

Monday, April 16, 2012  
PO Box 425367  
Cambridge, MA 02142  
www.FusionFuture.org

The Honorable Rodney P. Frelinghuysen  
Chairman  
Energy and Water Development Subcommittee  
House Appropriations Committee  
2369 Rayburn House Office Building  
Washington, DC 20515-3011

The Honorable Peter J. Visclosky  
Ranking Member  
Energy and Water Development Subcommittee  
House Appropriations Committee  
2256 Rayburn House Office Building  
Washington, DC 20515-1401

Dear Chairman Frelinghuysen and Ranking Member Visclosky:

As you prepare for the House Committee on Appropriations, Subcommittee on Energy and Water Development markup meeting on Wednesday, April 18, we wish to remind you of the critical situation facing the U.S. domestic magnetic fusion energy research program.

Attached to this cover letter are nine official statements and letters demonstrating the necessity and urgency of your subcommittee taking these actions:

- **Continue funding the Alcator C-Mod research program and do not close the facility.**
- **Maintain funding for a strong domestic fusion research program at or near FY2012 levels.**

The President's proposed budget for fiscal year 2013 requests just \$248.3-million for the domestic fusion program, a 16.4% decrease from FY2012. This cut would have a devastating impact on the U.S. fusion program, would jeopardize U.S. leadership in fusion energy research, threaten our country's ability to take advantage of the scientific advances that will be made at ITER, and ultimately delay the availability of commercial fusion energy. In particular, the budget proposes to shut down Alcator C-Mod at the Massachusetts Institute of Technology, a world-class experiment that is one of three major fusion research facilities in the United States.

Your legislative colleagues and their constituents support Alcator C-Mod and the domestic fusion program. We attach the following:

- A bipartisan Dear Colleague letter signed by 47 Representatives;
- A letter signed by 8 Representatives from the New England delegation;
- Support letter from Sen. John Kerry (D-MA);
- Support letter from Sen. Scott Brown (R-MA);

The academic institutions of the United States—executive and students—support Alcator C-Mod and the domestic fusion program. We attach the following:

- Statement from the Presidents/Chancellors of eight leading U.S. research universities;
- Statement by 258 young fusion scientists (graduate students and postdoctoral fellows) from around the country, representing the future of American fusion research;

Finally, the U.S. fusion research community is unanimous that there must be a strong domestic program. We attach the following:

- Statement of the Fusion Energy Sciences Advisory Committee, the official committee charged with advising the DOE Fusion Energy Sciences program;
- Statement of the leaders and stewards of seven major U.S. fusion energy research programs – national labs, universities, and private companies;
- Statement of Fusion Power Associates, a non-profit research and educational foundation.

We urge your subcommittee to insist that the Department of Energy work with the U.S. fusion research community to immediately develop a plan to sustain a strong domestic fusion program through the construction of ITER, before any irreversible actions, such as the shuttering of facilities, are undertaken.

Thank you very much for your consideration and attention.

Sincerely,

*Jennifer Hierchia*

*[Signature]*

*[Signature]*

*Robert Mumgaard*

*[Signature]*

*Rama Odionke*

*in [Signature]*

*Arthur Zinke*

*Tyler Christensen*

*[Signature]*

*[Signature]*

Students for Fusion Energy  
Massachusetts Institute of Technology  
[www.FusionFuture.org](http://www.FusionFuture.org)

**Congress of the United States**  
**House of Representatives**  
**Washington, DC 20515**

March 16, 2012

The Honorable Rodney Frelinghuysen  
Chairman  
House Appropriations Subcommittee on  
Energy and Water Development  
2362-B Rayburn House Office Building  
Washington, D.C. 20515

The Honorable Peter Visclosky  
Ranking Member  
House Appropriations Subcommittee on  
Energy and Water Development  
1016 Longworth House Office Building  
Washington, D.C. 20515

Dear Chairman Frelinghuysen and Ranking Member Visclosky:

We are writing to express our strong support for the fusion energy research programs carried out within the Office of Fusion Energy Sciences (OFES). We request that you restore funding for the U.S. domestic fusion program to the FY 2012 level and maintain the amount requested for the international fusion program ITER in the Administration's budget.

The Administration's FY 2013 budget requests just \$248.3 million for the domestic fusion program, a 16.4 percent decrease from FY 2012. This cut would have a devastating impact on the U.S. fusion program. Among other things, the budget's proposed funding level would result in the shutdown of one of the three major U.S. fusion research facilities; cutbacks in operations, reduced productivity, and delayed upgrades at the remaining fusion facilities; substantial layoffs of scientists, engineers, and support personnel throughout the country; increasing cutbacks in university research, the loss of numerous students and professors from the U.S. fusion program, and the related impact of discouraging future fusion researchers from entering the field. These consequences would jeopardize U.S. leadership in fusion research, threaten our country's ability to take advantage of the scientific advances made through ITER, and ultimately delay the availability of commercial fusion energy.

As you know, fusion power is a safe, clean, and sustainable energy source that can provide the United States with energy independence and a nearly limitless energy supply in a time-scale that matters and at a cost that we can afford. The OFES is working to make this energy source a reality by providing funding to a wide variety of fusion laboratories and research programs throughout the United States while also contributing to the international ITER fusion project. Both of these investments are vital to achieve the goals of the U.S. fusion program. The domestic program is key to developing the scientific basis for fusion, establishing the foundation for the next steps in the U.S. fusion program, and providing scientific advances for ITER. ITER is the most ambitious fusion

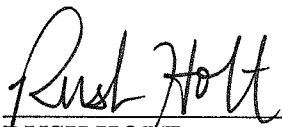
2-FY13 Office of Fusion Energy Sciences Letter to House Appropriations Energy & Water Subcommittee

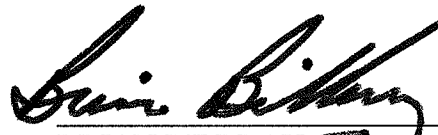
facility ever built and will provide critical information that will help usher in the commercialization of fusion energy. Without substantial support for both programs, we will cede further advantage to countries such as China, South Korea, Japan, and the European Union, all of which are pursuing substantially more aggressive fusion programs than our own.

