The Evolving Model for Building and Operating Nuclear Plants

- Nuclear construction is a multistep process with multiple actors
- Companies can choose among many designers, suppliers
- Either a designer or specialized engineering firm can manage construction *By Matt Wald*

Construction of the next generation of U.S. nuclear plants differs markedly from the old process. Under the current model, designs for new plants—including the four reactors under construction in Georgia and South Carolina—have all design-related safety issues resolved before construction begins. As reactor innovation continues, more changes may be in store. NEI guest columnist Matt Wald explains the evolving model of nuclear plant development.

March 27, 2017—The model for building new reactors is changing. One reactor entered commercial service in the United States last year under a traditional licensing system, and four are approaching completion using a new, alternative regulatory approach. Now a startup is seeking generic approval for a design that would be built in a factory. Here is how it works:

Step One: Deciding to Build

A company that supplies electricity to consumers decides to build. In regulated areas in the United States, an investor-owned utility needs the permission of a public service commission (PSC). That is a state body that regulates monopoly utilities and decides whether a company can raise consumers' rates to recover its construction costs. Georgia and South Carolina are regulated states and home to four reactors currently under construction. A municipal electric company or a federally-chartered electric system, like the Tennessee Valley Authority, may not need approval by a state power regulator. In areas with competitive markets, there is no PSC to regulate electricity prices. Prices are determined by auction, and the generators are "merchant plants," selling in an open market.



Georgia Power Co., Oglethorpe Power Corp., the Municipal Authority of Georgia and Dalton Utilities are the co-owners of Vogtle 3, one of two Westinghouse AP1000s being built at the Vogtle site, which is operated by Southern Nuclear Operating Co. [Photo: Georgia Power]

Step Two: Choosing a Model and a Builder

Then, the builder goes shopping for a reactor model to build. Companies around the world design reactors and manufacture their key components. These companies sell nuclear steam supply systems (NSSS), which include the reactor vessels, major valves and control room equipment. They may supply the turbine, which converts steam into mechanical power, and the generator, which converts that mechanical power into electricity. They usually do not supply the miles of pipes and cables, the steel reinforcing bars, or the concrete.

Usually, the owners of the new plant hire a company to manage construction and install the parts from the myriad suppliers. These are called EPC companies, for engineering, procurement and construction. In some cases, the NSSS vendor can also act as the EPC.



About 6,000 workers are constructing the Vogtle 3 and 4 AP1000s in Georgia. [Photo: Georgia Power]

In the United States, companies can pick an NSSS supplier from around the world. And NSSS vendors source their components from many different countries.

Step Three: Getting a License

There are two ways to get an operating license. For all the plants now running, the builder got a construction permit from the U.S. Nuclear Regulatory Commission or its predecessor agency, built the plant, and then applied for an operating license. The builder had to show that the new plant satisfied all NRC requirements.

In the 1990s, the NRC established an alternative process: NSSS vendors submit designs and have them approved before anyone starts building. Companies contemplating a new plant can get permits in advance for potential plant sites, valid for 20 years. When a company decides to build, it can pick a preapproved site and a preapproved design and receive a combined construction and operating license. That reduces time-to-market by months or even years. When the reactor is finished, the owner only has to show that the plant was built according to the specifications in the preapproved design.

That is the system being used in Georgia and South Carolina. In addition, the NRC has preapproved several designs for large reactors, and several plant sites around the country. In the future, this will reduce the time lag between a decision to build and the beginning of commercial operation.

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The industry's goal is to reduce significantly the time from granting of a combined construction and operating license to actual commercial operation.

Whichever path the builder chooses, picking a preapproved design or building and demonstrating that the plant meets safety requirements, the NRC rigorously inspects the reactor during construction, as it does during operation.

Builders still need state and local approvals for zoning changes, new power lines and water use. And the company that will operate the plant must be majority American-owned.

In January 2017, a new company, NuScale Power LLC, took a step that could make the process even shorter, by moving much of the construction to a factory. It applied for approval of a design for a "small modular reactor" that it would build and deliver to a site by barge, rail or truck for prompt installation. This month, the NRC agreed that NuScale's application was complete, and the agency will move forward to a full review.