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Steel-Concrete modular construction. Economic impact on the levelized cost of electricity in large reactors or SMRs

For nuclear power to remain an attractive option in the next decades, the cost of electricity must remain competitive with alternative sources, whereas investors and public acceptance have been eroded by new build projects costs overrun. Lots of reports have been published on means to stop the construction costs escalation that was observed for large reactors in the Western countries (OECD/NEA, IAEA). Regarding SMRs, the challenge to develop a viable business model is bigger, especially how to unlock cost reductions to compensate diseconomies of scale. Steel-Concrete Structures (SCS) is one of the possible economic drivers, by reduced Interests During Construction (IDC), indirect costs and owner's costs from the shorter schedule. However, outside generalities or technical evaluations, there is a lack of information on supplementary direct costs that may lessen the savings; moreover, the expected gain compared to reinforced concrete (RC) was not yet quantified in the literary in terms of reactor economic performance, namely the cost of electricity (LCOE) all included (capitalized cost, operation & maintenance, fuel, dismantling).

From the feedback of the SCHEDULE RFCS EU funded project 800732 (full-scale ultimate safety building in SCS), we developed a simplified model to assess the construction method sensitivity in various scenarios. Savings depends finally on the size of the project as construction & commissioning schedules and costs breakdown are very different.

For large reactors, SCS offers substantial LCOE discount ~ 0.92 . The higher is the cost of money (WACC), the higher are savings.

For SMRs, SCS is profitable in critical areas where it offers both schedule and direct costs reduction (e.g replacement of the pools steel liners). Elsewhere savings are generally smaller than for large reactors because civil works do not represent the main part of the global schedule and costs. The "time to money" exchange rate is -0.4% LCOE per removed month.

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