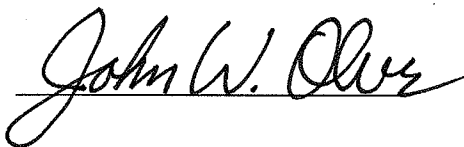
We request respectfully that you restore funding for the domestic fusion program and include a total of \$447 million for the Office of Fusion Energy Sciences in FY 2013. We understand that difficult funding choices must be made as the appropriations process moves forward. However, clean energy is an area in which our government can ill-afford to fall behind. We know fusion is a sound investment. Economical, potential fusion energy can be realized with a strong research program. Around the world, countries are making strong investments in fusion research and are pulling ahead of us. The United States would be wise to make a much larger investment in fusion, but at least with level funding for the domestic program and continued contribution to ITER, the United States can maintain its position as a world leader in fusion research, avoid layoffs, and help make commercial fusion a reality. We look forward to working with you on this issue as the appropriations process moves forward.

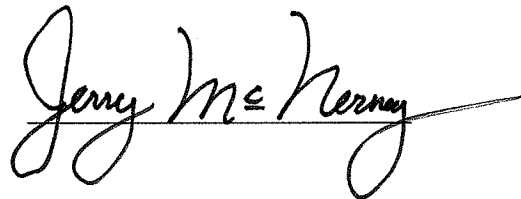
Thank you for your attention to this matter.

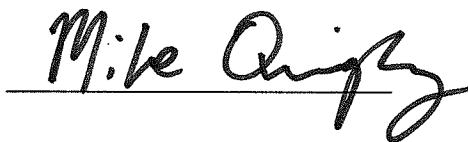
Sincerely,

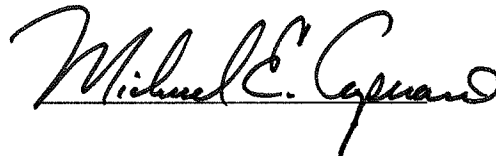
  
RUSH HOLT  
Member of Congress

  
BRIAN BILBRAY  
Member of Congress

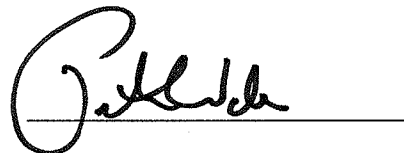












3-FY13 Office of Fusion Energy Sciences Letter to House Appropriations Energy & Water Subcommittee

Zu Lij

Edward J. Markey

Bob Filner

Tommy Baldwin

Laura M. Staughton

Anna Escobedo Cabral

Byron Pitts

Jim Moran

Robert E. Latta

Niki Bonaguidi

Phil V. Holden

Alan K. Latta

C.A. Dutch Ruppersberger

Bill Pascrell Jr.

Dan Latta

Gene Roddenberry

Gene Latta

Steven Rothman

4-FY13 Office of Fusion Energy Sciences Letter to House Appropriations Energy & Water Subcommittee

Jim Cooper

Pete Stark

Frank Pallone Jr.

Joel Pritchett

Joe Sestak

Edward Markey

Jim McDermott

Steve Largent

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5-FY13 Office of Fusion Energy Sciences Letter to House Appropriations Energy & Water Subcommittee

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Marcy Kapture

Bob With

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Jane Hak

Joe Courtney

Steve D

Bill of Bill

John Longers,

M. P. King

Barney Frank

Paul Tonko

John G....

6-FY13 Office of Fusion Energy Sciences Letter to House Appropriations Energy & Water Subcommittee

Rep. Rob Andrews  
Rep. Tammy Baldwin  
Rep. Brian Bilbray  
Rep. Tim Bishop  
Rep. Bruce Braley  
Rep. Mike Capuano  
Rep. John Conyers  
Rep. Joe Courtney  
Rep. Joe Crowley  
Rep. Diana DeGette  
Rep. Anna Eshoo  
Rep. Bob Filner  
Rep. Barney Frank  
Rep. John Garamendi  
Rep. Janice Hahn  
Rep. Maurice Hinchey  
Rep. Rush Holt

Rep. Jay Inslee  
Rep. Steve Israel  
Rep. Marcy Kaptur  
Rep. Ron Kind  
Rep. Leonard Lance  
Rep. Zoe Lofgren  
Rep. Stephen Lynch  
Rep. Edward Markey  
Rep. Jim McDermott  
Rep. Jim McGovern  
Rep. Jerry McNerney  
Rep. George Miller  
Rep. Gwen Moore  
Rep. Jim Moran  
Rep. Jerrold Nadler  
Rep. John Olver  
Rep. Frank Pallone

Rep. Bill Pascrell  
Rep. Jared Polis  
Rep. Mike Quigley  
Rep. Steve Rothman  
Rep. Dutch  
Ruppersberger  
Rep. Albio Sires  
Rep. Louise Slaughter  
Rep. Pete Stark  
Rep. John Tierney  
Rep. Paul Tonko  
Rep. Niki Tsongas  
Rep. Chris Van Hollen  
Rep. Peter Welch



