Special Issue of the Journal of Fusion Energy: "Strategic Opportunities"

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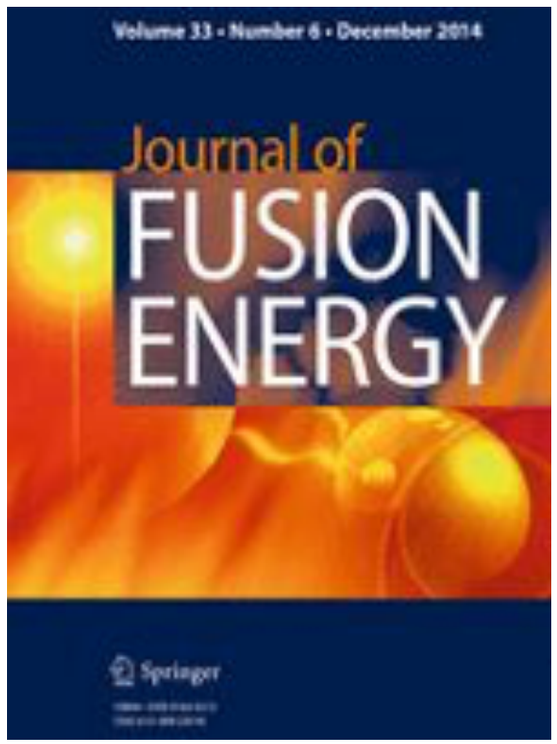
Guest Editor, *Special Issue*

- About the *Journal of Fusion Energy*
- Motivation: Significant recent planning activities
- Representative articles from open *Call for Papers*

Journal of Fusion Energy



Inaugurated 1981

Steve Dean, Editor-in-Chief

Mission

The Journal of Fusion Energy features original research contributions and review papers examining the development of thermonuclear fusion as a useful power source. It is designed to serve as a journal of record for publication of research results in the field.

This journal also provides a forum for discussion of broader policy and planning issues that have played and will continue to play a crucial role in energy fusion programs. In keeping with this theme, readers will find articles covering an array of important matters of policy and program direction.

Important Strategic Papers have appeared in *JOFE*

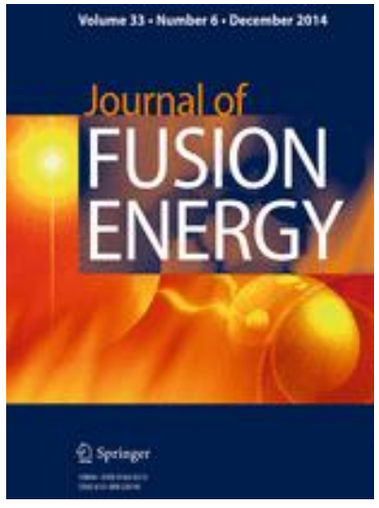
- **Dan Jassby**, “The fusion-supported decentralized nuclear energy system” **1**(1), 36 (1981).
- **N. Anne Davies, Paul Rutherford, Dan Cohen, and Carl Henning**,
  “The Role of Tokamak Ignition Device Options” **4**, 217 (1985).
- **Dan Jassby**,
  “Selection of a toroidal fusion reactor concept for a magnetic fusion production reactor” **6**, 65 (1987).
- **Ed Kintner,** “Electric Utilities in the Twenty-First Century” **10**, 210 (1991).
- **Y.-K. M. Peng** and **E. Cheng**,
  “Magnetic fusion driven transmutation of nuclear waste (FTW)” **12**, 127 (1993).
- **F. Najmabadi,** *et al.,*
  “Alternative concepts: A report to the Fusion Energy Sciences Advisory Committee” **15**, 249(1996).
- **N. Anne Davies**, “Strategic Plan for the Restructured U.S. Fusion Energy Sciences Program” **15**, 289 (1996).
- **H. Grunder**, *et al.,* “Recommendations on the Nature and Level of U.S. Participation in the International Thermonuclear Experimental Reactor (ITER) Extension of the Engineering Design Activities” **19**, 35 (2001).
- **S. Prager**, *et al.,*
  “Report of the FESAC panel on a burning plasma program strategy to advance fusion energy” **20**, 85 (2001).
- **R. Hirsch**, “The year 2015 fusion power conversations” **21**, 118 (2002).
- **J. Sheffield**, *et al.*, “Energy Options for the Future” **23**, 63 (2005).

