

# Overview of Advanced Design White Paper

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# Program Elements

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- Next-step device (burning plasma experiment) design studies
- Fusion application and Test Facilities design studies
- Development pathway analysis
- Strategic planning and forecasting -- role of fusion energy in a sustainable global energy strategy.
- Safety and environmental Design Studies

# Next-Step (Burning Plasma Experiment)

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## **Mission:**

Design of a burning plasma experiment which reveals the science of burning plasmas and demonstrate the scientific and technological feasibility of fusion energy.

## **Strategic Pathway:**

- Utilize the international ITER process
- Develop lower cost ITER options
- Develop US community consensus and satisfy four parties needs (technical and financial)
- Utilize industrial involvement

## **Examples of Recent Accomplishment:**

- ITER EDA

# Next-Step (Burning Plasma Experiment)

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## Deliverables by 2005: (ITER construction agreement)

- International agreements on a low cost design, on a host site, and on management and cost sharing
- US implementation of design and procurement system for US supplied systems and award of US contracts
- Successful construction permit and licensing review in the host country.

## FY99 Priorities:

- Support JCT on developing low-cost options
- Focus on highest leverage, highest priority tasks.

# Fusion Application & Test-Facilities Design

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## **Mission:**

- Design of commercial facilities for all confinement concepts are carried out to guide the science and technology R&D and to assist major program evaluations.
- Fusion application studies continue assessment of supply, demand, and cost of electricity from fusion as well as exploration of other non-electric application.
- Design of fusion test facilities, such as neutron sources, define cost and risk associated with different fusion development pathways.

## **Examples of Recent Accomplishment:**

- ARIES designs

# Fusion Application & Test-Facilities Design

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## Strategic Pathway:

- Through self-consistent design and trade-off among physics and technology constraints, optimum goals are set and high-leverage areas identified which in turn guide the physics and technology R&D.
- Studies are performed at varying level of detail and emphasis:
  - Scoping studies for “Concept Exploration” concepts
  - Conceptual design to guide R&D for “proof-of-principle” concepts
  - Conceptual design for concept optimization for “proof-of-performance” concepts.
- Non-electric application help gain new clients (specially near-term).

# Fusion Application & Test-Facilities Design

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## Deliverables by 2005:

- Advanced power-plant studies of tokamaks and alternatives (including IFE) as new information become available or a concept enters proof-of-principle phase.
- Conceptual design of advanced neutron sources for non-electric applications as well as fusion development.
- Design studies of large-output fusion devices for hydrogen production (or co-generation).

## FY99 Priorities:

- Conceptual design of advanced neutron sources
- Evaluate potential of fusion for hydrogen production.

# Role of Fusion in a Sustainable Global Energy Strategy

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## Mission:

Assess the role of fusion energy in a long-term vision of a sustainable global energy strategy, taking into account the portfolio of energy options available.

## Strategic Pathway:

- Include a range of scenarios to deal with future social, economic, and environmental conditions such as limit on greenhouse gases.
- Determine how fusion fits given fusion's environmental and economic characteristics.
- Determine the goals and requirements for fusion energy through examination of portfolio of fusion concepts and options.

# Role of Fusion in a Sustainable Global Energy Strategy

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## Deliverables by 2005:

- Assessment of role of fusion in a sustainable global energy strategy.
- Communication of the results to national policy makers, scientific and engineering societies, Congress, the Administration, and the general public.

## FY99 Priorities:

- Initiation of the study.

# Development Pathway Analysis

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## **Mission:**

Develop and apply methodologies for assessing the cost, risk, and schedule impact of different approaches to fusion development.

## **Strategic Pathway:**

- For each concept, identify the critical issues and a sequence of R&D steps needed to reach a competitive end-product.
- Develop methodology to incorporate factors such as technical uncertainties and the size and the cost of the need facilities.

# Development Pathway Analysis

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## **Deliverables by 2005:**

- A formalism for objective discussion, evaluation, and selection among various proposed development paths based on cost versus risk/benefits.

## **FY99 Priorities:**

- Identify a lead contractor/individual to begin to assemble a team to prepare the methodology.

# Safety Design

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## **Mission:**

Demonstrate the safety and environmental potential of fusion through early integration and iteration of S&E requirements in the design activity, focused S&E R&D to reduce key uncertainties, and state of the art S&E analysis to understand integrated behavior of a fusion facility.

## **Strategic Pathway:**

- Update, validate and verify safety analysis codes with experimental data and modeling from R&D program.
- Investigate recycling/reuse approaches to minimize rad-waste.

## **Examples of Recent Accomplishment:**

- ITER Safety Design, DOE order on licensing of fusion facilities.

# Safety Design

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## **Deliverables by 2005:**

- Comprehensive safety analysis tools capable of analyzing near-term and advanced designs.
- Assessment of the recycle/reuse potential of fusion material.
- Extension of 10CFR61 waste-disposal criteria to fusion-relevant isotopes.

## **FY99 Priorities:**

- Support ITER design effort
- Initial investigation of recycle/reuse potential of fusion material.