U.S. DEPARTMENT OF ENERGY
Office of Science

Perspectives on the Fusion Energy Sciences Advisory Committee (FESAC)

Fusion Power Associates 40th Annual Meeting
December 4, 2019

Dr. Samuel J. Barish
Acting Designated Federal Officer, FESAC
Office of Fusion Energy Sciences

Outline

- Explanation and History of FESAC
- Strategic Planning
- FESAC's Impact on Facilities
- FESAC's Impact on Research
- Committee of Visitors
- Thank You to the FESAC Chairs

Explanation and History of FESAC

EXPLANATION OF FESAC

- FESAC was chartered by the Federal Advisory Committee Act – Public Law 92-463.
- FESAC provides independent advice to the Director of the Office of Science on complex scientific and technological issues that arise in the planning, implementation, and management of the FES program.
- The SC Director charges FESAC to provide advice and recommendations on various issues of concern to the FES program.
- FESAC conducts its business in public meetings and submits reports containing its advice and recommendations to the SC Director.

Explanation and History of FESAC (cont'd)

HISTORY OF FESAC

- FESAC has had a profound influence on the conduct of the FES program.
- The Fusion Policy Advisory Committee was established in 1990.
- The Fusion Energy Advisory Committee (FEAC) operated from 1991 to 1996.
- It was renamed the Fusion Energy Sciences Advisory Committee (FESAC) in 1996 and is still in operation today.

Strategic Planning

- **2007 Priorities, Gaps, and Opportunities report:**
  - FESAC issued an influential report in 2007 that analyzed research gaps and opportunities in the FES program ("Priorities, Gaps, and Opportunities Towards a Long-Range Strategic Plan for Magnetic Fusion Energy").
  - Gaps and opportunities were emphasized pertaining to plasma transients, fusion materials science, and high-performance computing.
  - These emphases also served in part as the basis for the new FES budget structure.

- **2013 Priorities of MFES Program report:**
  - FESAC issued a report in 2013 ("Priorities of the Magnetic Fusion Energy Science Program") which proposed a set of scientific priorities for the FES program to target over the next 5-10 years.
  - It attempted to map those priorities onto major program elements under the three funding scenarios presented in the charge to FESAC.

Strategic Planning (cont'd)

- **2014 Strategic Planning report:**
  - FESAC issued a report in 2014 ("Report on Strategic Planning: Priorities Assessment and Budget Scenarios"). The report developed a vision for the domestic FES program for 2015-2024 consisting of the following elements:
    - Enable U.S. leadership in burning plasma science and fusion power production research.
    - Provide the scientific and technological basis for a U.S. Fusion Nuclear Science Facility.
    - Continue U.S. leadership in discovery plasma science and fusion-related technology.

- **2015 Fusion Energy Sciences Ten-Year Perspective:**
  - Based on FESAC 2014 and other considerations, SC sent a report to Congress on the FES Research Program over the next ten years. The report outlined four areas of enhanced emphasis:
    - Massively-parallel computing with the goal of validated whole-device-fusion modeling.
    - Non-nuclear and nuclear-related materials science and the impact of interactions of processes involved in each.
    - Research underpinning the prediction and control of transient events that can be deleterious to toroidal fusion plasma confinement.
    - Continued stewardship of research aimed at discovery at the plasma science frontier that is not expressly driven by the energy goal.

Strategic Planning (cont'd)

- **2015 Research Needs Workshops:**
  - Due to the concerns expressed by the fusion community about the 2014 FESAC Strategic Planning report, FES implemented five Research Needs Workshops in FY 2015 to seek further community engagement and input for future program planning.
  - The workshops were on integrated simulations for MFES, plasma-materials interactions, transients, and plasma science frontiers. The U.S. stellarator community conducted a sixth workshop.

- **2019-2020 Long-Range Planning:**
  - In response to a November 2018 charge to FESAC, a long-range strategic planning activity is now underway, consisting of two phases:
    - Community-organized townhalls, workshops, and white papers
    - FESAC subcommittee and final report

FESAC's Impact on Facilities

- **U.S. participation in ITER:**
  - A meeting with 80 scientists was held in Snowmass, CO, in 2002 to assess three options for burning plasma experimental facilities.
  - After Snowmass, FESAC issued a report ("A Burning Plasma Program Strategy to Advance Fusion Energy").
    - The report's conclusion was: "There is an overwhelming consensus among fusion scientists that we are now ready scientifically, and have the full technical capability, to embark on an experimental study of a burning plasma."
  - The National Research Council of the National Academies of Science issued a report in 2002 ("Bringing a Star to Earth"), which endorsed U.S. participation in ITER.
  - This report, together with the FESAC Snowmass report, helped propel the U.S. back into ITER.

