FACT SHEET

Small Modular Reactors Provide Clean, Safe Power and Industrial Process Heat

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Key Facts

- Near-term construction of large, new nuclear plants will address two of our nation's top priorities: additional supplies of clean energy and job creation. Small, modular reactors can complement these large-scale projects by expanding the level of deployment and application options for carbon-free nuclear energy. Small-scale reactors provide energy companies and other users with a broader array of energy options.

- Their small size—typically fewer than 300 megawatts (MW)—and modular construction will allow these reactors to be built in a controlled factory setting and installed module by module, reducing the financing challenge and matching a variety of needs for low-carbon energy.

- The potential applications for small reactors include electricity generation. Small reactors may be more compatible with the needs of smaller U.S. utilities from the standpoint of generation, transmission and financing than large 1,400-megawatt (MW) plants. The industry envisions modular reactors built in clusters, with modules added as needed to match growth in energy demand.

- Small, modular reactors could be used for industrial process heat applications, such as those used in the petrochemical industry, desalination or water purification.

- Another use for small reactors is providing power for the development of tar sands, oil shale and coal-to-liquids applications, reducing the overall life-cycle carbon footprint of these activities.

Designs Target Diverse Applications

Many small, modular reactor designs are under development to meet specific U.S. and international market needs, and they are attracting considerable attention from Congress and the news media.

The international community has been evaluating the feasibility of small reactor technologies for the past several years through the Generation IV International Forum.[i] The forum has identified six technologies for development.

The U.S. Department of Energy is focusing its efforts on two advanced reactor technologies: a high-temperature gas reactor (HTGR) and a sodium-cooled fast reactor (SFR). The Energy Policy Act of 2005 authorized research, development and construction of an HTGR. DOE is pursuing this design through its Next Generation Nuclear Plant project. The SFR technology is being studied as a method for managing high-level radioactive wastes.

Design activities are progressing in each of the three technologies. Each technology has unique development needs and a different timeline for reaching the market. Initial regulatory applications are expected within the next three years for NRC design certifications and combined licenses for prototype reactors.

Light Water Reactors

Small light water reactors are designed to capitalize on the benefits of modular construction, ease of transportation and reduced financing, all of which could create a compelling business case.

Since these designs typically are smaller than 300 megawatts electric, they could be used to replace older fossil-fired power stations of similar size that may no longer be economical to operate in a carbon-constrained world. The infrastructure, cooling water, rail and transmission facilities already exist at such facilities. Designs under development include:

- **Babcock & Wilcox Co. mPower Reactor**. The mPower reactor design is a 125-megawatt (electric) advanced light water reactor design that uses natural phenomena such as gravity, convection and conduction to cool the reactor in an emergency with a below-ground containment.
- **NuScale Power Inc. NuScale Reactor**. The NuScale is a 45-megawatt (electric) advanced light water reactor.
- **Westinghouse-Led Consortium International Partnership International Reactor Innovative and Secure (IRIS)**. The IRIS is a light water reactor design, with each module capable of producing between 100 and 300 megawatts.

High-Temperature Gas-Cooled Reactors

Although high-temperature gas-cooled reactors could be used for electricity generation, they are especially well-suited for providing process heat for industrial applications, including hydrogen production.

These reactors also could be used in the development of tar sands, oil shale and coal-to-liquids applications. The use of small reactors would reduce the life-cycle carbon footprint of all these activities.

Designs under development include:

- **AREVA Antares.** AREVA based the design for the Antares on the concept of a gas-cooled (helium) reactor. The company is developing the design in the context of the Generation IV International Forum.)
- **General Atomics Gas Turbine Modular Helium Reactor (GT-MHR).** The GT-MHR is a high-temperature reactor with advanced gas turbine technology.
- **Pebble Bed Modular Reactor Ltd. PBMR.** The PBMR is a high-temperature reactor that uses a gas or steam turbine for power conversion. Substantial design, component testing and fuel development have been undertaken in South Africa.

Liquid Metal-Cooled and Fast Reactors

Liquid metal-cooled and fast reactor technologies hold the promise of distributed nuclear applications for electricity, water purification and district heating in remote communities.

These types of reactors also could provide nuclear fuel cycle services, such as breeding new fuel and consuming recycled nuclear waste as fuel. They could support government-sponsored nonproliferation efforts by consuming material from former nuclear weapons, thus eliminating them as a threat.

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- **GE Hitachi (GEH) Nuclear Energy Power Reactor Innovative Small Module (PRISM)**. The PRISM is a 311-megawatt advanced reactor cooled by liquid sodium. As with some other small reactor designs, the plant will be built underground on seismic isolators to dampen the effects of earthquake motion.

- **Hyperion Power Generation Hyperion Power Module (HPG)**. The HPG is a 25-megawatt reactor. Company officials say the module's initial application is likely to be in oil shale fields.

- **Toshiba 4S (Super-Safe, Small and Simple).** The 4S is a 10-megawatt reactor cooled by liquid sodium for use in remote locations.

Summary

Small, modular nuclear power plants are an important addition to America's energy mix, helping to keep the air clean and enhance energy security. Small reactors can replace inefficient fossil-fired facilities, provide process heat for diverse industrial applications and generate electricity for remote locations. Modules can be added as needed—built in controlled factory settings and easily transported to the site, where they will operate without refueling for anywhere from two to 10 years, depending on the design. Together with large reactors, they comprise a full product line of clean, safe, secure carbon-free energy sources.

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[i] Existing U.S. reactors are Generation II and III designs. The advanced reactors now under licensing review at the U.S. Nuclear Regulatory Commission are Generation III+. Next-generation reactors are termed Generation IV designs.