SMR DEPLOYMENT FOR DISTRICT HEATING DECARBONIZATION IN EUROPE, FROM A LINCENCING PERSPECTIVE

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Current district heating capacity in Europe is around 450 TWh out of the 3,100 TWh of the lowtemperature heating market, and 60% of this production is still fossil-based. Biomass, the only source currently considered to be used on a large scale to replace fossil fuels, will rapidly reach a ceiling in terms of available resources. To achieve full decarbonisation of heat production by 2050, the deployment of Small Modular Reactors (SMRs) is evaluated among nuclear power solutions. This project will evaluate key engineering and management aspects to comply with the licensing processes based on the legal and regulatory frameworks. Licensing procedures were originally designed for large reactors, requiring separate approvals for each unit, a process that is time-consuming, complex, and expensive. This approach does not account for SMRs. which should benefit from a more efficient licensing system, ideally developed through collaboration between regulatory bodies and governments to enable recognition across countries. However, regulatory changes of this scale require strong political support. For example, within these required changes, one could highlight emergency zone regulations. The existing laws, originally intended for high-capacity plants, assume that all nuclear reactors must be built in remote locations with fixed-radius exclusion zones. This "one-size-fits-all" method does not consider the inherent safety advantages of SMRs, including smaller fuel loads, safer operation parameters (lower temperature and pressure), lower power output, and potential underground construction. Without an evidence-based, site-specific approach, regulators may fail to overly large emergency zones, restricting SMR deployment near population centres where heat demand is highest. Successfully integrating SMRs into district heating systems and achieving widespread heat decarbonisation will require permanently overcoming licensing barriers. This work centres on recommendations and guidelines, from a licensing perspective, to accelerate the SMR deployment for district heating decarbonisation in Europe.

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