

108TH CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session 108-578

DEPARTMENT OF ENERGY HIGH-END COMPUTING
REVITALIZATION ACT OF 2004

JULY 1, 2004.—Committed to the Committee of the Whole House on the State of
the Union and ordered to be printed

Mr. BOEHLERT, from the Committee on Science,
submitted the following

R E P O R T

[To accompany H.R. 4516]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science, to whom was referred the bill (H.R. 4516) to require the Secretary of Energy to carry out a program of research and development to advance high-end computing, having considered the same, report favorably thereon with an amendment and recommend that the bill as amended do pass.

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I. AMENDMENT

The amendment is as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the “Department of Energy High-End Computing Revitalization Act of 2004”.

SEC. 2. DEFINITIONS.

For purposes of this Act:

(1) **HIGH-END COMPUTING SYSTEM.**—The term “high-end computing system” means a computing system with performance that substantially exceeds that of systems that are commonly available for advanced scientific and engineering applications.

(2) **LEADERSHIP SYSTEM.**—The term “Leadership System” means a high-end computing system that is among the most advanced in the world in terms of performance in solving scientific and engineering problems.

(3) **INSTITUTION OF HIGHER EDUCATION.**—The term “institution of higher education” has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

(4) **SECRETARY.**—The term “Secretary” means the Secretary of Energy.

SEC. 3. DEPARTMENT OF ENERGY HIGH-END COMPUTING RESEARCH AND DEVELOPMENT PROGRAM.

(a) **IN GENERAL.**—The Secretary shall carry out a program of research and development (involving software and hardware) to advance high-end computing systems, and shall develop and deploy such systems for advanced scientific and engineering applications.

(b) **PROGRAM.**—The program shall—

(1) support both individual investigators and multidisciplinary teams of investigators;

(2) conduct research in multiple architectures, which may include vector, reconfigurable logic, streaming, processor-in-memory, and multithreading architectures;

(3) conduct research on software for high-end computing systems, including research on algorithms, programming environments, tools, languages, and operating systems for high-end computing systems, in collaboration with architecture development efforts;

(4) provide for sustained access by the research community in the United States to high-end computing systems and to Leadership Systems, including provision for technical support for users of such systems;

(5) support technology transfer to the private sector and others in accordance with applicable law; and

(6) ensure that the high-end computing activities of the Department of Energy are coordinated with relevant activities in industry and with other Federal agencies, including the National Science Foundation, the Defense Advanced Research Projects Agency, the National Security Agency, the National Institutes of Health, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the National Institute of Standards and Technology, and the Environmental Protection Agency.

(c) **LEADERSHIP SYSTEMS FACILITIES.**—

(1) **IN GENERAL.**—As part of the program carried out under this Act, the Secretary shall establish and operate Leadership Systems facilities to—

(A) conduct advanced scientific and engineering research and development using Leadership Systems; and

(B) develop potential advancements in high-end computing system hardware and software.

(2) **ADMINISTRATION.**—In carrying out this subsection, the Secretary shall provide access to Leadership Systems on a competitive, merit-reviewed basis to researchers in United States industry, institutions of higher education, national laboratories, and other Federal agencies.

SEC. 4. AUTHORIZATION OF APPROPRIATIONS.

In addition to amounts otherwise made available for high-end computing, there are authorized to be appropriated to the Secretary to carry out this Act—

(a) \$50,000,000 for fiscal year 2005;

(b) \$55,000,000 for fiscal year 2006; and

(c) \$60,000,000 for fiscal year 2007.

II. PURPOSE OF THE BILL

The purpose of the bill is to authorize a program at the Department of Energy (DOE) to support research and development (including the development of hardware and software) to advance high-end computing systems and to develop and deploy such systems for advanced scientific and engineering applications.

III. BACKGROUND AND NEED FOR THE LEGISLATION

State of high-performance computing in the world today

High-performance computers (also called supercomputers or high-end computers) are an essential component of U.S. scientific, industrial, and military competitiveness. However, the fastest and most efficient supercomputer in the world today—the “Earth Simulator”—is in Japan, not the U.S.

The success of Japan’s Earth Simulator has caused a great deal of soul-searching in the high-performance computing community in the U.S. The Earth Simulator reflects a serious, sustained investment by the Japanese government in research, development, and construction of a customized computer designed to be the best in the world at tackling specific scientific and engineering tasks, including climate modeling and earthquake simulation. While Japan pursued this course, the U.S. chose to favor the use of commercially available components for constructing high-performance computers. An advantage of this approach was that it made high-performance computers more cost-effective to develop by leveraging development costs against a larger market. A disadvantage was that certain kinds of research questions are difficult to pursue on the kinds of computers that can be built with commercial components.

The role of the U.S. Government in high-performance computing

Despite the recent technical success of the Japanese, most experts still rate the U.S. as highly competitive in high-performance computing. The depth and strength of U.S. capability stems in part from the sustained research and development program carried out by federal science agencies under an interagency program codified by the High-Performance Computing Act of 1991. That Act is widely credited with reinvigorating U.S. high-performance computing capabilities after a period of relative decline during the late 1980s.

The Federal government promotes high-performance computing in several different ways. First, it funds research and development at universities, government laboratories and companies to help develop new computer hardware and software; second, it funds the purchase of high-performance computers for universities and government laboratories; and third, it provides access to high-performance computers for a wide variety of researchers by allowing them to use government-supported computers at universities and government laboratories.

According to the National Coordination Office of the National Information Technology Research and Development Program (NITRD), 11 agencies or offices participate in the high-end computing elements of the NITRD program. The total NITRD budget for all 11 agencies in Fiscal Year 2003 (FY03) for high-performance computing was \$862.6 million. The largest research and development programs were at the National Science Foundation (NSF),

\$287.7 million, and the DOE Office of Science, \$135.7 million. Other major agency activities (with funding ranging between \$60 and \$115 million) were at the National Institutes of Health (NIH), the Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration (NASA), and DOE's National Nuclear Security Administration (NNSA). These budget estimates do not include the procurement costs for high-performance computers purchased by agencies such as NNSA and the National Oceanic and Atmospheric Administration (NOAA) for computational science related to their missions.

IV. SUMMARY OF HEARINGS

On July 16, 2003, the Committee on Science held a hearing to examine whether the United States was losing ground to foreign competitors in the production and use of supercomputers and whether federal agencies' proposed paths for advancing our supercomputing capabilities were adequate to maintain or regain the U.S. lead.

The Committee heard testimony from Dr. Raymond Orbach, Director of the Department of Energy's Office of Science; Dr. Peter Freeman, Assistant Director for Computing and Information Sciences and Engineering at the National Science Foundation; Dr. Daniel Reed, Director of the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign; and Dr. Vincent Scarafino, Manager for Numerically Intensive Computing at Ford Motor Company. Witnesses described the status of federal agencies' efforts to coordinate and leverage high-end computation investments. Witnesses also stressed the importance of high-performance computing to virtually every field of scientific endeavor, and to maintaining the competitiveness of U.S. industry in the global marketplace.

On May 13, 2004, the Committee on Science held a hearing to examine the current state of federal high-performance computing research and development activities. At the hearing, Dr. John Marburger, Director of the Office of Science and Technology Policy (OSTP) released the report of OSTP's High-End Computing Revitalization Task Force, Federal Plan for High-End Computing, which recommends that the federal government renew its commitment to making the most advanced high-performance computing infrastructure available to U.S. scientists and engineers.

