

White paper for ReNeW, Theme II: “High-Performance steady state”

US Fusion DEMO Assessment

C.P.C. Wong (General Atomics), C. C. Baker (SNL, Albuquerque),
S. L. Milora (ORNL), T. Evans (General Atomics), T. Rognlien (LLNL)

ReNeW

The ReNeW effort has brought the US fusion community together and provided more details on the technical gaps within and between different areas including fusion physics, materials and technology.

ITER

ITER is acting as a focal point to extend the present tokamak physics and technology understanding and practice to a DEMO sized DT Q=10 device. Many scientific issues are being resolved. A similar focus is necessary for the US DEMO design, even though it is many years away.

DEMO

DEMO as the fusion device before the first commercial fusion power reactor should become the US focus while going through the Component Test Facility (CTF) path and supported by other high energy neutron irradiation facilities.

US Fusion DEMO Assessment (USFUDA) Organization

Based on the results from ReNeW, a national approach and organization should be developed to cover areas of fusion design and coordination of physics, materials and technologies R&D for a US DEMO. A coordinated assessment with timely reviews and recommendations on the needed DEMO R&D should be carried out. Many scientific issues will be discovered and need to be addressed.

Why

The ITER Q=10 performance requirement has extended the need for plasma confinement, control and technology performance with presently available materials to the edge of acceptable performance. The ReNeW activity has confirmed, when extended to DEMO, critical issues in areas, such as plasma confinement, ELMs, disruption, energetic particles and the management of off-normal events require the development of advanced PFC surface materials and components, structural materials, internal components, diagnostics and control systems. Focused, highly coordinated, assessments and recommendations of R&D are required to overcome critical technical issues within and among physics,

materials and technology areas and to provide transparency to the community and timely progress report to the funding organization.

Recommendation

Formation of a US FUSion DEMO Assessment (USFUDA) organization with the inclusion of the fusion physics, design, materials and technology communities as defined within the organization of Virtual Laboratory for Technology (VLT).

Immediate tasks

- Formation of an action committee, sponsored by VLT and supported by OFES to explore all options on the best implementation of such a USFUDA organization

Proposed USFUDA mandate and follow on activities are:

- Formation of the national USFUDA organization with identification of critical area groups that cover the needs for DEMO design and development
- Review and define the range of physics and technology limits based on the existing knowledge base
- Identify critical path research and resources needs and organize National teams to address these needs
- Initiate the DEMO design and clearly define the range of DEMO parameters
- Review the corresponding range of CTF parameters
- Outline and implement necessary R&Ds for DEMO
- Active invitation of support from US industries and via SBIR programs
- Continue participation in ITER project including the TBM program. Support and forge participation in high energy neutron source activity
- Encourage international participation in USFUDA and allow flexibility to change to International FUSion DEMO Assessment (IFUDA)

Note: Similar functions as proposed are in place in Europe and Japan