Roadmap Panel

11:00 –13:00

Tuesday, 17 September 2013

Auditorium
Palau de Congressos de Barcelona

Moderated by
Mohamed Abdou

Panel Members: Gianfranco Federici, Yuanxi Wan, Gyung-Su Lee, Roberto Adinolfi, Pietro Barabaschi, Neil B. Morley, Kunihiko Okano, Boris Kuteev

Objectives of the Panel:

- Define the 5-10 dominant key questions that a credible roadmap to DEMO must address.
- Elaborate on the challenges embodied in these dominant key questions and suggested approaches to confronting them.

Panel Members:
Eight leaders from the major world fusion programs who have experience in fusion and technology R&D, fusion roadmapping, and FNT

Format:

- Panel session duration: 2 hours
- Introduction by Moderator, Prof. Mohamed Abdou
- Prepared remarks by panel members (50 minutes)
- Audience Q&A (70 minutes)

Mohamed Abdou (Panel Moderator) is a Distinguished Professor of Engineering and Applied Science at Univ. of California, Los Angeles (UCLA). He is also the Director of both the Energy and Fusion Centers at UCLA. He is the Founding President of The US Council of Energy Research and Education Leaders (CEREL). He pioneered many research areas of Fusion Nuclear Science and Technology (FNST). He has published >350 scholarly journal papers on experiment, modeling, and analysis for neutronics, tritium transport, MHD thermofluids, thermomechanics and materials; as well as on creative designs of fusion nuclear components and power plants. He led many US and international studies on fusion issues and innovative solutions as well as on technical planning and development pathways. Prof. Abdou won many honors and recognition for his pioneering technical contributions and leadership.

Panel Members

Gianfranco Federici, current head of EFDA's Power Plant Physics and Technology Department, is responsible for the coordination of EU Design and R&D efforts aimed at the conceptual design of a DEMOnstration Power Reactor. He has more than 20 years of professional experience in fusion engineering and design, mainly in divertor design, plasma surface interactions, and breeding blanket design. In addition to his over 100 publications, he is a Fellow of the American Nuclear Society, and has contributed over the years to the NET Team, ITER EDA Team, and Fusion for Energy (F4E).

Yuanxi Wan graduated from Beijing University and has since been working at the Institute of Plasma Physics, at the Chinese Academy of Science, serving many years as director in charge of the EAST superconducting tokamak project design, construction, and experiments. He is also currently USTC Dean of Nuclear Science and Technology. For several years he was Vice-Chair/Chair of ITER's STAC. In 2009, he was elected as an academician to the prestigious Chinese Academy of Engineering. He is leading the national integration reactor design group for the design of Chinese Fusion Engineering Test Reactor (CFETR).

Gyung-Su Lee received his doctorate in Plasma Physics and Fusion from the University of Texas at Austin, USA. Over the past fifteen years he has been very active in the fusion engineering and technology community, directing the KSTAR project from 1996-2006, as well as serving as the Director General of ITER Korea and the President of Korea's National Fusion Research Institute (NFRI). He is currently the Chairman of the IAEA International Fusion Research Council, as well as a member of the ITER Council.

Roberto Adinolfi received his degree in Nuclear Engineering cum laude at Milan Polytechnic in 1976. He immediately joined ANSALDO, designing nuclear power plants in Italy and abroad, applying his knowledge in fluid systems design, plant control, and system integration. As of 2007 he has been acting as Chief Executive Officer of ANSALDO Nucleare. He is also Vice-President of the Italian Nuclear Association, member of the nuclear energy commission of the Italian National Standard Institute (UNI), and member of the Governing Board of the European Sustainable Nuclear Energy-Technology Platform.

Pietro Barabaschi is currently the Head of the Broader Fusion Development Department in F4E. Up to early 2006 he was deputy to the Project Leader and Head of the Design Integration Division of the ITER International Team at the Garching Joint Work Site. Soon after his university studies in electrical engineering, he joined the JET Project, Culham UK, where he worked in the Machine Development Department. In 1992 he joined the ITER Joint Central Team, San Diego Site, in the design integration division dealing with systems engineering and analysis.