The other witnesses also voiced their support for renewed investments in high-performance computing infrastructure. The Committee heard testimony from Dr. Irving Wladawsky-Berger, Vice President for Technology and Strategy, IBM Corporation; Dr. Daniel Reed, Director of the Renaissance Computing Center at the University of North Carolina at Chapel Hill; and Dr. Rick Stevens, Director of the Mathematics and Computer science division at Argonne National Laboratory. Witnesses noted the importance of the federal role in high-performance computing to ensure U.S. leadership in the field, and to ensure that U.S. researchers in industry and academia have access to the most advanced high-performance computing systems.

V. COMMITTEE ACTIONS

On June 3, 2004 Representative Judy Biggert and Representative Lincoln Davis introduced H.R. 4516, the Department of Energy High-End Computing Revitalization Act of 2004.

The Energy Subcommittee of the Committee on Science met on Tuesday, June 15, 2004, to consider the bill.

- No amendments were offered.
- Mr. Larson moved that the Subcommittee favorably report the bill, H.R. 4516, to the Full Committee on Science, and that staff be instructed to make technical and conforming changes to the bill in accordance with the recommendations of the Subcommittee. The motion was agreed to by a voice vote.

The Full Committee on Science met on Wednesday, June 16, 2004, to consider the bill.

- Mrs. Biggert offered an amendment to delete the Findings section of the bill, and to make technical corrections. The amendment was agreed to by a voice vote.
- Mr. Sherman offered an amendment to require studies of the societal, ethical, and legal implications of creating artificial intelligence. A unanimous consent request to withdraw the amendment was agreed to.

• Mr. Gordon moved that the Committee favorably report the bill, H.R. 4516, as amended, to the House with the recommendation that the bill as amended do pass, and that the staff be instructed to make technical and conforming changes to the bill as amended and prepare the legislative report and that the Chairman take all necessary steps to bring the bill before the House for consideration. With a quorum present, the motion was agreed to by a voice vote.

VI. SUMMARY OF MAJOR PROVISIONS OF THE BILL

- The bill requires the Secretary of Energy to develop and deploy high-end computing systems for advanced scientific and engineering applications.
- The bill further requires that the Department of Energy's high-end computing program support individual investigators and multi-disciplinary teams of investigators; conduct research on multiple computing architectures; conduct research on algorithms, programming environments, tools, languages, and operating systems; support technology transfer to the private sector; and coordinate with industry and other federal agencies.
- The bill also requires the Secretary to establish and operate Leadership Systems facilities that would provide the U.S. research community with sustained access to high-performance computing resources. Leadership Systems are defined in the bill as high-end computing systems that are among the most advanced in the world in terms of performance in solving scientific and engineering problems. These Leadership Systems are to be made available on a competitive, merit-reviewed basis to researchers in U.S. industry, institutions of higher education, national laboratories, and other federal agencies.
- In addition to amounts otherwise made available for high-end computing, the bill authorizes the expenditure of \$50 million for fiscal year 2005, \$55 million for fiscal year 2006, and \$60 million for fiscal year 2007.

VII. SECTION-BY-SECTION ANALYSIS (BY TITLE AND SECTION)

Sec. 1. Short title

“ Department of Energy High-End Computing Revitalization Act of 2004.”

Sec. 2. Definitions

Defines terms used in the Act, including:

- High-end computing system: the term “high-end computing system” means a computing system with performance that substantially exceeds systems that are commonly available for advanced scientific and engineering applications;
- Leadership System: the term “Leadership System” means a high-end computing system that is among the most advanced in the world in terms of performance in solving scientific and engineering problems.

Sec. 3. Department of Energy high-end computing research and development program

Requires the Secretary of Energy to carry out a high-end computing (HEC) research and development program. Requires the Secretary to develop and deploy HEC systems for advanced scientific and engineering systems. Requires the program to:

- Support both individual investigators and multidisciplinary teams of investigators;
- Conduct research on multiple HEC architectures;
- Conduct research in algorithms, programming environments, tools, languages, and operating systems for HEC systems in collaboration with architecture development efforts;
- Provide for sustained access by the research community in the United States to HEC systems and to Leadership Systems, including the provision of technical support for users of such systems;
- Support technology transfer to the private sector;
- Ensure that Department of Energy HEC activities are coordinated with industry and with other Federal agencies.

Requires the Secretary to establish and operate Leadership Systems facilities to conduct advanced scientific and engineering research and development using Leadership Systems, and to develop potential advancements in HEC system hardware and software. Requires the Secretary to provide access to Leadership Systems on competitive, merit-reviewed basis to researchers in United States industry, institutions of higher education, national laboratories, and other Federal agencies.

Sec. 4. Authorization of appropriations

Authorizes appropriations to the Secretary of Energy to carry out this Act:

- \$50,000,000 for fiscal year 2005;
- \$55,000,000 for fiscal year 2006;
- \$60,000,000 for fiscal year 2007.

VIII. COMMITTEE VIEWS

Assuring U.S. researchers sustained access to high-performance computing infrastructure

The Committee believes that DOE's Office of Science must provide U.S. researchers with sustained access to high-performance computers that are among the most advanced in the world in terms of performance in solving scientific and engineering problems. This is necessary in order for the U.S. to maintain its position as a world leader in scientific and engineering fields and in technology innovation. By "among the most advanced in the world," the Committee means general purpose scientific computing systems that would rank among the top few systems in existence in performance (1) on widely accepted standardized tests, such as the LINPACK Benchmark used to generate the Top 500 list; and (2) on actual production codes for solving the most demanding problems in science and engineering disciplines. The Committee intends that such computing systems be equivalent to "Leadership Systems" as described in the May 10, 2004 report of the Office of Science and Technology Policy, Federal Plan for High-End Computing.

The Committee is supportive of recent initiatives to make DOE's Office of Science high-performance computing resources more broadly available to researchers not otherwise supported by DOE and to allocate those resources on a competitive, merit-reviewed basis. The Committee encourages DOE to increase the quantity of supercomputing resources allocated to U.S. researchers in this fashion and to provide information to the research community on the long-term availability of these resources.

But the most advanced high-performance computing hardware, on its own, will not be enough to enable researchers to conduct the most advanced science. The Committee believes that the development of software, applications, networking, and data storage and management techniques, including support for the applied mathematics required to develop advanced software and algorithms, will be essential to enable researchers to make effective use of the high-performance computing resources made available under this Act.

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 prior to the filing of this report and is included in Section X of this report pursuant to House Rule XIII, clause 3(c)(3).

H.R. 4516 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. 4516 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

U.S. CONGRESS,
CONGRESSIONAL BUDGET OFFICE,
Washington, DC, June 24, 2004.

Hon. SHERWOOD L. BOEHLERT,
*Chairman, Committee on Science,
House of Representatives, Washington, DC 20515.*

DEAR MR. CHAIRMAN: The Congressional Budget Office has prepared the enclosed cost estimate for H.R. 4516, the Department of Energy High-End Computing Revitalization Act of 2004.

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

Sincerely,

ELIZABETH M. ROBINSON,
(For Douglas Holtz-Eakin, Director).

Enclosure.

