Contribution ID: **11** Type: **Oral**

Perspectives on Consensus-Based Codes and Standards to Support and Enable a Robust Supply Chain for Commercial Fusion Energy

EPRI was established as an independent, nonprofit research organization to deliver technical solutions and address emerging R&D needs to support the delivery of safe, affordable, reliable, and sustainable electricity for the public benefit. EPRI's mission is primarily executed through the application of R&D by member utilities and other providers of electricity and energy resources. As an owner-operator facing organization, EPRI has supported the development, demonstration, and deployment of new technologies for electricity and energy generation, transmission, distribution, and end-use. EPRI previously investigated fusion energy in the 1970s and 80s and published its first utility requirements document for fusion in 1982—a decade before developing its better known Utility Requirements Document for Advanced Light Water Reactors. In light of the growth in private sector interest and investment in fusion technologies and notable technological advances in the past decade, EPRI has returned to fusion with a new strategic R&D program.

Based on EPRI's experience, a key part of commercializing new energy technologies is the establishment of a stable supply chain. The development and application of consensus-based codes and standards for emerging technologies can support and enable the emergence of an engaged, informed, and robust industry supply chain prepared for scaling of production beyond one or a few-of-a-kind. Accordingly, EPRI is engaged with the development of fusion-specific codes and standards, including via direct support for the accelerated development of ASME Boiler and Pressure Vessel Code Section III Division 4, Rules for Construction of Fusion Energy Devices. EPRI is also interested in supporting right-sized quality standards that reflect fusion unique safety and performance characteristics and accelerating qualification of advanced materials and manufacturing methods for commercial fusion applications.

For some fusion-specific materials and components, existing suppliers may not exist—requiring new entrants to assume the risks and overcome the barriers to entry associated with a new enterprise. However, for many fusion plant materials and components, capable suppliers likely exist—but many will still need to be convinced to take on the risk of investing in anticipation of an emerging technology and new customers instead of focusing on existing and/or proven customers and markets. Participants in a commercial supply chain to support a future commercial fusion energy sector need to consider a number of actions and investments well in advance of filling orders from a fusion customer. Having a framework of industry informed, consensus-based codes and standards in place can serve to inform prospective suppliers and vendors in this commercial endeavor. Absence of standard methods, parameters, and best practices places the entire burden for determining specifications and requirements for products and process on the customer, the supplier, or both. While materials and components for experimental, demonstration, and first-of-a-kind fusion plants will invariably involve bespoke and prototype fabrication and manufacturing, a truly commercial fusion sector will need the production quality, scale, and standardization provided by a mature framework of codes and standards in addition to appropriate regulatory frameworks and technology maturation.

Technical Categories Addressed

Structural materials

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Session Classification: Materials and Manufacturing