Neil B. Morley, Adj. Professor at the Univ. of California, Los Angeles, has spent the past 20 years in fusion science and technology research & design, focusing his efforts on liquid metal breeding blankets, first wall, divertor component, and systems. He is currently Chairperson of the IEA-NTFR Liquid Breeder Blankets Subtask (2011-ongoing). In addition to publishing over 100 papers in scientific journals, over the years he has served on several US and international planning committees, including the US APEX Team (1998-2003), US ITER-TBM Team (2003-2009), and the ongoing US Roadmapping Panel (2009-).

Kunihiko Okano is currently Senior Researcher of the Central Research Institute of Electric Power Industry, while also acting as Project Professor at Keio University and Leader of Demo Design Activity in IFERC. He is a member of the Working Committee on Fusion Research in the Council for the Japanese government MEXT. He has served as Chair of Roadmap Committee of Fusion Energy Forum of Japan and Board Member of Directors of the Japan Society of Plasma Science and Fusion Research. His primary areas of research include tokamak and current-drive physics and conceptual design/strategy for future energy technology.

Boris Kuteev is Head of the Fusion reactor department at Kurchatov Centre's Institute for Tokamak Physics, where he designs demonstration fusion reactors and neutron sources in RF. He has over 30 years of related professional experience, mainly in pellet fueling/diagnostics, transport phenomena in tokamaks and helical systems, divertor and breeding blanket design, plasma surface interactions, fusion neutron sources and fusion-fission hybrids. From 1972, he has also been a professor, at the State Polytechnic Univ. of St. Petersburg, the NRC Kurchatov Institute and currently as Plasma Physics Chair of Moscow Engineering Physics Univ.

Examples of Dominant Key Questions

Below are examples of key questions. Panel Members can select two or more to address, or panel members can propose and address other questions they deem critical.

1. How do you evaluate in a roadmap the risk associated with each step, and decide that the risks are acceptable? For example, can we really go from ITER to DEMO without FNSF? How do you decide that the risk of skipping FNSF is acceptable?

2. What are the main technical issues to be solved on the way to a fusion power plant? What are the major R&D tasks in non-fusion facilities? How many intermediate fusion devices are needed? What is DEMO? What should be the DEMO mission?

3. In all current DEMO and fusion reactor designs, the fusion nuclear components (blankets/FW, PFC, shield) are located inside the vacuum vessel. What R&D is required to ensure that the "availability" of the in-vessel components in DEMO is reasonable? What should be the DEMO "availability" target?
    - How can we get data on failure modes and failure rates for fusion nuclear components in a fusion nuclear environment prior to DEMO?
    - Can we get such data without integrated testing in a fusion facility?
    - Estimates of MTTR in fusion appear much longer than that of the fission reactor core. How do we confront this challenge?

4. With each of several countries planning to build their own DEMO, where will the start-up Tritium Inventory (~ 10kg/DEMO) come from?

5. How are we really going to demonstrate Tritium Self Sufficiency given that it depends on so many physics and technology parameters? Can it be extrapolated from module tests with sufficient accuracy?

6. What role can ITER-TBM play, and what other partially integrated technology testing facilities will be required to establish basic confidence that in-vessel components will perform and have reasonable infant mortality rates in FNSF or early stages of DEMO?

7. Should the next step fusion nuclear facility be a small size/small power or a large size/large power device?

8. What aspects of the roadmaps recently proposed by several countries (e.g. EU, China, US, Korea, India) you would modify or strengthen to make the plans more credible (and/or improve probability of success and/or reduce risk)?

9. What are the lessons to be learnt from the construction of existing fusion devices (e.g. NIF, W7X, ITER)?

10. What role should industry play in the design and construction of the next step after ITER?