**Congress of the United States**  
**Washington, DC 20515**

March 20, 2012

The Honorable Rodney Frelinghuysen  
Chairman  
Energy and Water Development  
Appropriations Subcommittee  
House Appropriations Committee  
2362-B Rayburn House Office Building  
Washington, DC 20515

The Honorable Peter Visclosky  
Ranking Member  
Energy and Water Development  
Appropriations Subcommittee  
House Appropriations Committee  
1016 Longworth House Office Building  
Washington, DC 20515

Dear Chairman Frelinghuysen and Ranking Member Visclosky:

We are writing to express our profound concern about the proposed gutting of the U.S. domestic programs for fusion sciences. The Administration's FY 2013 budget request for the Department of Energy's Office of Fusion Energy Sciences (OFES) reallocates funding in ways we find frankly incomprehensible. ***Domestic programs would lose \$49 million while \$45 million would be added to an international program, ITER, based in France.*** We merely ask for level funding of domestic fusion programs at the FY 2012 amount to sustain American research in this essential field. We are particularly concerned to preserve the important work done by the Alcator C-Mod Tokamak experiment at MIT as part of this account. We do not oppose international cooperation but domestic efforts must remain a priority.

The consequences of the projected cut are predictable and devastating:

- The loss of 300 to 1,000 American jobs, affecting academics, skilled technical workers, and support personnel.
- We see no reason to create jobs in Europe with American tax dollars at a time when we need every job possible right here in the United States.
- Decades of highly technical capital investment in American-based science, valued at \$200 million, will be moth-balled.

This proposal would also hurt America by forgoing the training of the next generation of fusion scientists. Training for those scientists will move to Europe and China. America would also lose the benefits we enjoy from the creation of companies related to the research at American facilities. Over the past decade, there have been many successful, cutting-edge businesses created by the scientists and research related to our fusion facilities.

We strongly urge the committee to reverse the misallocations proposed in the Department of Energy FY 2013 budget, specifically to restore funding for the domestic fusion programs. If monies can be found to expand the multinational efforts, that would be good, but ***US facilities and US jobs must not be sacrificed to fund research and jobs in Europe.***

Thank you for your attention to this important matter.

Sincerely,



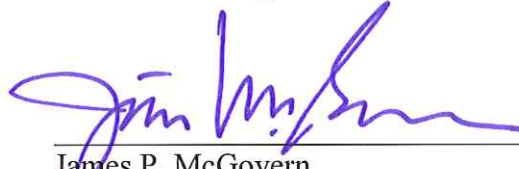
Michael E. Capuano  
Member of Congress



Peter Welch  
Member of Congress



Barney Frank  
Member of Congress



James P. McGovern  
Member of Congress



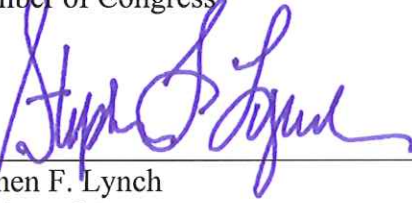
Edward J. Markey  
Member of Congress



Niki Tsongas  
Member of Congress



John W. Olver  
Member of Congress



Stephen F. Lynch  
Member of Congress

# United States Senate

WASHINGTON, DC 20510-2102

March 2, 2012

The Honorable Daniel Inouye  
Chairman  
Senate Appropriations Committee  
122 Dirksen Senate Office Building  
Washington, D.C. 20510

The Honorable Thad Cochran  
Vice Chairman  
Senate Appropriations Committee  
122 Dirksen Senate Office Building  
Washington, D.C. 20510

The Honorable Dianne Feinstein  
Chairman  
Committee on Appropriations  
Subcommittee on Energy and  
Water Development  
142 Dirksen Senate Office Building  
Washington, D.C. 20510

The Honorable Lamar Alexander  
Ranking Member  
Committee on Appropriations  
Subcommittee on Energy and  
Water Development  
188 Dirksen Senate Office Building  
Washington, D.C. 20510

Dear Chairman Inouye, Vice Chairman Cochran, Chairman Feinstein and Ranking Member Alexander:

I am writing you today to express my serious concerns about the funding included in President Obama's FY 2013 budget request for United States domestic fusion program and the effect it could have on our economy in the future. I request that you provide \$300 million for domestic fusion research and \$150 million for the international ITER project for fusion research program in the Senate FY 2013 Energy and Water Appropriations bill.

The United States has been an international leader in fusion energy research for generations. A critical part of that research has been done since 1976 at Massachusetts Institute of Technology's (MIT) Plasma Science and Fusion Center (PSFC) which is recognized as one of the leading university research laboratories in the physics and engineering aspects of magnetic and inertial fusion. The PSFC has focused on developing a basic understanding of plasma behavior in the laboratory and in nature. This research has led to practical applications which in the long term could solve the future energy needs of our nation and the world.

As Chairman of the Foreign Relations Committee, I fully understand the importance and potential benefits of the participation of the United States in international research projects, including ITER. However I also do believe that an appropriate balance must be struck between domestic and international considerations of our research investments. The investment and funding of international research projects makes little sense if it encourages future jobs to leave this country and be sent abroad while at the same time resulting in significant cuts to the jobs that these fields currently support here at home.

Unfortunately, the President's Fiscal Year 2013 budget proposal for the Department of Energy (DOE) fails to meet that important test by including a 16 percent reduction in domestic fusion

The Honorable Daniel K. Inouye  
The Honorable Thad Cochran  
The Honorable Dianne Feinstein  
The Honorable Lamar Alexander  
March 2, 2012  
Page 2

research to just \$248 million. At the same time, the President's budget proposal included a 43 percent increase for the international fusion research project (ITER) to \$150 million.