H.R. 4516—Department of Energy High-End Computing Revitalization Act of 2004

Summary: H.R. 4516 would authorize the appropriation of \$165 million to the Department of Energy (DOE), over fiscal years 2005 through 2007, for certain activities related to high-end computing systems. The bill would direct DOE to conduct research and development (R&D) on ways to advance the capabilities of high-end computing systems and to establish and operate leadership-class facilities. The bill would define high-end computing systems to include those computing systems that substantially exceed the performance of systems commonly available for scientific and engineering applications. Leadership systems would be those whose performance is among the most advanced in the world.

CBO estimates that implementing H.R. 4516 would cost \$165 million over the 2005–2009 period, assuming appropriation of the authorized amounts. Enacting H.R. 4516 would have no effect on direct spending or revenues.

H.R. 4516 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, and tribal governments.

Estimated cost to the Federal Government: The estimated budgetary impact of H.R. 4516 is shown in the following table. For this estimate, CBO assumes that the bill will be enacted near the end of 2004 and that the amounts specified in the bill will be appropriated near the beginning of each fiscal year. We assume outlays will follow historical patterns for DOE R&D activities. The costs of this legislation fall within budget function 250 (general science, space, and technology).

	By fiscal year, in millions of dollars—					
	2004	2005	2006	2007	2008	2009
SPENDING SUBJECT TO APPROPRIATION						
<i>Spending Under Current Law for DOE R&D on Certain High-End Computing Systems:</i>						
Budget Authority ¹	38	0	0	0	0	0
Estimated Outlays	19	17	2	0	0	0
<i>Proposed Changes:</i>						
Authorized Level	0	50	55	60	0	0

	By fiscal year, in millions of dollars—					
	2004	2005	2006	2007	2008	2009
Estimated Outlays	0	25	50	57	30	3
Spending Under H.R. 4516:						
Authorization Level ¹	38	50	55	60	0	0
Estimated Outlays	19	42	52	57	30	3

¹The 2004 level is the amount that Office of Management and Budget estimates was appropriated for activities like those authorized in H.R. 4516.

Intergovernmental and private-sector impact: H.R. 4516 contains no intergovernmental or private-sector mandates as defined in UMRA and would impose no costs on state, local, and tribal governments.

Estimate prepared by: Federal Costs: Kathleen Gramp; Impact on State, Local, and Tribal Governments: Greg Waring; and Impact on the Private Sector: Jean Talarico.

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

XI. COMPLIANCE WITH PUBLIC LAW 104–4 (UNFUNDED MANDATES)

H.R. 4516 contains no unfunded mandates.

XII. COMMITTEE OVERSIGHT FINDINGS AND RECOMMENDATIONS

The Committee on Science's oversight findings and recommendations 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 goals of H.R. 4516 are to establish a Program at the Department of Energy to support research and development (including the development of hardware and software) to advance high-end computing systems and to develop and deploy such systems for advanced scientific and engineering applications; and to authorize appropriations for the Department of Energy to carry out the Program.

XIV. CONSTITUTIONAL AUTHORITY STATEMENT

Article I, section 8 of the Constitution of the United States grants Congress the authority to enact H.R. 4516.

XV. FEDERAL ADVISORY COMMITTEE STATEMENT

H.R. 4516 does not establish nor authorize the establishment of any advisory committee.

XVI. CONGRESSIONAL ACCOUNTABILITY ACT

The Committee finds that H.R. 4516 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. STATEMENT ON PREEMPTION OF STATE, LOCAL, OR TRIBAL LAW

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

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

This legislation does not amend any existing Federal statute.

XIX. COMMITTEE RECOMMENDATIONS

On June 16, 2004, a quorum being present, the Committee on Science favorably reported H.R. 4516, The Department of Energy High-End Computing Revitalization Act of 2004, by a voice vote, and recommended its enactment.

**XX. PROCEEDINGS OF THE MARKUP BY THE
SUBCOMMITTEE ON ENERGY ON H.R. 4516,
DEPARTMENT OF ENERGY HIGH-END COM-
PUTING REVITALIZATION ACT OF 2004**

TUESDAY, JUNE 15, 2004

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

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

Chairwoman BIGGERT. Good afternoon. The Subcommittee will be in order. I apologize for being late. After a two-day markup, we are having votes at this very moment, so I did get three out of five in, so it was time to leave.

Pursuant to notice, the Subcommittee on Energy meets today to consider the following measures: H.R. 4516, to require the Secretary of Energy to carry out a program of research and development to advance high-end computing; and H.R. 3890, *To Reauthorize the Steel and Aluminum Energy Conservation and Technology Competitiveness Act of 1988*. I ask unanimous consent for authority to recess the Subcommittee at any point. Without objection, it is so ordered.

We will now proceed with opening statements, and I will start.

I want to thank you all for attending today's markup. The two bills the Energy Subcommittee will consider this afternoon are non-controversial in nature, and I anticipate that we will complete our business here quite quickly. The first bill before the Subcommittee is H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*, which I sponsored along with my Democratic colleague, Lincoln Davis. This bill would authorize a program of research and development in high-end computing at the Department of Energy. Next, the Subcommittee will consider H.R. 3890, a bill to reauthorize the Metals Initiative at the Department of Energy, sponsored by Ms. Hart. Representative Hart's bill will help the metals industry, one of our most energy-intensive industries, to develop more energy-efficient processes.

Let me speak for a moment about the legislation H.R. 4516, DOE's *High-Energy Computing Revitalization Act of 2004*. This bill requires the Secretary of Energy to establish and operate high-end computing facilities involving leadership-class machines that are among the most elite in the world. The bill also directs the Sec-

retary to conduct advanced scientific and engineering research and development using these leadership-class systems, and to continue to advance the capabilities of high-end computing hardware and software. Finally, the bill requires that these computing facilities be made available on a competitive, peer-reviewed basis to researchers with U.S. industry, institutions of higher education, national laboratories, and other federal agencies.

Last fall, the Department of Energy's Office of Science released its "20-year Facilities Plan," a prioritized list of the most important facilities needed to advance multiple fields of scientific endeavor over the next two decades. The second highest priority identified on the Department's list was ultra-scale computing. Ultra-scale, or high-end, computing ranks at the top of the Department of Energy's priority list, because these computers are essential tools for achieving the next generation of scientific breakthroughs in a variety of disciplines. These powerful machines are used to complement theory and experimentation in plasma physics and fusion, astrophysics, nuclear physics, and genomes, all fields central to the Department of Energy's mission.

In many cases, dramatic breakthroughs will require us to increase computing power by a factor of 100, or, in some cases, by a factor of 1,000. While obtaining these increases may seem daunting, the history of computer development has taught us that with a sustained commitment to research, such gains are within our reach.

The bill we are marking up today also complements a new initiative recently advanced by the Department. Last month, Secretary Abraham announced the selection of a team including Argonne National Laboratory, Oak Ridge National Laboratory, and other partners to develop and build a new high-end computing facility. When completed, this facility will outpace the world's current number one computer, Japan's Earth Simulator. By renewing our commitment to high-end computing research and development at the Department of Energy, the United States can regain its distinction as home to the world's most powerful computer.

[The prepared statement of Mrs. Biggert follows:]

PREPARED STATEMENT OF CHAIRMAN JUDY BIGGERT

I want to thank you all for attending today's markup. The two bills the Energy Subcommittee will consider this morning are non-controversial in nature, and I anticipate that we will complete our business here quite quickly.

