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Future Cost Projections of Small Modular Reactors: A Model-Based Analysis

Forecasting the future costs of innovative energy technologies, such as small modular reactors (SMRs), presents a complex challenge due to a multitude of uncertainties and variables. With over 100 SMR designs currently competing globally for commercial viability, achieving cost-effectiveness is a critical hurdle, particularly given the smaller reactors' inherent lack of economies of scale. This paper presents a model-based approach for estimating the first-of-a-kind (FOAK) costs for SMRs across various sizes, alongside determining the necessary deployment scale to achieve the supplier's projected Nth-of-a-kind (NOAK) costs, considering expected learning curves. Our analysis reveals that while smaller SMRs initially face higher costs, they possess significant potential for cost reduction, primarily through enhanced modularization strategies. The study demonstrates that SMRs can competitively match or surpass the cost-efficiency of larger nuclear power plants and alternative energy sources, conditional on the strategic deployment of a sufficient number of units. This work contributes to a nuanced understanding of SMR cost dynamics and laying a foundation for future research on their economic integration into the power market.

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