FESAC's Impact on Facilities (cont'd)

- **2012 Fusion Materials Science report:**
  - A FESAC report in 2012 ("Opportunities for Fusion Materials Science and Technology Research Now and in the ITER Era") recommended initiating a linear high heat flux facility for first-of-a-kind types of materials testing, and partnering with a spallation neutron source for opening up a new frontier in fusion materials nuclear research.

- **2013 Facilities Prioritization report:**
  - A FESAC report in 2013 ("Report of the FESAC Subcommittee on the Prioritization of Proposed Scientific User Facilities for the Office of Science") recommended five facilities for the next decade (2014-2024) as absolutely central:
    - DIII-D National Fusion Facility
    - Upgraded National Spherical Torus Experiment (NSTX-U)
    - Fusion Materials Irradiation Facility
    - Fusion Nuclear Science Facility
    - Quasi-Symmetric Stellarator Experiment

FESAC's Impact on Research

- **2007 Fusion Simulation Project report:**
  - FESAC considered the final report from the DOE-supported Fusion Simulation Project Workshop and issued its own assessment ("FESAC Fusion Simulation Project Panel Final Report") in 2007. This report and related community activities affirmed the readiness for making whole-device modeling an FES priority.

- **2008 Toroidal Alternates Panel report:**
  - FESAC was asked to assess magnetic confinement configurations other than tokamaks ("Report of the FESAC Toroidal Alternates Panel"). The 2008 report underscored the related nature and complementarity of the confinement physics of systems ranging from compact toroids to tokamaks and stellarators, and provided arguments for the continued support of stellarator research.

- **2012 International Collaboration report:**
  - A FESAC report in 2012 ("Opportunities for and Modes of International Collaboration in Fusion Energy Sciences Research During the ITER Era") emphasized the potentially high value of international partnerships when carried out from a platform of a strong domestic program.

FESAC's Impact on Research (cont'd)

- **2015 Non-Fusion-Energy Applications report:**
  - Congress requested the DOE to describe "the contribution of fusion energy sciences to scientific discovery and the development and deployment of new technologies beyond possible applications in fusion energy." In response to this request, FESAC issued a report in 2015 ("Applications of Fusion Energy Sciences Research: Scientific Discoveries and New Technologies Beyond Fusion").
  - Some of the report's findings were:
    - Spinoff technologies derived from fusion investments have had a transformative effect on society.
    - The economic benefit of non-fusion applications benefitting from Fusion Energy Sciences is unquestionably large.
    - FES research has yielded advancements in computational science applicable to a wide variety of non-fusion problems.

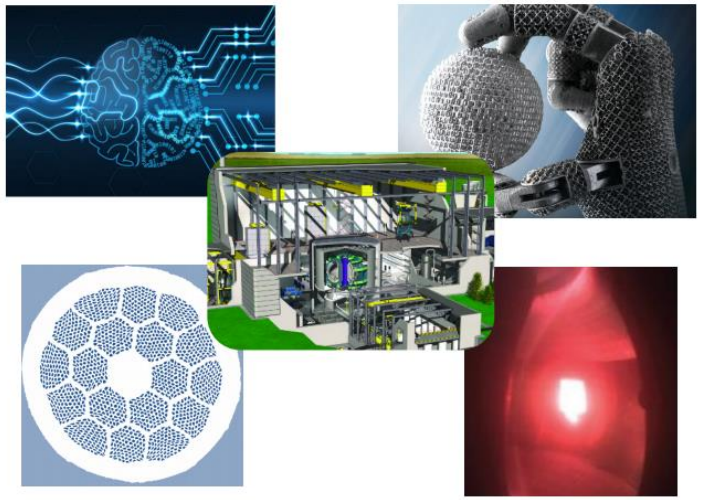
- **2018 Transformative Enabling Capabilities report:**
  - FESAC issued a report in 2018 ("Transformative Enabling Capabilities for Efficient Advance Toward Fusion Energy"). The report identified four top tier TECs:
    - Advanced Algorithms
    - High Critical-Temperature Superconductors
    - Advanced Materials
    - Novel Technologies for Tritium Fuel-Cycle Control

