INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE

Development of Technology for Viable International Deployment of Small Sodium-Cooled Fast Reactors

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Project Abstract

Small, modular, transportable sodium-cooled fast reactors (SFRs) can play a major role in helping to meet the significant projected growth in worldwide nuclear capacity, while reducing the risk of proliferation. Particular applications for which such reactors are well suited include powering industrial enterprises such as mining in remote regions and providing electricity to consumers in developing nations that do not have major grid connections.

This project will investigate and enhance the viability of deploying small modular transportable SFRs at remote sites. Researchers will identify approaches that minimize the construction time, labor, and costs and will develop component modularization techniques, transportation, and site installation sequences that reduce onsite assembly time and labor.

As these small modular reactors lack economies of scale, they must take advantage of innovations and simplifications that reduce capital and generation costs. A key contributor to cost reduction is through manufacturing and assembly processes that streamline nuclear plant construction. One approach is to pre-assemble components into modules in a factory setting. Applying this approach to fast reactor plants requires taking full advantage of factory mass production techniques and incorporating innovations that increase plant efficiency in order to reduce costs. Modules must be readily transportable to remote sites and based on a standardized design suitable for a worldwide market that meets regulatory requirements in various nations.

It is initially planned to utilize the 50 MWe (125 MWt) Small Modular Fast Reactor (SMFR) concept developed by an international team including ANL as the reference design. This reactor incorporates a supercritical carbon dioxide Brayton cycle power converter to further reduce costs through a simpler and less expensive balance-of-plant design and higher plant efficiency. Researchers will use time dependent, three-dimensional computer aided design models to simulate component fabrication, modularization, transportation, and installation sequences that are suited for deployment at remote sites and to determine optimal sequences for reducing construction time and cost.