U.S. Industry Opportunities for Advanced Nuclear Technology Development

Area of Interest Announcement**: Nuclear-Coupled Hydrogen Production and Use**

The Office of Nuclear Energy (NE) Light Water Sustainability Program (LWRS), in coordination with DOE's Office of Energy Efficiency and Renewable Energy (EERE) - Hydrogen and Fuel Cell Technologies Office (HFTO), seeks applications that support development of nuclear plant thermal integration that would be required for high temperature hydrogen production or hydrogen coupled end-uses for nuclear energy. In preparation for future scaleup of industrial use of nuclear energy, it is anticipated that selected awardees from this announcement could design and develop the heat extraction infrastructure needed for a nuclear and hydrogen industrial energy park or develop hydrogen coupled end-uses for nuclear produced hydrogen. This effort will enable the use of nuclear thermal and electrical outputs to produce hydrogen at higher efficiencies than today's low temperature electrolysis technology and enable the scale up of co-located hydrogen infrastructure and end use applications. Potential activities that advance nuclear integration beyond the current DOE funded high and low temperature electrolysis projects may include:

Nuclear Plant Thermal Integration:

- Front end engineering and design (FEED) studies for nuclear plant thermal energy extraction, distribution, and control at the 20 to 300 MW_{th} levels. FEED studies should include high temperature electrolysis designs, as well as develop accurate construction costs to demonstrate economic viability. These FEED studies may include infrastructure for distribution of hydrogen, electricity, heat, and other potential feedstocks or products near existing nuclear plants supporting development of an energy park based on nuclear energy and hydrogen. The energy park could ultimately involve multiple end uses and revenue streams. Factors such as modularity, scalability and flexibility should be considered.
- License amendments, other regulatory and permitting requirements of the Nuclear Regulatory Commission (NRC), or requirements of other authorities having jurisdiction, as needed to demonstrate thermal extraction infrastructure and associated hydrogen production and infrastructure.

Hydrogen Coupled End-Uses:

- Development of scalable prototype systems that integrate nuclear powered electrolysis with the development and demonstration of a specific hydrogen end-use. The focus is on applications that offer potential for significant greenhouse gas emission reduction as well as cost competitive market potential. End use applications may include, but are not limited to, using hydrogen for transportation applications, such as heavy-duty hydrogen fuel cell applications or drop-in/synthetic fuels; power generation and energy storage; and/or industrial and chemical applications such as ammonia, metals, or oxygen utilization. Prototype hydrogen systems may be used for verification of chemical conversion or manufacturing efficiencies, development of fully autonomous plant controls, or demonstrating technical and economic viability. Although low temperature

proton exchange membrane (PEM) electrolyzers for hydrogen production or gas turbines for end-use applications may be considered as part of a larger application, these specific topics would not be eligible for project funding (neither Federal nor applicant cost share) as DOE is already supporting work in this area.

It is expected that these first-of-a-kind activities will support and lead to an eventual demonstration of thermal energy extraction, distribution, and control at the 20 to 300 MWth levels. The resulting information produced from these activities will be used to benefit all U.S. nuclear plants through data sharing and by providing a basis for the development of regulatory requirements and eventual licensing. It is also expected that any demonstration activities would engage local communities and support DOE's environmental and energy justice priorities, including providing benefits to disadvantaged communities.