U.S. DEPARTMENT OF ENERGY
Office of Science

Some FESAC Reports

FUSION ENERGY SCIENCES ADVISORY COMMITTEE REPORT

Transformative Enabling Capabilities for Efficient Advance Toward Fusion Energy

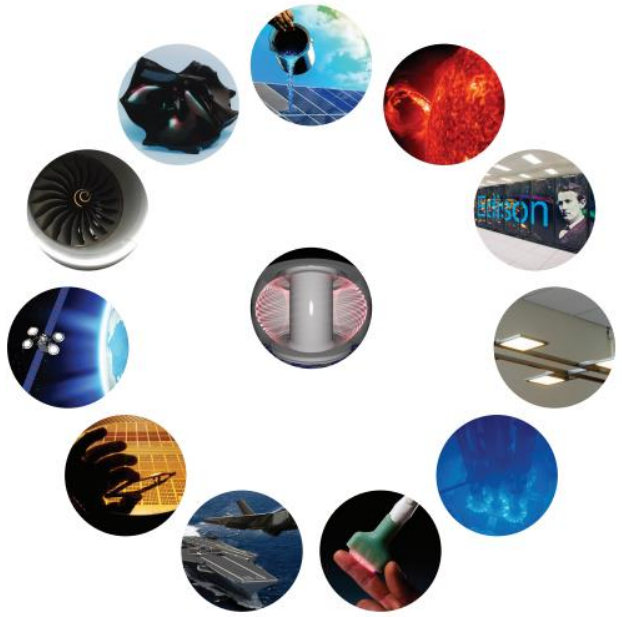


Feb. 2018

U.S. DEPARTMENT OF ENERGY | Office of Science | *Fusion Energy Sciences*

Applications of Fusion Energy Sciences Research

Scientific Discoveries and New Technologies Beyond Fusion



Report on Strategic Planning

Priorities Assessment and Budget Scenarios

Control of Burning Plasmas

Fusion Predictive Modeling

Fusion Nuclear Science

Discovery Plasma Science

U.S. Department of Energy
Office of Science

December 2014

U.S. DEPARTMENT OF ENERGY
Office of Science

What is a Committee of Visitors (COV)?

- Each of the six SC programs has a Committee of Visitors review every 3 years.
  - The committee consists of scientists and engineers who visit the SC offices every several years.

- For the FES program, the COV is a FESAC subcommittee, whose job is to assess:
  - The efficacy and quality of the processes used by FES to solicit, review, recommend, monitor, and document awards and declinations for universities, national laboratories, and industry.
  - The breadth, depth, and quality of the resulting program portfolio, and provide an evaluation of the program's national and international standing.
  - FES's management of its portfolio of line item construction and Major Items of Equipment Projects, including the US contributions to ITER project (2014 and 2018 COVs).

Committee of Visitors Key Recommendations

- The recent COVs (for 2009, 2014, and 2018) will be discussed today. These COVs made a total of 149 recommendations. Some examples are the following.

- ***2009 Recommendation:*** Work with NSF to ensure continuity in management, funding, and vitality of the NSF/DOE Partnership (2009 COV).
  - ***FES action***: The NSF/DOE Partnership program, which arose from the 2000 NAS Plasma Decadal Assessment report, has successfully operated more than twenty years.

- ***2014 Recommendation***: Restore the Budget Planning Meeting (or variant thereof) that provides the community with a forum to discuss future plans openly, and can inform FES decision-making (2014 COV).
  - ***FES action:*** FES instituted individual-group Budget Planning Meetings in 2016 and subsequent years to receive budget information that FES needs for future program planning. In these meetings, national laboratories, universities with large fusion programs, General Atomics, and community organizations that help coordinate program areas made budget presentations to FES.

