line 17, strike the period and insert "; and".

Page 3, after line 17, insert the following new paragraph:

1 (8) hydrogen as an energy storage medium.

○