If the President's request is enacted into law, the C-Mod research facility at MIT will be abruptly terminated and 130 fusion scientists, engineers, graduate students, and support personnel at MIT would be terminated. The domestic fusion program simply cannot withstand the proposed reductions without a severe negative impact to our fusion research and our scientific contributions to ITER.

To remain at the cutting edge, United States fusion researchers must participate in the international ITER being built in Cadarache, France. But to pay for ITER—which aims to produce a self-sustaining fusion reaction, or "burning plasma," and prove that fusion is a viable energy source—the United States is sacrificing the very community of researchers who would apply the results from the ITER experiments. This shortsighted approach could eliminate the ability of the United States to take a lead role in developing the next generation of energy research.

As the Energy and Water Appropriations Subcommittee begins the process of looking at funding allocations for DOE in FY 2013. I hope you will continue to invest in fusion projects and research that supports American jobs now and in the future and that you will provide \$300 million for domestic fusion research.

Thank you in advance for your consideration of my request.

Sincerely,



John F. Kerry

SCOTT P. BROWN  
MASSACHUSETTS

359 DIRKSEN SENATE OFFICE BUILDING  
WASHINGTON, DC 20510  
(202) 224-4543  
(202) 228-2646 FAX

## United States Senate

WASHINGTON, DC 20510

COMMITTEES:  
HOMELAND SECURITY  
AND GOVERNMENTAL AFFAIRS

ARMED SERVICES  
VETERANS' AFFAIRS  
SMALL BUSINESS

April 6, 2012

Senator Dianne Feinstein  
Chairwoman  
Senate Committee on Appropriations  
Subcommittee on Energy & Water Development  
142 Dirksen Senate Office Building  
Washington, D.C. 20510

Senator Lamar Alexander  
Ranking Member  
Senate Committee on Appropriations  
Subcommittee on Energy & Water Development  
188 Dirksen Senate Office Building  
Washington, D.C. 20510

Dear Chairwoman Feinstein and Ranking Member Alexander,

I write to you today to urge the Subcommittee to support domestic fusion energy research in the FY13 Energy and Water Appropriations bill. The United States must maintain its commitment to being a world leader in fusion research.

Since 1976, the Plasma Science and Fusion Center at the Massachusetts Institute of Technology (MIT) has been recognized as one of the world leaders in fusion research. The Center's research has led to a breakthrough understanding of plasma behavior and its practical application for long term domestic energy use. However, the President's FY13 budget for the Department of Energy contains a 16 percent reduction to domestic fusion research while also significantly increasing our commitment to the International Fusion Research Project known as ITER. This puts over 100 scientists, engineers, graduate students and support staff at MIT at risk of losing their jobs and puts domestic research at a disadvantage in favor of an international project.

Our ability to lead and be competitive in the next generation of energy depends on a sustained commitment to the domestic fusion program. I respectfully request the Subcommittee provide strong support to domestic fusion research as well as provide clear directions to the Administration to prioritize domestic fusion research programs.

Thank you for your attention to this matter.

Sincerely,



Scott P. Brown  
United States Senator

2400 JFK FEDERAL BUILDING  
BOSTON, MA 02203  
PHONE: (617) 565-3170  
FAX: (617) 723-7325

18 MAIN STREET EXTENSION, SUITE 202  
PLYMOUTH, MA 02360  
PHONE: (508) 830-0040  
FAX: (508) 830-0288

1550 MAIN STREET, SUITE 406  
SPRINGFIELD, MA 01103  
PHONE: (413) 788-2693  
FAX: (413) 788-2692

HAROLD D. DONOHUE FEDERAL BUILDING  
595 MAIN STREET, SUITE 105  
WORCESTER, MA 01608  
PHONE: (508) 791-3570  
FAX: (508) 791-3572

April 13, 2012

The Honorable Steven Chu  
Secretary  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, D.C. 20585

The Honorable John P. Holdren  
Director  
Office of Science and Technology Policy  
Executive Office of the President  
725 17<sup>th</sup> Street, NW, Room 5228  
Washington, D.C. 20502

Dear Secretary Chu and Dr. Holdren:

We are writing to request that you reconsider the Administration's proposed funding level for the domestic fusion program in the FY 2013 Budget. Implementing a 16.4 percent cut to the domestic fusion program in order to fund the increased contribution to ITER would have a severe impact on the important work being done at our universities in areas of fusion energy and plasma science. In a recent communication to Dr. Brinkman, the Fusion Energy Sciences Advisory Committee (FESAC) set forth its concerns with the proposal, which we share: "The committee objects to the theme/impression that these cuts leave the program relatively unscathed. ... The damage is real. ... We cannot maintain a viable fusion science program on a flat \$400M budget."

Our institutions play a vital role in the quest for clean energy in the form of fusion power. We recruit and train the scientists and engineers of the future and conduct a wide range of fusion experiments. In addition to developing the scientific basis for fusion and generating important data essential to ITER's success, our federally funded fusion programs conduct experimental work in high energy density laboratory plasmas, fusion theory and modeling, and general plasma science. Until now, the United States has been a leader in the development of fusion energy, but without a vibrant domestic program, our ability to capitalize on ITER will be greatly diminished.

