Back to the future: nuclear energy prospects in Sweden

Sweden's electricity production and consumption profile can be characterised as rather stable and environmental friendly, where most of the power comes from hydro and nuclear, and complemented by wind [1]. By 2023, Sweden has six active nuclear power reactors at three conventional nuclear power plants (CNPs) – Forsmark, Ringhals, and Oskarshamn. However, the current electricity supply challenges including energy shortage and the overall projected energy demands in the country require other kind of solutions. After the long stagnation and phasing-out period, Sweden is experiencing new wave of interest towards nuclear energy – both large-scale nuclear reactors and SMRs - small modular nuclear reactors.

Nuclear technology, and specifically SMRs, received strong advocacy to being able combat climate change [cf. 2,3] and facilitate sustainable energy transition mainly because of its carbon free nature, stability of supply and relatively low waste production [4]. Despite the revived strong interest towards nuclear, CNPs similar to other kind of large-scale mega projects, seen as high risk for running late and over the budget [cf. 5,6]. In Sweden, the most recent reactor was finalised at Oskarshamn CNP in 1985. It turned to be a success – as it was finished earlier than scheduled and below the budget showing the positive effect of the learning curve. Since that time, there were no nuclear projects in Sweden of any scale, which puts at risk potential future projects.

SMRs - the existing technology shaped in a new form - require different kind of logics than a regular CNP in planning, construction and maintenance. However, it is seen as a viable alternative to the conventional CNPs. SMRs are projected to be much more beneficial and efficient in terms of capital costs, construction time, and return on investments [7]. The challenge is there is no single operating SMR power plant in the world, no existing supply chains and numerous safety & logistic issues [7,8]. Further, SMR technology is economically viable not as a single plant-project, but as a package or a programme of several projects on a scale of a country or a region [7,9], which is alike a mega-project.

This paper is dedicated to an overview of the status of nuclear energy in Sweden, drivers and challenges of deployment of SMRs. We seek to answer a question how an SMR technology can be efficiently deployed in Sweden. We do a qualitative study based on semi-structured interviews with the key actors in the nuclear sector in Scandinavia, including companies, vendors, governmental agencies, and researchers. This data is triangulated through the literature review. Data collection is done within the ANItA (Academic-industrial Nuclear

technology Initiative To Achieve a sustainable energy future) competence center managed by Uppsala University. Theoretically, we aim contributing to knowledge on efficient planning, management and governance of large-scale (or mega-) projects [cf. 6], and understanding the constellation and interplay of actors engaged in the project [10,11].

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