

# **THE PATH TO CLEAN ENERGY: DIRECT COUPLING OF NUCLEAR AND RENEWABLE TECHNOLOGIES FOR THERMAL AND ELECTRICAL APPLICATIONS**

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# THE PATH TO CLEAN ENERGY: DIRECT COUPLING OF NUCLEAR AND RENEWABLE TECHNOLOGIES FOR THERMAL AND ELECTRICAL APPLICATIONS

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The U.S. Department of Energy (DOE) recognizes the need to transform the energy infrastructure of the U.S. and elsewhere to systems that can significantly reduce environmental impacts in an efficient and economically viable manner while utilizing both clean energy generation sources and hydrocarbon resources. Thus, DOE is supporting research and development that could lead to more efficient utilization of clean nuclear and renewable energy generation sources. A concept being advanced by the DOE Offices of Nuclear Energy (NE) and Energy Efficiency and Renewable Energy (EERE) is tighter coupling of nuclear and renewable energy sources in a manner that better optimizes energy use for the combined electricity, industrial manufacturing, and the transportation sectors. This integration concept has been referred to as a “hybrid system” that is capable of providing energy (thermal or electrical) where it is needed, when it is needed. For the purposes of this work, the hybrid system would integrate two or more energy resources to generate two or more products, one of which must be an energy commodity, such as electricity or transportation fuel. This definition requires coupling of subsystems “behind” the electrical transmission bus, where energy flows are dynamically apportioned as necessary to meet demand and the system has a single connection to the grid that provides dispatchable electricity as required while capital intensive generation assets operate at full capacity.

Development of integrated energy systems for an “energy park” must carefully consider the intended location and the associated regional resources, traditional industrial processes, energy delivery infrastructure, and markets to identify viable region-specific system configurations. This paper will provide an overview of the current status of regional hybrid energy system design, development and application of dynamic analysis tools to assess technical and economic performance, and roadmap development to identify and prioritize component, subsystem and system testing that will lead to prototype demonstration.

*Keywords: nuclear-renewable hybrid energy systems, integrated energy park, zero carbon energy systems*

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