As we approach the steps that will ultimately take us to fusion power generation, the goal of the U.S. fusion program, it is imperative that both the domestic research program and the U.S. contributions to ITER be funded. Cutting one program in order to fund the other will result in the U.S. falling behind countries such as China, South Korea, the European Union, and Japan, all of which are pursuing substantially more aggressive fusion programs than our own. The Administration's request would not only seriously jeopardize the excellent research and training that is being done at our institutions, but it would ultimately delay the availability of commercial fusion energy. Among other consequences, the funding level would result in the shutdown of one of the three major U.S. fusion research facilities (Alcator C-Mod at MIT); the layoff of hundreds of fusion researchers and support personnel; significant cutbacks in fusion theory, computation, and simulation; and a limited ability to contribute to and benefit from ITER's promise. We are especially concerned about the students and professors who will be forced to leave the U.S. fusion program as a result of this cut, as well as the future fusion researchers who will be dissuaded from entering the field at all.


We share the President's deep commitment to a future based on a clean energy economy. We believe that fusion – a potential source of clean, safe and virtually limitless energy – will be an important part of that new economy. With level funding for the domestic program and the Administration's proposed funding for ITER, the United States can maintain its position as an international leader in fusion research with the researchers and program elements in place to help make commercial fusion a reality.

Thank you in advance for your consideration of this request.

Sincerely,



Jay Gogue  
President  
Auburn University




Lee C. Bollinger  
President  
Columbia University



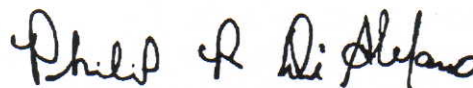
Alice P. Gast  
President  
Lehigh University



Susan Hockfield  
President  
Massachusetts Institute of Technology



Shirley M. Tilghman  
President  
Princeton University



Philip P. DiStefano  
Chancellor  
University of Colorado Boulder



Wallace D. Loh  
President  
University of Maryland



David Ward  
Interim Chancellor  
University of Wisconsin-Madison

Cc: The Honorable William F. Brinkman  
Director – The Office of Science  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Room 7B-058  
Washington, D.C. 20585

The Honorable Carl Wieman  
Associate Director for Science  
Office of Science and Technology Policy  
Executive Office of the President  
725 17<sup>th</sup> Street, NW, Room 5228  
Washington, D.C. 20502

March 20, 2012

The Honorable Steven Chu  
Secretary of Energy  
Washington, D.C. 20585

The Honorable John P. Holdren  
Director, Office of Science and Technology Policy  
Washington, D.C. 20502

Dear Secretary Chu and Director Holdren,

As graduate students and postdoctoral researchers in the rising generation of fusion researchers, we are writing because the goal of attaining commercialized fusion energy may be compromised by the proposed FY 2013 budget. We entered this challenging and exciting field to address the nation's growing energy requirements and need for energy independence. Fusion energy is a potentially attractive component of the United States' future energy portfolio. It will provide a large-scale energy supply using domestically available, abundant fuel, create zero greenhouse gas or acidic emissions, offer inherently safe operation, use limited land, and have no need for long-term waste disposal.

We are very concerned about the future direction of funding for the US fusion research program as specified in the proposed budget. The proposal reduces the domestic fusion spending from \$300M to \$255M, and it also underfunds our obligations to ITER by \$50M. ITER obligations would be funded at the expense of the domestic fusion program, though both are essential for the development of domestic fusion power.

Our concerns include:

- **Long-term progress in fusion research depends on the continuous transfer of knowledge; the proposed budget damages the community required for this continuity**
  - Talented young researchers are driven away by the funding instability in the domestic program
  - Today's graduate students and postdoctoral researchers will be needed to build on progress made by ITER and advance towards a domestic fusion reactor
  - Educating new researchers takes more than a decade, and loss of personnel puts the US drastically behind the international community
- **ITER and the domestic fusion program are *both* critical to achieving commercial fusion power and *should not be placed in competition with each other***
  - The proposed budget presupposes a decision between ITER construction and the domestic program; both are vital to attaining commercial fusion power in the US
  - In order for the US to benefit from international facilities and collaborations, it must also maintain expert personnel and advanced domestic facilities
  - Domestic program reductions diminish the local workforce, driving our scientific expertise and technological innovation overseas



- **The direction of the FY 2013 budget strongly threatens US global leadership in fusion research and technology**
  - University programs have been especially hard-hit by recent and proposed cuts; a 19% cut in graduate student funding threatens the next generation of researchers
  - Domestic operations will be reduced, new experiments will be delayed, and crucial facilities will be eliminated
  - Reduced support for theoretical and computational research, as well as basic plasma physics, will further impair our ability to remain an international leader in the field
  - Rather than moving the nation towards energy independence, the proposed budget will exacerbate US reliance on foreign energy technology

As America's young scientists, we understand the high risk and high rewards of this area of research and have chosen to dedicate our careers to the prospect of contributing to the nation's future energy portfolio. Our contribution requires a healthy domestic fusion program. It is in the long-term interest of the United States to maintain predictable and sufficient funding for facilities and personnel. Facilities must advance with the science, which can drive replacement; however, we also need to maintain our existing scientific investments. We are enthusiastic about the future of the nation's fusion energy program, but it can only move forward with adequate support.

**We respectfully request support for a competitive, healthy domestic fusion program in the coming years. Specifically, we ask that at least the current FY 2012 funding level be maintained for the domestic fusion program, while continuing to meet our full obligations to ITER.**

We would like to thank both of you for your leadership in moving the country forward towards a cleaner energy future.