The first bill before the Subcommittee is H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*, which I sponsored along with my Democratic colleague, Lincoln Davis. This bill would authorize a program of research and development in high-end computing at the Department of Energy. Next, the Subcommittee will consider H.R. 3890, a bill to reauthorize the metals initiative at the Department of Energy, sponsored by Ms. Hart. Representative Hart's bill will help the metals industry, one of our most energy intensive industries, to develop more energy efficient processes.

Let me speak for a moment about my legislation, H.R. 4516, the *DOE High-End Computing Revitalization Act of 2004*. This bill requires the Secretary of Energy to establish and operate high-end computing facilities involving "leadership-class" machines that are among the most elite in the world. My bill also directs the Secretary to conduct advanced scientific and engineering research and development using these leadership class systems, and to continue to advance the capabilities of high-end computing hardware and software. Finally, the bill requires that these computing facilities be made available on a competitive, peer-reviewed basis to research-

ers with U.S. industry, institutions of higher education, national laboratories, and other federal agencies.

Last fall, the Department of Energy's Office of Science released its twenty-year facilities plan, a prioritized list of the most important facilities needed to advance multiple fields of scientific endeavor over the next two decades. The second highest priority identified on the Department's list was "ultra-scale computing."

Ultra-scale or high-end computing ranks at the top of the Department of Energy's priority list because these computers are essential tools for achieving the next generation of scientific breakthroughs in a variety of disciplines. These powerful machines are used to complement theory and experimentation in plasma physics and fusion, astrophysics, nuclear physics, and genomics, all fields central to the Department of Energy's mission.

In many cases, dramatic breakthroughs will require us to increase computing power by a factor of a hundred, or in some cases, by a factor of a thousand. While attaining these increases may seem daunting, the history of computer development has taught us that with a sustained commitment to research, such gains are within our reach.

The bill we are marking up today also complements a new initiative recently advanced by the Department. Last month, Secretary Abraham announced the selection of a team, including Argonne National Laboratory, Oak Ridge National Laboratory, and other partners to develop and build a new high-end computing facility. When completed, this new facility will outpace the world's current "number one" computer, Japan's Earth Simulator.

By renewing our commitment to high-end computing research and development at the Department of Energy, the United States can regain its distinction as home to the world's most powerful computer.

Thank you.

Chairwoman BIGGERT. I now recognize Mr. Larson for five minutes to present his opening remarks.

Mr. LARSON. Thank you, Madame Chair. I join with you in the sentiments that you have expressed that the two bills that we are about to undertake are one that enjoy unanimous support of the Subcommittee, and we look forward to their passage in taking them before the Committee of the whole. And I would like to congratulate both Congresswoman Hart and also yourself and Congressman Lincoln Davis for your hard work in putting forth this legislation.

Madame Chair, I am pleased to join you in supporting the Department of Energy's High-End Computing Revitalization Act that is before the Subcommittee today. I want to congratulate you and Congressman Lincoln Davis on our side of the aisle for all of your hard work in developing this important bill. It has been a bipartisan effort, as you know, that culminated in an excellent legislative product deserving of the support of the Subcommittee.

The activities authorized at Department of Energy by H.R. 4516 will help to ensure that United States researchers have the tools they need now and in the future to make progress in science and engineering research and to generate the new ideas that will underpin future technology products and services. The bill will re-energize the Department of Energy's R&D efforts in supercomputing, which have been at the forefront in past development of high-end computing capabilities, as you have previously noted. The resources authorized will provide researchers with access to the most powerful computing systems and will also support the education and training of new scientists and engineers in computer and computational sciences.

[The prepared statement of Mr. Larson follows:]

PREPARED STATEMENT OF REPRESENTATIVE JOHN LARSON

Madam Chair, I am pleased to join you in supporting the Department of Energy High-End Computing Revitalization Act that is before the Subcommittee today.

I want to congratulate you and Congressman Lincoln Davis, on this side of the aisle, for all of your hard work in developing this important bill. It has been a bipartisan effort that culminated in an excellent legislative product deserving of the support of the Subcommittee.

The activities authorized at the Department of Energy by H.R. 4516 will help to ensure that U.S. researchers have the tools they need now and in the future to make progress in science and engineering research and to generate the new ideas that will underpin future technology products and services.

The bill will re-energize the Department of Energy's R&D efforts in supercomputing, which have been at the forefront in the past development of high-end computing capabilities. The resources authorized will provide researchers with access to the most powerful computing systems and will also support the education and training of new scientists and engineers in computer and computational sciences.

I would like to yield now to the co-author of the bill, Congressman Lincoln Davis, for any comments he may wish to make on the legislation.

Mr. LARSON. I would also seek unanimous consent, and I know that Mr. Davis is not here, and I know how hard he has worked on this proposal and would seek unanimous consent to submit, for the record, any remarks that Mr. Davis, who I know is also probably detained by a markup and is unable to be here at this point.

Chairwoman BIGGERT. Without objection, all Members' opening statements will be placed in the record at this time.

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF REPRESENTATIVE LINCOLN DAVIS

Madam Chair, I am pleased to have joined you in introducing H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*. Thank you for bringing the measure before the Energy Subcommittee for its consideration today.

In response to the need for greater resources and focus on high-end computing, we have introduced H.R. 4516. This bill authorizes activities at the Department of Energy to advance high-end computing. This is a technology that is needed to address urgent challenges related to national security, economic competitiveness, health care, and environmental protection.

H.R. 4516 focuses on activities at the Department of Energy, which has been a major player in the development of supercomputing since its earliest days. DOE has taken a leadership position in attempting to advance high-end computing as is evident from the recent award to Oak Ridge National Laboratory to lead a partnership to build the world's most powerful supercomputer by 2007. I am particularly proud that the Center for Computational Sciences at Oak Ridge will be the new home of the world's fastest computer.

H.R. 4516 authorizes R&D activities needed to develop future high-end computing systems and provides for the sustained development and deployment of the most capable computing systems for use by U.S. researchers from academia, industry and federal labs. These will be truly national resources that will address important problems requiring the most powerful computational capabilities.

H.R. 4516 responds to an identified national need. I commend the bill to my colleagues, and ask for their support in reporting it favorably to the Full Committee.

Chairwoman BIGGERT. We will first consider the bill H.R. 4516, a bill to require the Secretary of Energy to carry out a program of research and development to advance high-end computing. Since I have already discussed the bill in my opening statement, I would recognize Mr. Larson, however, I think that you have also covered the bill in your opening statement—

Mr. LARSON. Yes.

Chairwoman BIGGERT.—but if you would like to make some more remarks. Otherwise, without objection, all Members may place opening statements in the record at this time.

I ask unanimous consent that the bill is considered as read and open to amendment at any point. Without objection, so ordered.

Are there any amendments? Hearing none, the question is on the bill, H.R. 4516, to require the Secretary of Energy to carry out a program of research and development to advance high-end computing, as amended. All those in favor will say aye. Those opposed, no. In the opinion of the Chair, the ayes have it.

I will now offer—recognize Mr. Larson to offer a motion.

Mr. LARSON. Thank you, Madame Chairwoman. I move that the Subcommittee favorably report the bill H.R. 4516 to the Full Committee. Further, I ask unanimous consent that the staff be instructed to make all necessary technical and conforming changes to the bill in accordance with the recommendation of the Subcommittee.

