



*U.S. Department of Energy's  
Office of Science*

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# Charge to FESAC



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# Entering a New Era in Fusion Science

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- o ITER Agreement signed November 21, 2006
- o First access to burning plasmas and burning plasma-scale science
- o Unprecedented level of international cooperation
- o U.S. must have a world-class, compelling program with international and domestic components
- o Fully exploit the expected scientific and technical developments from ITER
- o Support our involvement in the international fusion community
- o Challenges to compete in the ACI and AEI

# Towards a Strategic Plan for the Fusion Energy Sciences (FES) Program in the ITER Era

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- o Establish a process for strategic planning for FES
  - Within the context of the broader Office of Science Strategic Plan
  - Engage FESAC through a series of charges to cover all areas of the FES portfolio
  - A living process: will be updated as the science and technology develop
- o Address the FES Mission: establishing the knowledge base for fusion energy
  - Developing a predictive understanding of the fusion plasma state
  - What does this mean and what is needed to achieve it?
  - Flesh out long-term directions mentioned in past studies

# Charge: Identifying Opportunities for U.S. Leadership in the ITER Era

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- o Focus on ITER-centric science and technology program development
  - ITER as the penultimate step to fusion energy development
- o Identify issues that need to be addressed to establish the knowledge base for a fusion DEMO
  - DEMO is endpoint in time used to identify important remaining issues presuming ITER success
    - Not a specific facility concept or next step facility
    - I.e., what needs to be resolved on the ITER timeframe ( $\approx 2035$ )?
    - A combined critical path—gap analysis for fusion science following the ITER path
    - Prioritize!
- o Thematic identification of compelling scientific and engineering challenges and opportunities
  - Fully build on past studies: FESAC, NRC, etc.

## **High Energy Density Laboratory Plasmas ( HEDLP) and Energy-related HEDLP Not to be Considered in This Charge**

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- o HEDLP will be an integral part of the FES Joint Program with NNSA
- o HEDLP Inter-Agency Task Force nearing concurrence on design of the Joint Program and many other HEDP-related issues
- o Planning for HEDLP expected to be discussed in other venues
- o Near-term discussions in upcoming Workshop at LLNL in April
- o To be integrated into larger DOE and inter-agency strategic planning

**Slide 5**

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**DoE5**

**HEDLP - High Energy Density Laboratory Plasmas?**

Department of Energy, 2/28/2007

# Charge 1: Identify and Prioritize Broad Scientific and Technical Questions Needed to Make the Case for Fusion Energy

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- o What are the main questions for scientific and technological understanding for some future entity to build a DEMO?
- o Assume success of ITER program
- o Prioritize: rank order of importance of issues to attain the desired knowledge base/predictive understanding, e.g., materials
- o Focus on broad themes and questions to identify overarching challenges
- o Details and specific implementation considered later, e.g., fusion material challenges, tritium breeding, plasma control issues, etc.

DoE3

## Slide 6

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**DoE3**

These examples look like pretty broad, significant topics to me. Did you mean that you don't want them to go into the specific details of each?

Department of Energy, 2/28/2007

## **Charge 2: Assess all Available Means (Existing and Planned Facilities Worldwide, Theory, Modeling) to Address These Issues**

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- o What is already planned or exists to address the questions identified in Charge 1?
- o What are the means/things needed to address/resolve the questions?
- o Don't limit discussion to facility concepts!
- o Discuss advances in Theory, Computation, Diagnostics, Materials, etc., e.g. world-class, large-scale computation
- o Assume full involvement in the world fusion program

## **Charge 3: Identify Research Gaps and How They May Be Addressed Through New Initiatives**

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- o Initiatives = Theory, Modeling, Facilities, etc.
- o Gap analysis of critical path to predictive understanding, e.g., gap = VNS/materials
- o Identifying compelling new opportunities for world-leading activity in the U.S.

# Final Thoughts

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- o DEMO is an endpoint in time and is not to be a central part of the discussion of this charge.
- o Do not become mired in specific discussions of extending the life of domestic facilities or planning for new domestic facilities – think more broadly
- o With ITER, we for the first time have a large-scale burning plasma experiment and the opportunity to demonstrate the feasibility of fusion energy