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Harnessing the Potential of Small Modular Reactors for Climate Change Mitigation through Energy-Mix Optimization and Hydrogen Generation

Small modular reactors (SMRs) are gaining attention as potential contributors to climate change mitigation, particularly in hydrogen generation. SMRs are smaller and more flexible than traditional nuclear reactors, allowing for deployment in diverse locations and integration into existing energy infrastructure. They offer low-carbon electricity, reducing reliance on fossil fuels and supporting grid integration. This clean electricity can power electrolyzers for hydrogen production, aiding decarbonization in transportation, industry, and heating. The high-temperature gas-cooled SMRs also offer a reliable and continuous source of heat, which can be efficiently utilized for producing hydrogen using thermolysis through different processes. SMRs have inherent safety features, standardized manufacturing, and simplified construction, potentially reducing costs and timelines. They can provide continuous power with a smaller footprint, benefiting remote communities and industries. However, deploying SMRs for energy planning and hydrogen generation requires considerations such as regulatory frameworks, public acceptance, waste management, and non-proliferation. Economic viability and scalability must also be assessed compared to alternative low-carbon energy solutions. Careful consideration of various factors is necessary to ensure the safe and sustainable deployment of energy systems. In this work, the IAEA-MESSAGE code is used to model the energy-supply systems to determine the optimum energy-mix technology in addition to the hydrogen demand to meet future energy demands in the country.

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