Chairwoman BIGGERT. The question is on the motion to report the bill. Those in favor will say aye. Those opposed will say no. The ayes have it, and the motion is agreed to.

Without objection, the motion to reconsider is laid upon the table.

This concludes our Subcommittee markup. And I thank you all. And again, I apologize for being late. My one goal always is to be on time and to start our meetings on time. So once again, thank you for coming, and the Chair declares the Subcommittee adjourned.

[Whereupon, at 2:20 p.m., the Subcommittee was adjourned.]

Appendix:

H.R. 4516, DEPARTMENT OF ENERGY HIGH-END COMPUTING REVITALIZATION ACT OF 2004; SECTION-BY-SECTION ANALYSIS OF H.R. 4516

108TH CONGRESS
2D SESSION

H. R. 4516

To require the Secretary of Energy to carry out a program of research
and development to advance high-end computing.

IN THE HOUSE OF REPRESENTATIVES

JUNE 4, 2004

Mrs. BIGGERT (for herself and Mr. DAVIS of Tennessee) introduced the
following bill; which was referred to the Committee on Science

A BILL

To require the Secretary of Energy to carry out a program
of research and development to advance high-end computing.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “Department of Energy
5 High-End Computing Revitalization Act of 2004”.

6 **SEC. 2. FINDINGS.**

7 Congress finds that—

8 (1) high-end computing is a critical component
9 of the scientific advances, defense capabilities, and

1 commercial competitiveness of the United States in
2 the 21st Century;

3 (2) with the deployment of the Earth System
4 Simulator in Japan, the United States no longer has
5 a clear lead in high-end computing worldwide;

6 (3)(A) promising new architectures should be
7 developed that increase memory and network band-
8 width, minimize latency, and coordinate the architec-
9 tures' various components to maximize application
10 performance; and

11 (B) it is recognized that different architectures
12 may be better suited to different applications;

13 (4)(A) software that improves efficiency on and
14 accessibility to high-end systems should be devel-
15 oped; and

16 (B) this development effort should include re-
17 search in optimal algorithms, programming environ-
18 ments, tools, languages, and operating systems for
19 high-end computing in collaboration with architec-
20 ture development efforts;

21 (5) without government support, market forces
22 are unlikely to drive sufficient innovation in high-
23 end computing because the private sector would not
24 capture the full value of its innovations on a short
25 enough time frame; and

1 (6) having played an important role in the de-
2 velopment of high-end computing, networking, and
3 information technology, the Department of Energy,
4 and the research programs of the Office of Science
5 of the Department of Energy, are particularly qualifi-
6 fied to lead research in those fields.

7 **SEC. 3. DEFINITIONS.**

8 For purposes of this Act:

9 (1) **HIGH-END COMPUTING SYSTEM.**—The term
10 “high-end computing system” means a computing
11 system with performance that substantially exceeds
12 systems that are commonly available for advanced
13 scientific and engineering applications.

14 (2) **LEADERSHIP SYSTEM.**—The term “Leadership
15 System” means a high-end computing system
16 that is among the most advanced in the world in
17 terms of performance in solving scientific and engi-
18 neering problems.

19 (3) **INSTITUTION OF HIGHER EDUCATION.**—The
20 term “institution of higher education” has the
21 meaning given the term in section 101(a) of the
22 Higher Education Act of 1965 (20 U.S.C. 1001(a)).

23 (4) **SECRETARY.**—The term “Secretary” means
24 the Secretary of Energy.

1 **SEC. 4. DEPARTMENT OF ENERGY HIGH-END COMPUTING**

2 **RESEARCH AND DEVELOPMENT PROGRAM.**

3 (a) IN GENERAL.—The Secretary, acting through the
4 Director of the Office of Science, shall carry out a pro-
5 gram of research and development (involving software and
6 hardware) to advance high-end computing systems, and
7 shall develop and deploy such systems for advanced sci-
8 entific and engineering applications.

9 (b) PROGRAM.—The program shall—

10 (1) support both individual investigators and
11 multidisciplinary teams of investigators;

12 (2) conduct research in multiple architectures,
13 which may include vector, reconfigurable logic,
14 streaming, processor-in-memory, and multithreading
15 architectures;

16 (3) conduct research in software development
17 on optimal algorithms, programming environments,
18 tools, languages, and operating systems for high-end
19 computing systems, in collaboration with architec-
20 ture development efforts;

21 (4) provide for sustained access by the research
22 community in the United States to high-end com-
23 puting systems and to Leadership Systems, includ-
24 ing provision for technical support for users of such
25 systems;

1 (5) support technology transfer to the private
2 sector and others in accordance with applicable law;
3 and

4 (6) ensure that the high-end computing activi-
5 ties of the Department of Energy are coordinated
6 with relevant activities in industry and with other
7 Federal agencies, including the National Nuclear Se-
8 curity Administration, the National Science Founda-
9 tion, the Defense Advanced Research Projects Agen-
10 cy, the National Security Agency, the National Insti-
11 tutes of Health, the National Aeronautics and Space
12 Administration, the National Oceanic and Atmos-
13 pheric Administration, the National Institute of
14 Standards and Technology, and the Environmental
15 Protection Agency.

16 (c) LEADERSHIP SYSTEMS FACILITIES.—

17 (1) IN GENERAL.—As part of the program car-
18 ried out under this Act, the Secretary, acting
19 through the Director of the Office of Science, shall
20 establish and operate Leadership Systems facilities
21 to—

22 (A) conduct advanced scientific and engi-
23 neering research and development using Lead-
24 ership Systems; and

1 (B) develop potential advancements in
2 high-end computing system hardware and soft-
3 ware.

4 (2) ADMINISTRATION.—In carrying out this
5 subsection, the Secretary, acting through the Direc-
6 tor of the Office of Science, shall provide access to
7 Leadership Systems on a competitive, merit-reviewed
8 basis to researchers in United States industry, insti-
9 tutions of higher education, national laboratories,
10 and other Federal agencies.

11 **SEC. 5. AUTHORIZATION OF APPROPRIATIONS.**

12 In addition to amounts otherwise made available for
13 high-end computing, there are authorized to be appro-
14 priated to the Secretary to carry out this Act—

- 15 (a) \$50,000,000 for fiscal year 2005;
16 (b) \$55,000,000 for fiscal year 2006; and
17 (c) \$60,000,000 for fiscal year 2007.

○

SECTION-BY-SECTION ANALYSIS OF H.R. 4516, THE DEPARTMENT OF ENERGY HIGH-END COMPUTING REVITALIZATION ACT OF 2004

Sec. 1. Short Title

“Department of Energy High-End Computing Revitalization Act of 2004.”

Sec. 2. Findings

States a number of finding by Congress with respect to high-end computing (HEC), including:

- HEC is a critical component of the Nation's scientific, military, and economic competitiveness
- Deployment of the Earth System Simulator in Japan challenges U.S. leadership in HEC
- Promising new architectures that may be better suited to different applications should be developed along with software that improves HEC systems efficiency
- HEC development efforts should include research in algorithms, programming environments, tools, languages, and operating systems for HEC systems in collaboration with architecture development efforts
- Government support is required to drive accelerated HEC system innovation
- The Office of Science in the Department of Energy is well qualified to lead research in HEC, networking technology, and information technology.

