

## Appliance of the Analytic Hierarchy Process Methodology for the Selection of a Small Modular Reactors to Enhance Maritime Traffic Decarbonisation

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**Abstract :** International shipping is considered one of the largest sources of pollution in the world, accounting for 812 million tons of CO<sub>2</sub> emissions in the year 2018. Current maritime decarbonisation is based on the implementation of new fuel alternatives, such as LNG, biofuels, and methanol, among others, which are less polluting as well as less efficient. Despite being a carbon-free and highly-developed technology, nuclear propulsion is hardly discussed as an alternative. Scientifically, it is believed that Small Modular Reactors (SMR) could be a promising solution to decarbonized maritime traffic due to their small dimensions and safety capabilities. However, as of today, there are no merchant ships powered by nuclear systems. Therefore, this project aims to understand the challenges of the development of nuclear-fuelled vessels by analysing all SMR designs to choose the most suitable one. In order not to fall into subjectivities, the Analytic Hierarchy Process (AHP) will be used to make the selection. This multiple-criteria evaluation technique analyses complex decisions by pairwise comparison of a number of evaluation criteria that can be applied to each SMR. The state-of-the-art 72 SMRs presented by the International Atomic Energy Agency (IAEA) will be analysed and ranked by a global parameter, calculated by applying the AHP methodology. The main target of the work is to find an adequate SMR system to power a ship. Top designs will be described in detail, and conclusions will be drawn from the results. This project has been conceived as an effort to foster the near-term development of zero-emission maritime traffic.

**Keywords :** international shipping, decarbonization, SMR, AHP, nuclear-fuelled vessels

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