Contribution ID: **188** Type: **Poster**

Evaluating the Viability of Small Modular Reactors for Non-Electric Applications in Kuwait: A Preliminary Assessment

Small Modular Reactors (SMRs) stand at the forefront of nuclear technology innovation, presenting a potential solution to the increasing energy demand while achieving net zero emissions by 2050. The operational flexibility of SMRs is a key focus, providing power for processing heat for industrial applications, desalination, hydrogen production, and electricity generation.

In the context of Kuwait, which presently lacks a nuclear power infrastructure, SMRs emerge as a potential solution for meeting the nation's specific energy requirements and sustainability ambitions, including achieving the goal of net zero emissions by 2050. Our analysis leverages the IAEA comprehensive database on SMRs to provide policymakers with the latest advancements in SMR technologies if Kuwait decides to pursue a nuclear power program. While acknowledging that a Reactor Technology Assessment (RTA) requires an extensive, multidisciplinary effort and continuous stakeholder engagement that can evolve over the course of developing a nuclear power program, a preliminary RTA was conducted. This assessment aimed to determine the most suitable SMR technologies for Kuwait, focusing on reactor types and operational temperatures for cogeneration applications that could contribute to decarbonizing the desalination and oil/gas sectors.

Our findings indicate that Pressurized Water SMRs (PWSMRs) are especially well-matched for lower-temperature applications, making them an ideal option for Kuwait's desalination industry. PWSMRs can supply electricity for desalination plants employing reverse osmosis technology, in addition to serving thermal processes in multi-stage flash distillation (MSF) and multiple-effect distillation (MED) plants. Concurrently, SMRs designed as high-temperature gas-cooled reactors are recognized for their potential to facilitate high-temperature industrial processes that can be utilized in the upstream and downstream oil sectors and for hydrogen production.

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Track Classification: Topical Group A: SMR Design, Technology and Fuel Cycle: Track 5: Non-Electric Applications for SMR