



1 EXECUTIVE SUMMARY

X Energy, LLC (X-energy), and South Carolina Electric & Gas (SCE&G) performed a joint feasibility study to investigate replacement and/or repowering of existing coal-fired power stations with the Xe-100, a pebble-bed High Temperature Gas-Cooled Reactor (HTGR). The Xe-100 is a promising next-generation reactor concept: the Department of Energy recently surveyed seven advanced reactor designs and ranked the Xe-100 among the most market ready and licensable concepts [8]. The joint feasibility study determined that the Xe-100 could satisfy the long-range power generation needs of a regulated utility such as SCE&G, and included examination of X-energy's licensing strategy, which leverages the pebble-bed reactor's extensive history and the Xe-100's intrinsic and passive safety characteristics.

The joint X-energy/SCE&G study team explored two scenarios—station Expansion and station Repowering—for deploying an Xe-100 four-reactor plant within the SCE&G service area. Under the Expansion scenario, an Xe-100 plant would be constructed on unused land at an existing SCE&G coal-fired station to augment the power production capacity of the site. Under the Repowering scenario, an Xe-100 plant would replace the utility boiler in an existing coal-fired station while maintaining as much of the balance of plant as practicable.

In the Expansion scenario, the study team found that the Xe-100 could provide a technically and economically viable supplement for a coal-fired station based on the following findings:

- Steam temperature and pressure conditions are similar to those of existing coal-fired stations.
- Power output can load follow at attractive ramp rates as low as 25% power, exceeding the existing coal-fired station capabilities.
- The Xe-100 plant occupies as little as 10 acres of land, allowing siting on existing facilities.
- Zero SO_x and NO_x emissions potentially enables siting near environmentally sensitive areas.
- Zero CO₂ emissions allow satisfying state mandates while generating reliable power.
- Installation leverages existing infrastructure, including transmission and distribution, significantly reducing costs and schedule.
- Construction schedule is approximately 24 months, comparable to other power enhancement approaches.
- The Xe-100 is among the lowest cost clean-energy sources for expanding capacity at existing power plants based on Energy Information Administration estimates.

The benefits of the Xe-100 include ease of integration with existing infrastructure, operating characteristics analogous to fossil fuel plants, reduced up-front financial risk, and enhanced fuel diversity. These benefits allow a utility to satisfy increasingly-stringent federal clean-air mandates while meeting growing power demands. Note that these benefits apply not only to the Expansion scenario, but to green field or total coal plant replacement scenarios as well.

In the Repowering scenario, the study team concluded that the Xe-100 could also provide a technically feasible replacement heat source for an existing coal-fired station. However increased maintenance on aging balance of plant components and increased integration complexity offset savings from reusing existing energy conversion equipment. SCE&G's experience with similar repowering projects with natural gas indicate that this represents an economic deterrent, therefore a preferable option would be to place a standard Xe-100 plant next to the existing aging coal-fired station as in the Expansion scenario.



In summary, the Xe-100 is a promising next-generation alternative energy source that could satisfy the long-range small-to-medium power generation needs of the utility industry. It was determined to be a viable alternative if SCE&G needed new production capabilities particularly in the Expansion scenario, while adding a number of unique features and benefits. The results of the Expansion scenario can be extrapolated to a green field site project as well. Additional political or regulatory factors such as more stringent regulations, like the Mercury and Air Toxic Standards (MATS) and the Clean Air Act (CAA) section 111(d) on greenhouse gas emissions, could further enhance the economic and environmental attractiveness of the Xe-100.