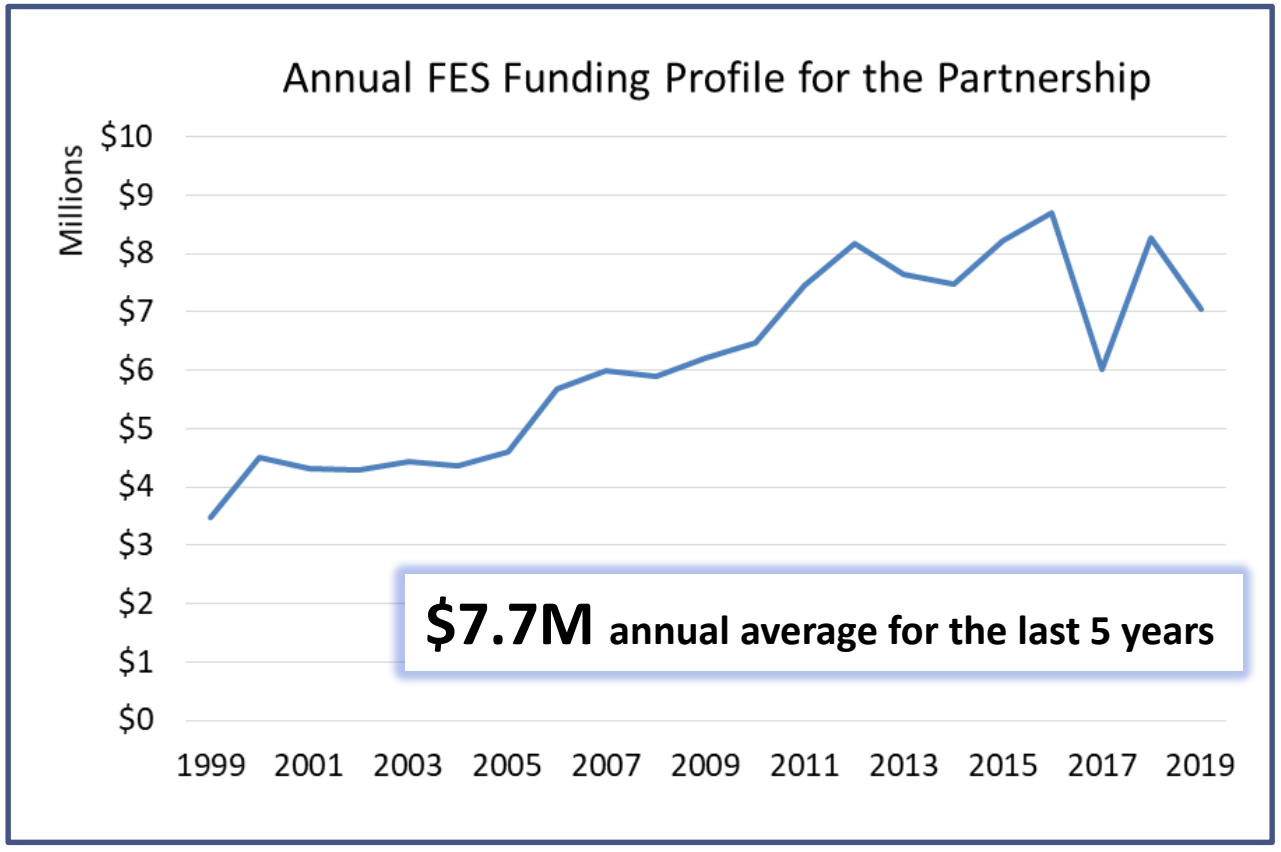
U.S. DEPARTMENT OF ENERGY
Office of Science

NSF/DOE Partnership: Over $7 million funded by DOE in 2019

NSF/DOE Partnership includes:

- ✓ **General Plasma Science**
- ✓ **Exploratory Magnetized Plasmas**
- ✓ **and HEDLP**

FY 2019 FES contribution **$7.0 M**



- FES provided $7.0 million FY 2019 funds for the Partnership, supporting 11 new and 3 supplemental proposals in basic plasma, non-neutral/dusty plasma, HED plasma, and low-temperature plasma
- This includes $2.7 million for Basic Plasma Science Facility's (BaPSF) continuing operation and collaborative research at UCLA

Committee of Visitors Key Recommendations (cont'd)

- ***2014 Recommendation***: Issue new solicitations for National Laboratory General Plasma Science and for Plasma Science Centers (2014 COV).
  - ***FES actions:***
    - FES issued a solicitation for DOE National Laboratories in 2016, entitled: "Opportunities in Basic Plasma Science." $6M was funded over three years. Another solicitation is planned for FY 2020.
    - FES issued a Funding Opportunity Announcement for non-laboratories, and a companion announcement for laboratories, in 2018, entitled: "Low Temperature Plasma Science Centers and Facilities." $20.2M was funded over five years.

- ***2014 Recommendation***: The FOP Division should utilize the impending FES strategic plan in conjunction with a series of user and scientific community workshops to develop its project portfolio to further define science and project needs that could be considered for Critical Decision-0.
  - ***FES action:*** FES used "The Office of Science's Fusion Energy Sciences Program: A Ten-Year Perspective" and the results of the five FES-sponsored community engagement workshops to develop its project portfolio." It will also use the results of the current strategic Long-Range Planning activity.

