

Expanded Manufacturing Capacity Needed To Support New Nuclear Plant Construction

April 2007

Key Facts

■ Companies and consortia are pursuing plans to build more than 30 new nuclear power plants to meet projected increases in U.S. electricity demand. However, the infrastructure for building new nuclear plants has diminished because few plants have been built outside of Asia. As a result, the industry may face difficulties obtaining components necessary to build new nuclear plants, as well as experienced construction management, engineering personnel and skilled workers.

■ The industry anticipates that construction may begin on as many as 17 new nuclear plants in the United States and 30 overseas over the next six years, causing a dramatic increase in demand for components.

■ An internal Nuclear Energy Institute (NEI) study identified several potential manufacturing constraints that could hinder the construction of new nuclear power plants: component design and engineering, supply of raw materials and subcomponents, work force, qualified suppliers of nuclear plant components, specialized equipment and machinery, and global

infrastructure for heavy forgings. The study provides recommendations to minimize these potential constraints on new-plant construction.

New Plants Will Require Increased Infrastructure

The U.S. Department of Energy predicts significant increases in demand for electricity production—45 percent by 2030. Few power plants that provide baseload generation have been built in the last 20 years. As a result, energy companies are exploring options for new baseload electricity generation, including new nuclear power reactors.

After more than a decade since the last U.S. reactor began operation, 16 companies and consortia are preparing to submit applications to build more than 30 new plants.

A 2005 DOE report¹ concluded that the necessary manufacturing capacity is available or can be readily available to support the construction and commissioning of up to eight reactors between 2010 and 2017. However,

companies may begin construction on as many as 17 new plants in the United States over the next six years, according to industry estimates.

One of the steps the industry is taking toward new-plant construction is beginning to develop the supply chain for building new plants. This will ensure critical components are available for multiple projects.

Identifying Capacity Constraints

NEI's study evaluated key components that could be "pinch points" as new-plant construction accelerates. These components include:

- reactor pressure vessels
- steam generators
- moisture separator reheaters
- turbine generators
- nuclear-grade pumps
- nuclear-grade heat-exchangers
- nuclear-grade valves
- transformers
- large-bore seamless piping
- plant simulators
- nuclear-grade batteries
- nuclear-grade mechanical insulation.

The study outlined seven categories of constraints:



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¹ "NP2010 Nuclear Power Plant Construction Infrastructure Assessment," Department of Energy, October 2005.

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Component Design and Engineering. Vendors must submit final component requirements to suppliers before manufacturing can begin in order to meet the individual specifications of each project. Detailed reactor designs have yet to be completed, but designers are providing suppliers with new specifications as they are developed to avoid project delays.

Raw Material Supply. There is a limited availability of raw materials (defined as any input material, such as steel sheeting) for many plant components, including steam generators, pumps, heat exchangers, valves, and alloy and stainless steel piping. Prolonged procurement of raw materials could result in extended lead times and higher costs to manufacture these components.

Subcomponent Supply. Just as constraints on raw material supply could delay construction, so could limits on the supply of subcomponents or those items—from processed raw materials to entire sub-systems—required to produce a given component.

Specialized Training and Supervision of the Manufacturing Work Force. The procurement, manufacturing and assembly of nuclear plant parts involve personnel who are trained in company procedures and nuclear quality assurance procedures. Without skilled

workers and qualified supervisors, manufacturers will have difficulty fulfilling orders for components on schedule.

Limited Suppliers of Nuclear-Grade Plant Components. “Nuclear grade” refers to a process of rigorous manufacturing quality assurance for those components that are especially critical to reactor safety. A limited number of certified suppliers of certain nuclear-grade components, including pumps, heat exchangers and valves, will increase competition for the limited resources of the remaining certified suppliers. This, in turn, will extend lead times and raise component prices.

Specialized Equipment and Machinery. Tight supplies of certain pieces of specialized equipment or machinery may hinder new-plant construction.

Forging Capability. Only one company, in Japan, produces ultra-large forgings that are used mainly for reactor pressure vessels, and the company has a three-year order backlog. This could inhibit the expansion of nuclear power in the United States and around the world absent new foundries.

The NEI study identified ultra-large forgings as the first major pinch point that the industry will encounter before 2010, but constraints on supplies of nuclear-grade pumps, valves and heat exchangers in safety-related systems could arise in

subsequent years. “These constraints may intensify if the manufacturing industry does not increase capacity on a schedule consistent with the nuclear industry’s needs,” the report concluded.

In addition, no U.S. company has the capability to produce large forgings necessary for manufacturing steam generators and large turbine generators for nuclear plants.

Recommendations for Mitigating Potential Constraints

Based on the results of the infrastructure survey, NEI developed recommendations for the nuclear energy industry, manufacturers and policymakers to mitigate these potential shortfalls. These recommendations are:

- Nuclear plant designers should communicate often with architectural, engineering and manufacturing firms on forecasted project schedules for nuclear components. This will facilitate a continuous evaluation of the manufacturing capacity for nuclear components.
- Design, architect/ engineering, construction and manufacturing companies should cooperate to solve common supply-chain issues that may pose construction challenges, including processing raw materials and limited subcomponent supply.

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- Electric companies should interact with the manufacturing industry to broaden understanding of the number of new-plant components and their quality requirements.
- The energy industry should pursue aggressive outreach to encourage communication among electric companies, reactor designers, vendors and equipment manufacturers.
- The nuclear industry should assess the commodity markets to better understand the impact of raw material supplies on the manufacturing of nuclear plant components and on construction. Sound mitigating strategies must be developed.

Building Momentum for New Nuclear Plants

As the need for new nuclear power plants increases, the demand for nuclear components will place an additional burden on a limited number of suppliers. The ability to accurately define equipment requirements and assess overall manufacturing capacities will become even more critical to avoiding supply shortages and delays in production and deployment.

This fact sheet also is available at www.nei.org.