Recent Level of Strategic Planning Activity in U.S. has been Significant

- Three FESAC subcommittees for advice how to:
  - "Capture the science of ITER" (Rosner, 2013),
  - "Prioritize scientific facilities to ensure the optimal benefit from Federal investments" (Sarff, 2013), and
  - "Exert long term leadership roles within and among the areas of burning plasma science and discovery plasma science" (Koepke, 2014).
- From April 2012 through October 2014, U.S. fusion scientists and engineers contributed over ***220 white papers and participated in a dozen workshops***
- At the time this *Special Issue* was announced, DOE/FES initiated a series of four technical workshops "to seek community engagement and input for future program planning activities" with ***several hundred additional white papers and presentations***

Recent Level of Strategic Planning Activity also Significant Internationally

- In 2012, European Fusion Development Agreement (EFDA) prepared a roadmap to fusion electricity by 2050
  - Formulated using the input from experts, discussions with industry, and the feedback from a community workshop.
  - The European roadmap is a goal-oriented program to produce "**a demonstration fusion power plant (DEMO), producing net electricity**" to start operation before 2050
- In 2013, the Japanese Working Group on Fusion Research (under Ministry of Education, Culture, Sports, Science and Technology) developed a strategic roadmap for a fusion DEMO to improve the prospects for "**the economic and social rationality of fusion energy competitive with other energy sources.**"
  - **Hiroshi Yamada**, *et al.*, "Development of Strategic Establishment of Technology Bases for a Fusion DEMO Reactor in Japan" (JOFE *online)*
  - The Working Group identified eleven technical R&D elements for DEMO and proposed a dual-path strategy for fusion development, "**the DEMO design activity … [should] play a role not only to promote and boost secure progress of the main stream options [for a fusion DEMO] but also to promote innovative technological developments for breakthrough**."



February 2015

Call for Papers

Special Issue of *Journal of Fusion Energy* "Strategic Opportunities"

Guest Editor: Mike Mauel (*Columbia University*)
Associate Guest Editors: Martin Greenwald (*MIT*),
Dmitri Ryutov (*LLNL*), and Mike Zarnstorff (*PPPL*)

- **Purpose of the *Special Issue***: Gather and record technical viewpoints and clear statements of the challenges and opportunities that can drive advancements in fusion energy research.
- Inform researchers and policy makers of the scientific and technical opportunities, and strategies for fusion energy research and development.
- **Scope**: Focus on "important matters of policy and program direction".
- All articles must be technically sound, to cite published articles, and will be peer-reviewed.
- Encourage authors of white papers, proposals, and talks to update their contributions for this issue.
- Encourage international contributions.

Special Issue: Strategic Opportunities for Fusion Energy

- 15 published papers (already online)
- 2 papers in final stages of revision
- 4 international papers
- All papers benefited from peer-reviewed and revision
- Eight (8) technical descriptions of research opportunities most of which were based on white papers originally prepared for the FESAC strategic planning activities
- Nine (9) discussion papers containing viewpoints, and sometimes personal opinions, for fusion energy research and development strategies.

Representative Technical/Pathway Papers (from WPs)

- **M. Kotschenreuther**, *et al.*, "Taming the Heat Flux Problem: Advanced Divertors Towards Fusion Power"

- **V. Soukhanovskii** and **X. Xu**, "Tokamak Power Exhaust with the Snowflake Divertor: Present Results and Outstanding Issues"

- **R. Raman**, *et al.*, "Simplifying the ST and AT Concepts"

- **D. Pace**, *et al.,* "Controlling Fusion Yield in Tokamaks with Spin Polarized Fuel, and Feasibility Studies on the DIII-D Tokamak"

- **T. Simonen**, "Three Game Changing Discoveries: A Simpler Fusion Concept?"

