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Role of Small Modular Reactor in De-carbonization of Indian Energy Sector

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Abstract

As coal consumption surges amid energy market turmoil, global efforts to slash the use of the most polluting fossil fuel by 2050 appear increasingly challenged. Several countries are now eyeing a strategy for using nuclear power that could reduce their reliance on fossil fuels over the coming years: installing nuclear reactors on or near the site of retired coal fired plants. For example, repurposing fossil plants with nuclear technologies like SMRs, besides helping lower emissions and maintain energy security, could also ensure a just economic transition for local communities. But several challenges must be addressed before such an approach can be widely adopted.

Coal is responsible for the largest share of CO₂ emissions from the energy sector, making its phase-out key to tackling climate change. But while the COP26 climate summit agreed to accelerate efforts towards a “phasedown” of unabated coal-fired power stations, coal demand continue to rise as countries grapple with high energy prices amid the current market turmoil and global geo-politics. Given that coal provides more than one third of the world’s electricity, there is scope for nuclear to over time replace it as a low-carbon primary energy source that provides 24/7 supply security.

Cost saving factors could include avoiding land acquisition for the nuclear plant, having an existing water source as well as rail and road connectivity, and a pool of trained human resources within commuting distance.

Many of the balance of plant (BOP) systems used for running the coal-fired plant can also be repurposed for use with an SMR. These include plant make-up water and water storage systems; desalination plants; compressed air systems; chemical stores; technical gases storage system; wastewater treatment systems; and cooling towers.

Supply chains are also similar for coal and nuclear plants, meaning jobs can be preserved, while the cost of finance for nuclear, always such a significant part of the total price, can be reduced. This would create a competitive cycle in the finance community for nuclear on the back of lower capital costs.

To get a comprehensive understanding of repurposing, this paper suggests a bidirectional assessment method. In the longitudinal direction, this report submits a breakdown of technical, economic, regulatory, and all other related aspects of repurposing the thermal stations. In the transversal direction, assessments focus on what capacities of nuclear technologies are possible for re-purposing of thermal stations.