Sincerely,

258 graduate students and postdoctoral researchers at the following institutions:

Auburn University	College of William and Mary
Columbia University	General Atomics
Florida A&M University	John Hopkins University
Kansas State University	Massachusetts Institute of Technology
Oak Ridge National Laboratory	Princeton University
Princeton Plasma Physics Laboratory	Purdue University
Rensselaer Polytechnic Institute	Sandia National Laboratory
University of California, Irvine	University of California, San Diego
University of Iowa	University of Illinois
University of Maryland	University of Michigan
University of Texas at Austin	University of Washington
University of Wisconsin-Madison	

cc:

The Honorable Dr. William Brinkman, Director, Office of Science

Dr. Edmund Synakowski, Associate Director, Office of Fusion Energy Science



Plasma Science & Fusion Center  
Phone 617.253.6053  
Fax 617.253.0627  
Email g@psfc.mit.edu

February 29 , 2012

Dr. William F. Brinkman  
Director - Office of Science, SC-1  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585

Dr. Brinkman,

First, I want to thank you for your continuing support and for the frank discussion we had during this week's FESAC meeting. The reports from the two panels responding to your charge of July 2012 were discussed and approved. I will be forwarding those to you in the next few days.

It is clear that the community is upset about the current budget trajectory and the potential impact on our domestic program. At the end of the meeting, a statement to that effect was prepared and approved unanimously (17 for, 0 against, 2 recusals, 1 absent). While this statement will be found in the minutes of our meeting, I felt it was important for you to understand the views expressed by the committee without delay.

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The statement reads:

- 1) The committee objects to the theme/impression that these cuts leave the program relatively unscathed and strongly cautions against claims of impactful potential at this level or lower without real study and discussion.
  - a) Specific impacts on the domestic program were noted during the meeting, these include many aspects of fusion science, plasma physics, and HEDLP research.
  - b) The damage is real.
  - c) The portents for the future are even more threatening.
- 2) If this whole discussion is in flux inside the Administration, this does not appear to be the time to make termination decisions that cannot be reversed. We are not clear on the wisdom to do lasting changes to program based on an undefined ITER profile and in the absence of an overall plan for the program.
- 3) Buy-in, cohesion of community is critical as we confront hard decisions – we don't want community to give a message different from DOE/OSC/FES
- 4) Thus we encourage FESAC charges covering

- a) Near-term crisis management; shoring up the case for domestic research while ITER is under construction
    - i) We cannot maintain a viable fusion science program on flat \$400M budget
    - ii) Once a field is shut down, you need to start over and that can take decades
    - iii) The plan should run to 2021 (ITER start): and include option and plans for the next decade
  - b) Long-term planning goals
    - i) For ITER-era Burning Plasma leadership
    - ii) For a Fusion Nuclear Science Program leading to fusion energy
- 

Sincerely,



Martin Greenwald  
Chair, Fusion Energy Sciences Advisory Committee

Cc: Patricia Dehmer  
Edmund Synakowski  
Al Opdenaker

February 27, 2012

The Honorable Steven Chu  
Secretary of Energy  
Washington, DC 20585

The Honorable John P. Holdren  
Director, Office of Science and Technology Policy  
Washington, D.C. 20502

Dear Secretary Chu and Director Holdren,

As you know, the United States has been an international leader in fusion energy research for decades, delivering numerous scientific and technical advances, and building a world-class fusion science workforce. Following in-depth deliberations and multiple reviews, the U.S. government committed to the international ITER project and to a strong domestic fusion program as the optimal strategy for fusion energy.

With ITER pioneering the study of burning plasma science, the world fusion program is poised to enter the final era of fusion research, where commercialization can be realistically envisioned. This is one of the grand scientific challenges of our time, as expressed by the National Academies of Engineering. Studies by the National Academies and others articulate that the United States must sustain a vigorous domestic research program that enables us to prepare for experiments on ITER, benefit from ITER operation, and solve the remaining challenges for fusion energy.

As leaders and stewards of the current U.S. fusion research effort, we are unfortunately compelled to point out that the Fiscal Year 2013 budget request will demote the U.S. program to a second-tier player in the world fusion effort. After years of operating on minimal budgets and essentially level funding, **the domestic fusion program cannot withstand the proposed reductions without severe negative impact to our essential capabilities and our scientific contributions to the international fusion program in ITER.** If implemented, the \$49 million cut contained in the budget request will result in the layoff of hundreds of fusion scientists, engineers, graduate students, and support personnel, with the following consequences:

- Of our three major fusion research facilities, one will be abruptly terminated (C-Mod at MIT); one will be severely reduced in its operations with facility enhancements cancelled; and one will experience significant delay in its upgrade.
- It will require the shutdown or slowdown of major university programs, with subsequent discouragement of new researchers that could potentially cost us an entire generation.
- It will severely reduce our efforts both in basic plasma physics research and in alternative fusion concept research, which are foundational for the field.
- It will eliminate many opportunities for theoretical and computational discoveries in fusion systems, possibly stunting our ability to exploit advances in high performance computing.
- It will substantially curtail activities in high energy density physics.
- It will endanger our ability to develop fusion-enabling technologies, and to design and build future fusion facilities in the U.S.

The FY 13 budget reductions will deal a blow to the U.S. fusion research program and the U.S. position in the field that will be felt for many years to come.

**Further, while the budget's \$150M for U.S. participation in ITER is a \$45M increase from the FY2012 level, it is \$50M below the U.S. ITER Project's plan, making U.S. achievement of the ITER schedule expectations extremely difficult.**

As documented in the National Academies' 2004 report, *Burning Plasma: Bringing a Star to Earth*, ITER is the seminal science experiment through which we will explore, understand, and control the burning plasma state. The knowledge gained will inform our predictions of burning plasma behavior in a wide variety of potential confinement systems for fusion reactors. As such, ITER is tightly integrated with the domestic research enterprise that is developing the knowledge base for tokamaks and alternative confinement configurations. The U.S. will have access to all ITER-developed technology and scientific data, while bearing only nine percent of its construction cost. There are few, if any, U.S. government-funded R&D program with such high leverage.