Committee of Visitors Key Recommendations (cont'd)

- ***2009, 2014, and 2018 recommendations***: These COVs made five recommendations concerning the Enabling R&D program.
  - ***FES actions:***
    - FES conducted regular peer review of proposed and ongoing programs/projects.
    - FES issued an FOA for non-laboratories, and a companion announcement for laboratories, in 2012, entitled: "Materials Solicitation with Focus on Structural Materials, Blanket First Walls, and Divertor Plasma Facing Components."
    - FES uses panels to assess the scientific and technical quality and progress of R&D activities associated with awards to national laboratories.

U.S. DEPARTMENT OF ENERGY
Office of Science

Chairs of FESAC and its Predecessor Organizations

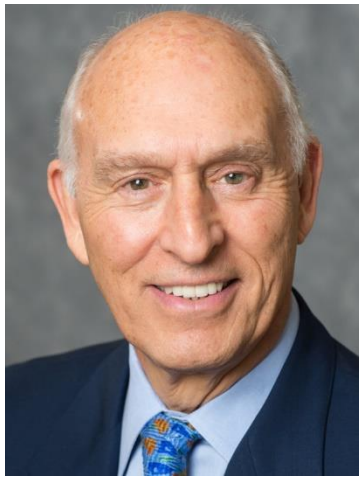
Chair	Years of Service	Name of Committee	Chair's Institution
Guyford Stever	1990	Fusion Policy Advisory Committee	MIT/CMU
Robert Conn	1991-1996	Fusion Energy Advisory Committee [1]	UCLA
John Sheffield	1996-2000	FESAC	ORNL
Richard Hazeltine	2000-2005	FESAC	U. Texas-Austin
Stewart Prager	2006-2008	FESAC	U. Wisconsin-Madison
Martin Greenwald	2008-2013	FESAC	MIT
Mark Koepke	2013-2016	FESAC	West Virginia U.
Don Rej	2016-present	FESAC	LANL

[1] FESAC was established in May 1996 with Robert Conn as its first chair.

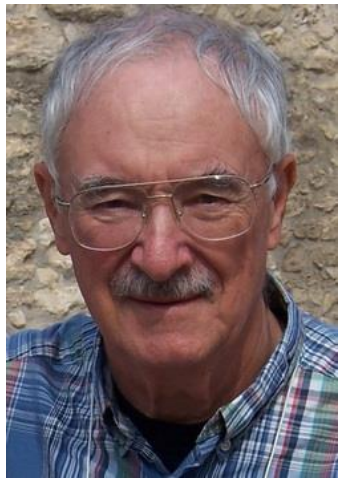
U.S. DEPARTMENT OF ENERGY
Office of Science

Chairs of FESAC and its Predecessor Organizations

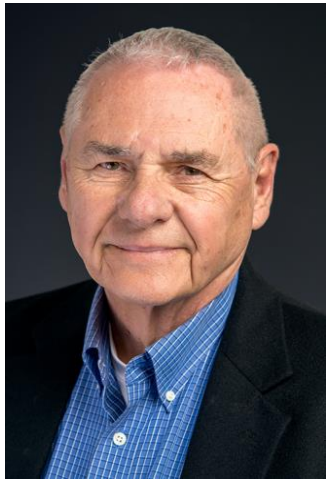
Guyford Stever (1990)



Robert Conn (1991-1996)

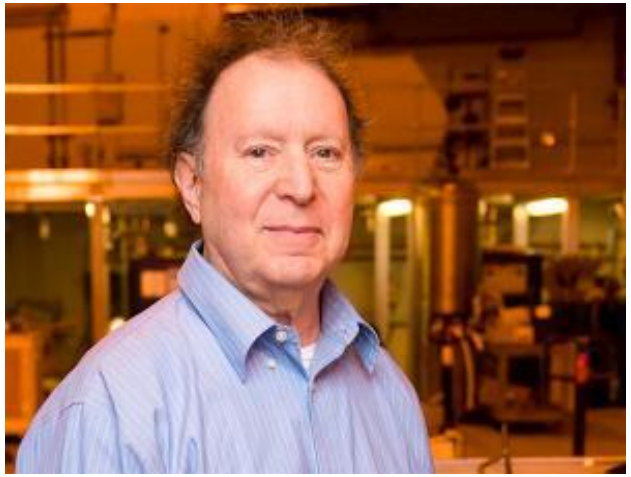


John Sheffield (1996-2000)



Richard Hazeltine (2000-2005)

Stewart Prager (2006-2008)



Martin Greenwald (2008-2013)

Mark Koepke (2013-2016)

Don Rej (2016-present)