MOLTEN SALT REACTORS AS A WASTE MANAGEMENT STRATEGY FOR SPENT FUEL

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Enhancing nuclear waste management, optimizing uranium resource utilization, and improving fuel utilization are key factors to ensure the long-term sustainability of nuclear energy and to increase efficiency throughout the nuclear fuel cycle. Molten Salt Reactors (MSRs) present a promising opportunity to address these issues by enhancing fuel efficiency and reducing nuclear waste. Indeed, Molten Salt Reactors have the potential to utilize as fuel a composition of plutonium and minor actinides coming from the spent fuel of conventional reactors, which are currently considered waste. To make it possible, the spent fuel must be reconditioned and converted into fuel salt in specialized facilities. The fuel would then be continuously reprocessed enabling multi-recycling. This approach reduces dependency on fresh uranium, mitigates long-term waste storage concerns, and transforms previously discarded materials into valuable resources. This study aims to evaluate the feasibility of using spent fuel to sustain a fleet of Small Modular Reactors (SMRs) using Molten Salt technology across Europe. The fleet would be connected to a centralized facility for spent fuel conversion and then waste management. The key focus is to quantify the needs of used fuel that would be necessary to feed the reactors and compare it to the amount of spent fuel currently stored and produced by conventional reactors. To do so, the study will try to use the mass balance between the amount of burnt fuel in the MSRs and the amount of spent fuel needed. By quantifying the amount of used fuel consumed, this research seeks to evaluate the long-term sustainability of a fleet of Molten Salt Reactors and to provide insights into the role of advanced nuclear technologies in addressing global energy challenges. If successful, the study could highlight the use of a centralized spent fuel facility and MSRs as a viable alternative for improving nuclear fuel utilization, reducing reliance on finite fuel resources, and contributing to a cleaner and more efficient nuclear energy future.

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