Sec. 3. Definitions

Defines terms used in the Act, including:

- High-end computing system—the term “high-end computing system” means a computing system with performance that substantially exceeds systems that are commonly available for advanced scientific and engineering applications
- Leadership System—the term “Leadership System” means a high-end computing system that is among the most advanced in the world in terms of performance in solving scientific and engineering problems.

Sec. 4. Department of Energy High-End Computing Research and Development Program

Requires the Secretary of Energy, acting through the Director of the Office of Science, to carry out a HEC research and development (R&D) program. Requires the Secretary to develop and deploy HEC systems for advanced scientific and engineering systems. Requires the program to:

- Support both individual investigators and multidisciplinary teams of investigators
- Conduct research on multiple HEC architectures
- Conduct research in algorithms, programming environments, tools, languages, and operating systems for HEC systems in collaboration with architecture development efforts
- Provide for sustained access by the research community in the United States to HEC systems and to Leadership Systems, including the provision for technical support for users of such systems
- Support technology transfer to the private sector
- Ensure that Department of Energy HEC activities are coordinated with industry and with other federal agencies

Requires the Secretary to establish and operate Leadership Systems facilities to conduct advanced scientific and engineering R&D using Leadership Systems, and to develop potential advancements in HEC system hardware and software. Requires the Secretary to provide access to Leadership Systems on competitive, merit-reviewed basis to researchers in United States industry, institutions of higher education, national laboratories, and other federal agencies.

Sec. 5. Authorization of Appropriations

Authorizes appropriations to the Secretary of Energy to carry out this Act:

- \$50,000,000 for fiscal year 2005
- \$55,000,000 for fiscal year 2006
- \$60,000,000 for fiscal year 2007

XXI. PROCEEDINGS OF THE FULL COMMITTEE MARKUP ON H.R. 4516, DEPARTMENT OF ENERGY HIGH-END COMPUTING REVITALIZATION ACT OF 2004

WEDNESDAY, JUNE 16, 2004

**HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE,
Washington, DC.**

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

Chairman BOEHLERT. The Committee on Science will be in order. Pursuant to notice, the Committee on Science meets today to consider the following measures: H.R. 3890, *To Reauthorize the Steel and Aluminum Conservation and Technology Competitiveness Act of 1988*; H.R. 3598, *Manufacturing Technology Competitiveness Act of 2004*; H.R. 4218, *High-Performance Computing Revitalization Act of 2004*; and H.R. 4516, *Department of Energy High-End Computing Revitalization Act of 2004*. I ask unanimous consent for the authority to recess the Committee at any point during consideration of these matters. And without objection, it is so ordered.

We will now proceed with opening statements, and I will lead off.

I am going to keep my remarks very brief, because we have a long markup ahead of us. I would simply point out that once again we have come up with a good set of bipartisan bills that prepare our nation for the future. We have Ms. Hart's metals bill, which will help our nation save energy, helping the steel and aluminum industries remain competitive by helping our nation become less dependent on foreign sources of energy, all worthy goals. We have Ms. Biggert's computing bill—bills, which will revitalize our high-performance computing efforts, enabling our scientists and computing industry to excel as they face new challenges from abroad. And we have Dr. Ehlers' manufacturing bill, which will help our smaller manufacturers stay up-to-date and competitive. All of these bills reflect significant contributions from the Minority and have lead Minority co-sponsors, whom I am sure Mr. Gordon will acknowledge.

Our debate today will be prolonged, but it won't be on fundamental goals or principles. It will be about whether to do even more in the manufacturing bill. I think we need to get this measure through before we take on additional issues. We will have lively discussion on that, but we are united on trying to do everything possible for our manufacturers.

With that, let the games begin.

Mr. Gordon.

[The prepared statement of Chairman Boehlert follows:]

PREPARED STATEMENT OF CHAIRMAN SHERWOOD BOEHLERT

I'm going to keep my remarks very brief because we have a long markup ahead of us.

I would simply point out that once again we've come with a good set of bipartisan bills that prepare our nation for the future. We have Ms. Hart's metals bill, which will help our nation save energy, helping the steel and aluminum industry remain competitive while helping our nation become less dependent on foreign sources of energy. We have Ms. Biggert's computing bills, which will revitalize our high-performance computing efforts, enabling our scientists and computing industry to excel as they face new challenges from abroad. And we have Mr. Ehlers manufacturing bill, which will help our smaller manufacturers stay up-to-date and competitive.

All these bills reflect significant contributions from the Minority and have lead Minority co-sponsors, whom I'm sure Mr. Gordon will acknowledge.

Our debate today will be prolonged, but it won't be on fundamental goals or first principles. It will be about whether to do even more in the manufacturing bill. I think we need to get this measure through before we take on additional issues. We'll have lively discussion on that, but we are united on trying to do everything possible for our manufacturers.

With that, let the games begin.

Mr. Gordon.

Mr. GORDON. Thank you, Mr. Chairman. Let me say that we are pleased at the bipartisan cooperation we have experienced in the development of three of the bills considered today: H.R. 3890, *To Reauthorize the Steel and Aluminum Energy Conservation and Technology Competitiveness Act of 1988*; H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*; and H.R. 4218, the *High-Performance Computing Revitalization Act of 2004*.

With regard to H.R. 4218 and H.R. 4516, we believe the Committee is making a major contribution to reinvigorating high-end computing at a time when traditional U.S. lead is under vigorous challenge. We are depending on this program to increase ability to understand huge data sets across a wide spectrum of programs ranging from advanced manufacturing to weather prediction.

The steel industry is one of several industrial sectors that are heavy users of energy and benefit from cooperative research with the Federal Government. We support not only continuing the Department of Energy's program with the steel industry as set out in H.R. 3890, but also strengthening the entire Industries of the Future Program.

Unfortunately, though, however, the same level of cooperation did not occur on H.R. 3598 in developing our manufacturing policy. This is particularly disturbing in light of the battering this sector has endured over the last three years. We have no problem with the tentative first steps taken in H.R. 3598, but we do not think it is an adequate response to the problems that have cost the jobs of two million Americans. I will have further comments on this bill when it is called up for consideration.

Thank you.

[The prepared statement of Mr. Gordon follows:]

PREPARED STATEMENT OF REPRESENTATIVE BART GORDON

We are pleased at the bipartisan cooperation we have experienced in the development of three bills to be considered today: H.R. 3890, *To Reauthorize the Steel and*

Aluminum Energy Conservation and Technology Competitiveness Act of 1988; H.R. 4516, The Department of Energy High-End Computing Revitalization Act of 2004, and H.R. 4218, The High-Performance Computing Revitalization Act of 2004.

With regard to H.R. 4218 and H.R. 4516, we believe the Committee is making a major contribution to reinvigorating high-end computing at a time when the traditional U.S. lead is under vigorous challenge. We are depending on this program to increase our ability to understand huge data sets across a wide spectrum of problems ranging from advanced manufacturing to weather prediction. The steel industry is one of several industrial sectors that are heavy users of energy that benefit from cooperative research with the Federal Government. We support, not only continuing the Department of Energy's program with the steel industry as set out in H.R. 3890, but also strengthening the entire Industries of the Future Program.