- **D. Sinars**, *et al.*, "The Role of Magnetized Liner Inertial Fusion as a Pathway to Fusion Energy"

Representative Discussion/Opinion Papers

- **A. J. H. Donne**, *et al.*, "Risk Mitigation for ITER by a Prolonged and Joint International Operation of JET"
- **N. J. Lopes Cardozo, A. G. G. Lange, and G. J. Kramer**, "Fusion: Expensive and Taking Forever?"
- **H. Hornfeld**, "Strategic Opportunities in Fusion Energy"
- **J. Sheffield**, "Some Observations on Future Directions in Fusion Energy Research"
- **W.M. Stacey**, "A Strategic Opportunity for Magnetic Fusion Energy Development"
- **W. Manheimer**, "Fusion Breeding: an Old, New Strategic Opportunity for Fusion,"
- **G.A.Wurden**, *et al.*, "A New Vision for Fusion Energy Research: Fusion Rocket Engines for Planetary Defense"

Invitation…

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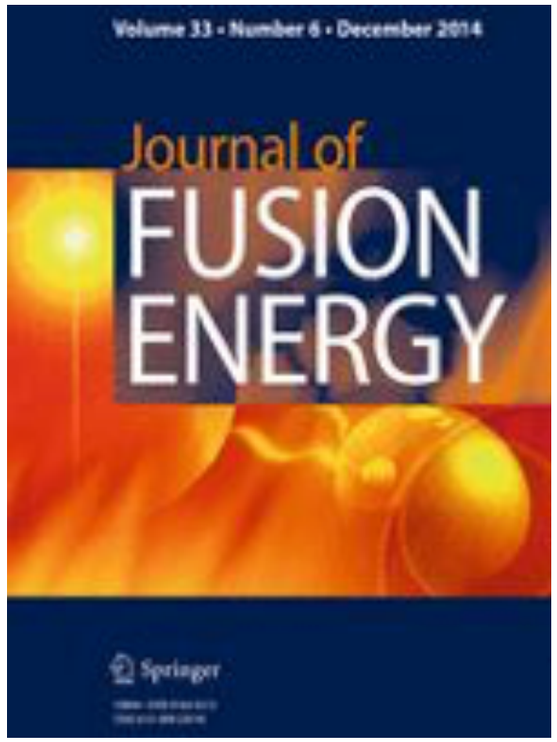

Mission

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You are Invited to Publish in *JOFE*

- ***Status of ITER Project*** – Bernard Bigot
- ***Status of NIF Research*** – John Edwards
- ***Status of US ITER Contributions*** – Ned Sauthoff
- ***Laser Fusion Strategy in Japan*** - Hiroshi Azechi
- ***High Temperature Superconducting Magnets and Other Innovations*** - David Kingham
- ***Stellarator Paths to a Fusion DEMO*** – Mike Zarnstorff
- ***Summary of UFA Activities and Workshop*** – Uri Shumlak
- ***Materials Prospects for Fusion Power Plants*** – Steve Zinkle
- ***Progress and Plans at General Fusion*** – Michel Laberge
- ***Opportunities on NIF as a User Facility*** – Mark Herrmann
- ***US Fusion Program Overview*** – Ed Synakowski
- ***NNSA Inertial Confinement Fusion Program Overview*** – Keith LeChien
- ***Thoughts on Fusion Development Strategies*** - Stewart Prager, Robert McCrory, Phil Ferguson, Tony Taylor, Dennis Whyte, Don Correll, Stephen Obenschain, Don Rej, Peter Seidl, Robert L. Hirsch
- ***Progress and Fusion Vision at Tri Alpha Energy*** – Mich Binderbauer
- ***Fusion Contributions to Today's Commercial Applications*** – Rich Callis, Chris Keane
- ***Importance of Advanced Computers and Computation to Fusion Development*** – Paul Bonoli
- ***Fusion Contributions to Other Fields of Science*** – Sean Finnegan