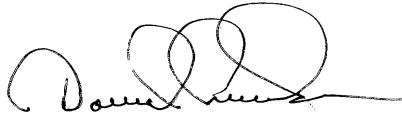
The proposed cuts to the domestic program are rationalized by the need to increase funding for the U.S. contribution to ITER construction. In contrast, our ITER partners are strongly fulfilling their construction obligations, and several nations are additionally strengthening their domestic fusion programs. The proposed FY13 budget takes the U.S. program in the other direction: it puts us well on the road to a time when only our international partners can benefit from ITER (and the U.S. contribution to it) and pursue the remaining steps for fusion.

The fusion community will be working with Congress to restore funding to the program. Meanwhile, we respectfully, but urgently, request that in developing future budgets for the Office of Science, the Administration endeavor to provide funding levels adequate for the U.S. to meet its ITER obligations, but not at the expense of either a strong domestic fusion effort or of other Office of Science programs.

We very much appreciate the challenges of advancing science and energy research, and of balancing the needs of multiple programs. We also thank you for your eloquent advocacy of science as the foundation of a secure energy future. We look forward to working with you to ensure that fusion is part of that future.

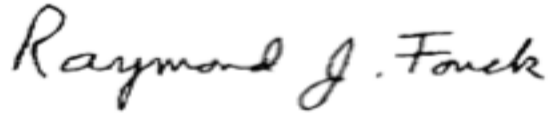
Sincerely,

[Signatures on following page]



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David Anderson  
President, University Fusion Association  
Professor of Electrical & Computer Engineering  
University of Wisconsin - Madison



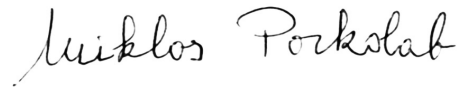
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Raymond J. Fonck  
Steenbock Professor in Physical Science  
Department of Engineering Physics  
University of Wisconsin - Madison



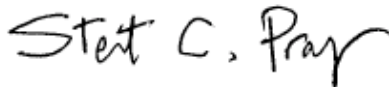
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Stanley Milora, Director  
Fusion Energy Division  
Oak Ridge National Laboratory



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Miklos Porkolab  
Professor of Physics and Director  
Plasma Science and Fusion Center, MIT




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Stewart C Prager  
Professor of Astrophysical Sciences  
Princeton University



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Ned. R. Sauthoff  
Director  
U.S. ITER Project Office



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Tony S. Taylor  
Vice President  
Magnetic Fusion Energy Division  
General Atomics

cc: The Honorable Dr. William Brinkman, Director, Office of Science  
The Honorable Jeffrey Zients, Director, Office of Management and Budget  
Dr. Edmund Synakowski, Associate Director, Office of Fusion Energy Science

**Written Statement  
Of  
Dr. Stephen O. Dean  
President, Fusion Power Associates  
To  
Meeting of DOE Fusion Energy Sciences Advisory Committee  
February 29, 2012**

**Public Comment Session**

First, let me say that I endorse the recommendation just made by Dr. Earl Marmor of MIT that no irrevocable decisions be made relative to reductions in the fusion program, as proposed in the President's FY 2013 budget submission to Congress, until a vetting of such reductions occurs within the U.S. fusion community. This should be done by FESAC, or otherwise, to seek community consensus relative to priorities identified previously by FESAC.

Much of the discussion has been focused on the proposed termination of the Alcator C-Mod program at MIT. The proposed termination is of serious concern, since that program has made, and is making, important contributions to our understanding of tokamak physics and, furthermore, is important to the training of the next generation of fusion scientists. Termination of Alcator C-Mod would mean a "double whammy" for the MIT fusion program, since DOE terminated the other significant experimental facility there last year, the Levitated Dipole Experiment (LDX). Without these two facilities, MIT will lack the facilities to continue providing experience to students doing experimental fusion research.

But the problem with the proposed reductions is much broader and more serious than just the role and future of the MIT program. Reductions in other areas, such as High Energy Density Laboratory Plasmas (HEDLP), theory, and systems studies will result not only in a loss of valuable talent and expertise throughout the U.S. fusion program, but will also mean that research results these people and facilities would otherwise provide in the coming years will not be obtained. On that subject, I would note that the practice of requiring many fusion programs to compete for renewal periodically via open solicitations is not working well, especially if those programs are imbedded in larger institutions having upper layers of management. One example is that of the heavy ion fusion effort at the Lawrence Berkeley National Laboratory. Using "stimulus" funding, LBNL has finally been able to complete a new facility with which to study warm dense matter physics. However, they were notified that they had to compete against other proposals, not yet received by DOE, after DOE advertises broadly for proposals in HEDLP. These solicitations often get delayed for months beyond the date expected. Upper management at LBNL, understandably, has to make plans to possibly layoff many personnel in case there is a funding lapse or no funding at all in FY2013. So, unintended consequences can result from these procedures.



The reductions proposed in the domestic fusion program were deemed necessary by DOE in order to increase funding for the U.S. contribution to ITER from \$105 million in FY 2012 to \$150 million in FY 2013. As several FESAC members noted yesterday, we have not been told by DOE how much is really needed in FY 2013, how much will be needed in future years to meet the November 2019 ITER first plasma target date, or where these funds will come from. We were told yesterday that Japan plans to spend \$250 million in 2013 to maintain their ITER commitment. Since the U.S. has the same one-ninth share of ITER commitments, it would seem logical that the U.S. may really have needed roughly that amount in order to meet the ITER schedule. Thus, even with \$150 million in FY 2013, the U.S. may not have the funds it really needs for ITER in FY 2013.