Unfortunately, the same level of cooperation did not occur on the H.R. 3598, The *Manufacturing Competitiveness Act of 2004*, in developing our manufacturing policy. This is particularly disturbing in light of the battering this sector has endured over the past three years. We have no problem with the tentative first steps taken in H.R. 3598, but we do not think it is an adequate response to the problems that have cost the jobs of two million Americans. I will have further comments on this bill when it is called up for consideration.

Chairman BOEHLERT. Thank you very much, Mr. Gordon.

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

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF REPRESENTATIVE LINCOLN DAVIS

Thank you, Mr. Chairman. Mrs. Biggert and I are pleased to bring H.R. 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*, for the consideration of the Full Committee today.

H.R. 4516 authorizes the Department of Energy to advance high-end computing. The Committee has held several hearings that have emphasized the importance of high-end computing to achieving progress in many fields of science and engineering.

In response to needs for better planning and governance of the federal efforts in high-performance computing, Mrs. Biggert and I introduced H.R. 4218 to strengthen the existing interagency planning and budgeting mechanisms. In response to the need for greater resources and focus on high-end computing, we have introduced this bill, H.R. 4516.

This bill focuses on activities at the Department of Energy, which has been a major player in the development of supercomputing since its earliest days. Tennessee's Oak Ridge National Laboratory will lead a partnership supported by DOE to build the world's most powerful supercomputer by 2007. I am thrilled that the Center for Computational Sciences at Oak Ridge will soon be the new home of the world's fastest computer.

H.R. 4516 authorizes R&D activities needed to develop future high-end computing systems, and equally important, provides for the sustained development and deployment of the most capable computing systems for use by U.S. researchers from academia, industry and federal labs. These computing systems will truly be national resources that will address important problems related to national security, economic competitiveness, health care, and environmental protection.

H.R. 4516 responds to an identified national need for government's support of high-end computing. I commend the bill to my colleagues, and ask for their support.

Chairman BOEHLERT. The next and final bill is H.R. 4516, *Department of Energy High-End Computing Revitalization Act of 2004*, and I now yield five minutes to Mrs. Biggert to introduce her bill.

Mrs. BIGGERT. Thank you, Mr. Chairman. I, again, want to start by recognizing and thanking my colleague from Tennessee, Mr. Davis, for his work as chief co-sponsor of this legislation to authorize the program, research and development in high-end computing at the Department of Energy.

Given the bill that this committee has just passed, this bill is—that we are considering right now, is to authorize specific research and development that the Department of Energy will need to un-

dertake to meet the mandates laid out in H.R. 4218, the bill just approved by the Committee.

It requires the Secretary of Energy to establish and operate high-end computing facilities. The bill directs the Secretary to conduct advanced scientific and engineering research and development using these leadership class systems, and to continue to advance the capabilities of high-end computing hardware and software.

And finally, the bill requires that these computing facilities be made available on a competitive, peer-reviewed basis to researchers from U.S. industry, institutions of higher education, national laboratories, and other federal agencies. And I will have an amendment, a manager's amendment. And I would yield back the balance of my time.

Chairman BOEHLERT. I now recognize Mr. Gordon.

Mr. GORDON. Thank you, Mr. Chairman. I want to commend the Chair of the Energy Subcommittee, Congresswoman Biggert, and Ranking Member Congressman Lincoln Davis for their work on developing H.R. 4516, and I yield the balance of my time to Congressman Davis.

Chairman BOEHLERT. The gentleman is recognized.

Mr. DAVIS. Congressman Gordon, thank you very much. And Mr. Chairman, thank you. Mrs. Biggert, you have been very instrumental in being sure this legislation that is being proposed today is as complete as it can be, and I certainly appreciate the efforts that you have—that you put forth. House Resolution 4516, the *Department of Energy High-End Computing Revitalization Act of 2004*, and I am glad it is being considered today for the Full Committee.

This resolution authorizing the Department of Energy to advance high-end computing, our committee has held several hearings that have emphasized the importance of high-end computing to achieving progress in the many fields of science and engineering.

In response to needs for better planning and governance of the federal efforts in high-performance computing, Mrs. Biggert and I have introduced House Resolution 4218, to strengthen the existing interagency planning and budgeting mechanisms. In response to the need for greater resources and focus on high-end computing, this bill will do exactly that.

This bill focuses on activities at the Department of Energy, which has been a major player in the development of supercomputing since its earliest days. Tennessee's Oak Ridge National Lab, which will lead a partnership supported by DOE to build the world's most powerful supercomputer by the year 2007. I am thrilled that the Center for Computational Science at Oak Ridge will soon be the new home of the world's fastest computer.

This resolution authorizes research and development activities needed to develop future high-end computing systems, and equally important, provides for the sustained development and deployment of the most capable computing systems for use by U.S. researchers for academia, industry, and our federal labs.

These computing systems will truly be national resources that will address the important problems related to national security, economic competitiveness, health care, and environmental protec-

tion. This resolution responds to an identified national need for America's support of high-end computing.

I comment the bill to my colleagues, and ask for their support. Thank you, Mr. Speaker.

Chairman BOEHLERT. Thank you very much. Without objection, all Members may place opening statements in the record at this point. I ask unanimous consent that the bill is considered as read and opened to amendment at any point, and that Members proceed with the amendments in the order of the roster. Without objection, so ordered.

The first amendment on the roster is an amendment in the nature of a substitute, offered by Mrs. Biggert. I ask unanimous consent that the amendment in the nature of a substitute be treated as original text for purposes of amendment under the five minute rule. Without objection, so ordered. The Clerk shall report the amendment.

Ms. TESSIERI. Amendment in the nature of a substitute, to H.R. 4516, offered by Mrs. Biggert.

[Note: See the Appendix for the Amendment offered by Ms. Biggert.]

Chairman BOEHLERT. The gentlelady is recognized for five minutes or less to offer her amendment.

Mrs. BIGGERT. Thank you. Thank you, Mr. Chairman, and the manager's amendment is technical in nature.

It makes the following changes to H.R. 4516. First, the amendment makes the Secretary of Energy responsible for coordinating high-end computing R&D at the Department. Second, the amendment eliminates NSA from the list of federal agencies the Department of Energy is required to coordinate with, since that is—NSA is part of the Department of Energy. Third, the amendment clarifies the language pertaining to research on algorithm development. And finally, the manager's amendment eliminates the finding sections.

I urge my colleagues to support the manager's amendment, and yield back the balance of my time.

Chairman BOEHLERT. Any further discussion on the amendment? Hearing none, the next amendment on the roster is amendment number 2, an amendment offered by the gentleman from California. Are you ready to proceed under the same ground rules? Mr. Sherman.

Mr. SHERMAN. Mr. Chairman, the amendment—

Chairman BOEHLERT. The Clerk will report the amendment.

Ms. TESSIERI. Amendment offered by Mr. Sherman to the amendment in the nature of a substitute.

[Note: See the Appendix for the Amendment offered by Mr. Sherman.]

Chairman BOEHLERT. The gentleman is recognized.

Mr. SHERMAN. Thank you, Mr. Chairman. This amendment is identical to the one I offered to the previous bill, and for identical reasons, then, I hope that we would reach an identical result.

Chairman BOEHLERT. And the Chair gives an identical response.

Mr. SHERMAN. Thank you. I withdraw the amendment.

