

## Supercritical Water Reactors: Powering Saudi Arabia's Nuclear Future

In an era where global energy consumption is surging, Saudi Arabia, historically known for its vast oil reserves, is now pivoting towards the future of nuclear energy with the groundbreaking potential of Supercritical Water Reactors (SCWRs). The rising demand for sustainable, non-fossil fuel-delivered electricity emphasizes the need for advanced nuclear reactors that offer superior thermal efficiency. SCWRs represent a promising advancement in nuclear reactor technology, offering potential benefits in terms of thermal efficiency, safety, and fuel cycle enhancements. SCWRs would not only improve electricity production, but also minimize the nuclear waste and its detrimental effects on the environment. The SCWRs eliminate the phase change between liquid and steam, and hence simplify the system design and optimize the cooling cycle components by utilizing water under supercritical conditions as both coolant and neutron moderator. The objective of this project is to explain the working principles of SCWR, compare with generation III reactors, and then highlight its specific applications and benefits in Saudi Arabia particularly. The project includes explaining the advantages of utilizing SCWRs in terms of reduced nuclear wastes, thermal efficiency advancement (from 30-35% to 45-50%) and design simplification by illustrating the basic SCWRs schematic diagram. On the other hand, it is essential to acknowledge that while SCWRs have superior advantages, they also come with challenges that are discussed within this project, such as the need for advanced materials and comprehensive safety analyses. Finally, a comprehensive conclusion is provided highlighting the feasibility and compatibility of utilizing SCWRs in Saudi Arabia particularly.

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