In July 2002, approximately 280 fusion scientists assembled in Snowmass, Colorado, to assess our options for a burning plasma experiment. Three were identified: Ignitor (a short pulse, copper high field magnet tokamak), FIRE (an intermediate-length pulse, superconducting tokamak), and ITER (a long pulse, superconducting tokamak). In August 2002, a special FESAC panel met in Austin, Texas, and identified ITER as the preferred choice, but under certain assumptions. At the time, ITER was estimated to cost about \$5 billion and the U.S. share was estimated to be ten percent of that, or \$500 million. I was a member of that panel. I believe the panel would have chosen the FIRE concept except for the fact that we were being offered a bargain: for \$500 million we could have a much more capable facility, since we only would have to pay ten percent of the cost. The full FESAC adopted the panel's recommendations in September but emphasized that the U.S. ITER contribution had to be provided on top to the existing domestic (or base) fusion program. The FY 2003 OFES budget at that time was \$241 M. The U.S. was not an ITER participant at that time, but rejoined about one year later.

In spite of the FESAC proviso, in FY 2004 and 2005, the President started requesting funds for ITER by reducing the domestic fusion budget, but the Congress largely (but not completely) rebuffed these efforts. The OFES fusion technology efforts were largely terminated to accommodate these conflicts. FESAC, on its own initiative, wrote a strong letter to Office of Science director Ray Orbach saying, "Devastating cuts in certain program elements are alarming; this note expresses our most serious concerns."

The President's request for FY 2006 contained a \$17 million increase for OFES, but also a proposed \$51 million increase for ITER. Congress refused to go along with this, cutting the ITER request by \$30 million and directing it into the domestic program, stating, "As in previous years, the conferees direct the Department to fund the U.S. share of ITER in fiscal 2007 through additional resources rather than through reductions to domestic fusion research or to other Office of Science programs." For FY 2007, the President, for the first time, requested an increase in the total OFES budget that was approximately equal to the proposed increase for ITER (there was a \$4 million decrease proposed for the domestic program). The Congress eventually went along with this budget through an omnibus appropriation that did not pass until 5 months into the fiscal year.

In sending the FY 2007 request to Congress, the President re-estimated the cost of the U.S. contribution to be \$1.122 billion, as follows:

FY 2006	19.3 M
FY 2007	60.0 M
FY 2008	160.0 M
FY 2009	214.5 M
FY 2010	210.0 M
FY 2011	181.3 M
FY 2012	130.0 M
FY 2013	116.9 M
FY 2014	30.0 M
Total	1122.0 M

This is the only out-year projection ever made publicly available by DOE. However, in 2008, DOE stated that the total required had been increased to a “range” of \$1.4 to \$2.2 billion. The total appropriated for ITER and the domestic program (third column), starting with FY 2006, is as follows:

FY 2006	25.0 M	263 M
FY 2007	60.0 M	259 M
FY 2008	10.7 M	276 M
FY 2009	124.0 M	282 M
FY 2010	135.0 M	291 M
FY 2011	80.0 M	287 M
FY 2012	105.0 M	296 M
FY 2013	150.0 M	248 M (requested)

Thus, if US ITER receives the requested \$150 M in FY 2013, it will have spent \$690 M. If ITER is to operate in November 2019, essentially all needed construction funds must be spent by end of FY 2018. Since the latest (informal) estimate of the total US contribution to ITER has risen reportedly to \$2.6 billion, the President will need to request, and the Congress will need to appropriate, an additional nearly \$2 billion over the five fiscal years 2014-2018, or an average of nearly \$400 million per year. Clearly this cannot come by continuing to decrease the US domestic fusion program. Something needs to be done.

On January 30, 2003, the U.S. decided to rejoin the ITER project. The decision was made at the highest level of the U.S. government, an announcement from President George W. Bush stating, “I am please to announce that the United States will join ITER, an ambitious international research project to harness the promise of fusion energy.”

**To ensure the successful completion of the ITER project, without destroying the U.S. domestic program, requires that we regain the high level U.S. government support for the project that seems to have been lost in the FY 2013 budget submission. The ITER project must be again recognized as a presidential commitment that cannot be funded by reducing the U.S. domestic fusion effort.**

There has been much talk at this meeting of making a new plan for fusion; in fact, Congress has requested it. Some feel that preparing such a plan could be the vehicle for getting the issues of ITER and domestic fusion funding resolved. I doubt that.

Next summer, I will have been working in fusion for half a century. I have seen and/or been involved in preparing many fusion plans over this time period. While all have been exemplary in their logic and content, they have all essentially been ignored after completion. Furthermore, plans take time to prepare well; and we are in a crisis situation with respect to the funding of the US domestic fusion program. I do not sense that the DOE wants to proceed on an urgent basis with a new planning activity. So I suggest that the fusion community should self-organize to do the required vetting of the FY 2013 budget proposals and not depend on, or wait, for a DOE-initiated planning activity to begin.

**Yesterday, Dr. Brinkman told us that when he arrived at DOE Secretary Chu told him, with regard to ITER, he needed to “fix it or kill it.” I think now is the time Dr. Brinkman should respond to the Secretary, “I have fixed it. Now help me pay for it.”**

**The U.S. domestic fusion program does not have sufficient funds to pay for the U.S. contribution to ITER construction.**