Chairman BOEHLERT. Thank you. I ask unanimous consent to withdraw the amendment. Without objection, so ordered. Are there

any further amendments to the amendment in the nature of a substitute? Hearing none, the question is on the amendment in the nature of a substitute. All in favor, say aye. Aye. The opposed, no. The ayes have it, and the amendment in the nature of a substitute is agreed to.

Are there any other amendments? Hearing none, the question is now on the bill, H.R. 4516, *Department of Energy High-End Computing Revitalization Act of 2004*, as amended. All those in favor, say aye. Aye. Opposed, no. In the opinion of the Chair, the ayes have it.

I now recognize Mr. Gordon to offer a motion.

Mr. GORDON. Mr. Chairman, I move that the Committee favorably report H.R. 4516, as amended, to the House with the recommendation that the bill, as amended, do pass. Furthermore, I move that the staff be instructed to prepare the legislative report, and make necessary technical and conforming changes, that the Chairman take all necessary steps to bring the bill before the House for consideration.

Chairman BOEHLERT. The question is on the motion to report the bill, as amended, favorably. Those in favor of the motion will signify by saying aye. Aye. Opposed, no. The ayes appear to have it, and the bill is favorably reported. Without objection, the motion to reconsider is laid upon the table. I move that Members have two subsequent calendar days in which to submit supplemental, minority, or additional views on the measure. 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. 4516, as amended, and to go to conference with the Senate on H.R. 4516, or a similar Senate bill. Without objection, so ordered.

This concludes our Committee markup, and I want to thank those who indulged all of us for so many hours. I want to thank the staff on a bipartisan basis for their outstanding input, that makes these success stories possible.

This committee is adjourned.

[Whereupon, at 2:15 p.m., the Committee was adjourned.]

Appendix:

**AMENDMENT ROSTER; SUMMARY OF MANAGER'S AMENDMENT TO
H.R. 4516**

**COMMITTEE ON SCIENCE
FULL COMMITTEE MARKUP**

June 16, 2004

AMENDMENT ROSTER

H.R. 4516, Department of Energy High-End Computing Revitalization Act of 2004.

- Motion to adopt the bill, as amended: agreed to by a voice vote.
--Motion to report the bill, as amended: agreed to by a voice vote.

No.	Sponsor	Description	Results
1.	Mrs. Biggert	Amendment In The Nature of A Substitute to H.R. 4516.	--Adopted by a voice vote.
2.	Mr. Sherman	Amendment would restrict research on artificial intelligence.	--Withdrawn by unanimous consent.

**AMENDMENT IN THE NATURE OF A SUBSTITUTE
TO H.R. 4516
OFFERED BY MRS. BIGGERT**

Strike all after the enacting clause and insert the
following:

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “Department of Energy
3 High-End Computing Revitalization Act of 2004”.

4 **SEC. 2. DEFINITIONS.**

5 For purposes of this Act:

6 (1) **HIGH-END COMPUTING SYSTEM.**—The term
7 “high-end computing system” means a computing
8 system with performance that substantially exceeds
9 that of systems that are commonly available for ad-
10 vanced scientific and engineering applications.

11 (2) **LEADERSHIP SYSTEM.**—The term “Leader-
12 ship System” means a high-end computing system
13 that is among the most advanced in the world in
14 terms of performance in solving scientific and engi-
15 neering problems.

16 (3) **INSTITUTION OF HIGHER EDUCATION.**—The
17 term “institution of higher education” has the

2

1 meaning given the term in section 101(a) of the
2 Higher Education Act of 1965 (20 U.S.C. 1001(a)).

3 (4) SECRETARY.—The term “Secretary” means
4 the Secretary of Energy.

5 **SEC. 3. DEPARTMENT OF ENERGY HIGH-END COMPUTING**
6 **RESEARCH AND DEVELOPMENT PROGRAM.**

7 (a) IN GENERAL.—The Secretary shall carry out a
8 program of research and development (involving software
9 and hardware) to advance high-end computing systems,
10 and shall develop and deploy such systems for advanced
11 scientific and engineering applications.

12 (b) PROGRAM.—The program shall—

13 (1) support both individual investigators and
14 multidisciplinary teams of investigators;

15 (2) conduct research in multiple architectures,
16 which may include vector, reconfigurable logic,
17 streaming, processor-in-memory, and multithreading
18 architectures;

19 (3) conduct research on software for high-end
20 computing systems, including research on algo-
21 rithms, programming environments, tools, languages,
22 and operating systems for high-end computing sys-
23 tems, in collaboration with architecture development
24 efforts;

3

1 (4) provide for sustained access by the research
2 community in the United States to high-end com-
3 puting systems and to Leadership Systems, includ-
4 ing provision for technical support for users of such
5 systems;

6 (5) support technology transfer to the private
7 sector and others in accordance with applicable law;
8 and

9 (6) ensure that the high-end computing activi-
10 ties of the Department of Energy are coordinated
11 with relevant activities in industry and with other
12 Federal agencies, including the National Science
13 Foundation, the Defense Advanced Research
14 Projects Agency, the National Security Agency, the
15 National Institutes of Health, the National Aero-
16 nautics and Space Administration, the National Oce-
17 anic and Atmospheric Administration, the National
18 Institute of Standards and Technology, and the En-
19 vironmental Protection Agency.

20 (c) LEADERSHIP SYSTEMS FACILITIES.—

21 (1) IN GENERAL.—As part of the program car-
22 ried out under this Act, the Secretary shall establish
23 and operate Leadership Systems facilities to—

4

- 1 (A) conduct advanced scientific and engi-
2 neering research and development using Lead-
3 ership Systems; and
4 (B) develop potential advancements in
5 high-end computing system hardware and soft-
6 ware.

7 (2) ADMINISTRATION.—In carrying out this
8 subsektion, the Secretary shall provide access to
9 Leadership Systems on a competitive, merit-reviewed
10 basis to researchers in United States industry, insti-
11 tutions of higher education, national laboratories,
12 and other Federal agencies.

13 **SEC. 4. AUTHORIZATION OF APPROPRIATIONS.**

14 In addition to amounts otherwise made available for
15 high-end computing, there are authorized to be appro-
16 priated to the Secretary to carry out this Act—
17 (a) \$50,000,000 for fiscal year 2005;
18 (b) \$55,000,000 for fiscal year 2006; and
19 (c) \$60,000,000 for fiscal year 2007.

**AMENDMENT OFFERED BY MR. SHERMAN
TO THE AMENDMENT IN THE NATURE OF A
SUBSTITUTE**

Page 4, after line 12, insert the following new subsection:

1 (d) ARTIFICIAL INTELLIGENCE LIMITATION.—Noth-
2 ing in this Act authorizes research that is likely to or de-
3 signed to facilitate the creation of artificial intelligence
4 that meets or surpasses human cognitive ability before ap-
5 propriate studies are conducted into the societal, ethical,
6 and legal implications of the creation of such artificial in-
7 telligence.

SUMMARY OF MANAGER'S AMENDMENT TO H.R. 4516

The amendment makes the following changes to H.R. 4516:

- Deleted the findings.
- Changes “the Secretary [of Energy], acting through the Director of the Office of Science” to “the Secretary” at every occurrence.
- Eliminates the National Nuclear Security Administration from the list of federal agencies the Department of Energy is required to coordinate with on high-end computing activities. The National Nuclear Security Administration is an agency within the Department of Energy.
- Clarifies the language pertaining to research on algorithm development.

