SMALL MODULAR NUCLEAR REACTORS

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Small modular nuclear reactors (SMNR) are compact nuclear reactors with a capacity of 300 – 400 MW, which are manufactured to modular specifications, i.e. manufactured in separate factories and fabricated on site (International Atomic Energy Agency, 2021).

The main advantage of SMNR is their flexibility and adaptability. Modularity provides flexibility, allowing modules to be added as needed, which is a significant benefit (International Atomic Energy Agency, 2018). Additionally, SMNR can be built in remote areas, along with the necessary infrastructure and accessibility of the facility (International Atomic Energy Agency, 2018; International Atomic Energy Agency, 2021). It is suitable for large-scale nuclear reactors.

Moreover, what is important for society is that the increased safety can be achieved through factors such as natural (passive) safety, reduced negligence, and reduced risk of accidents, in addition to having many economic benefits such as cost savings (International Atomic Energy Agency, 2023a). Depending on the type of material, small modular nuclear reactors can be used for various purposes: heating,

water filtration, etc. (International Atomic Energy Agency, 2024).

However, along with the advantages, SMNR also have disadvantages, namely: the technology is very new and requires adaptation, bureaucratic problems that do not allow for the rapid implementation of SMNR, and the high cost of a unit of energy (International Atomic Energy Agency, 2023b). Compared to traditional nuclear reactors, SMNR are cheaper, and this is despite the need for insurance and guarantees, as well as the need to resolve issues of electricity supply (adaptation to the power system, fuel supply, installation of SMNR). For it, highly qualified personnel are needed (International Atomic Energy Agency, 2023a).

The USA has already ordered more than 20 SMNR, although it is not yet clear when they will be launched (International Atomic Energy Agency, 2024).

The results of SMNR research are a promising solution for providing affordable, flexible and low-carbon energy, especially for countries that seek to become responsible for environmental protection (International Atomic Energy Agency, 2024).

References:

International Atomic Energy Agency. (2018). *Deployment Indicators for Small Modular Reactors (IAEA-TECDOC-1854).* Vienna: IAEA

International Atomic Energy Agency. (2021). *Technology Roadmap for Small Modular Reactor Deployment (IAEA Nuclear Energy Series No. NR-T-1.18).* Vienna: IAEA.

International Atomic Energy Agency. (2023a). *Applicability of IAEA Safety Standards to Non-WaterCooled Reactors and Small Modular Reactors (Safety Reports Series No. 123).* Vienna: IAEA.

International Atomic Energy Agency. (2023b). *Phase 3 Summary Report – SMR Regulators' Forum (IAEA)*. Vienna: IAEA.

International Atomic Energy Agency. (2024). *Small Modular Reactors: Advances in SMR Developments 2024 (Non-serial Publications, IAEA).* Vienna: IAEA. Retrieved from https://doi.org/10.61092/iaea.3o4h-svum