A Nuclear Powerhouse

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 When we talk about next-generation technologies, it’s rare for the impact of such a technology to be so obvious. As the only so-called Generation III+ nuclear reactor to receive final design approval from the Nuclear Regulatory Commission (NRC), the Westinghouse AP1000 is being embraced as the nuclear solution for the worldwide clean-energy revolution.

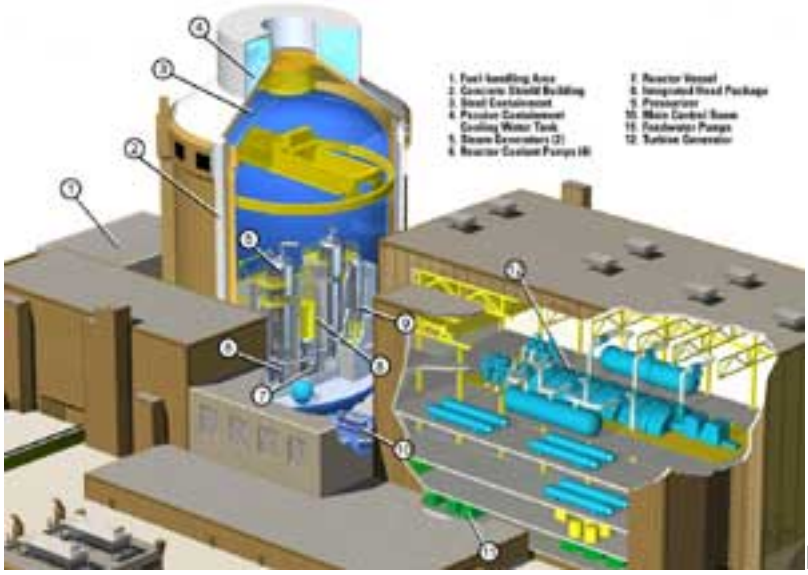
The hallmark of Generation III reactors — first built in the 1990s — is improved fuel technology, superior thermal efficiency, passive safety systems, and a standardized design for reduced maintenance and capital costs. Any reactor that offers significant improvements in safety and economics over the Generation III reactor is considered to be Generation III+.

While there are several other Generation III+ reactors being designed and tested, the AP1000 is way ahead of the pack with six units being built in China, and plans for another 14 across the U.S. This is just the beginning, according to Westinghouse CEO Aris Candris, with China reportedly wanting 100 of the units operational by 2020.

Passive Safety

Westinghouse received NRC approval for an earlier Generation III reactor design — the 600-MWe AP600 — in 1998, but no orders were ever placed. Westinghouse decided that it could scale-up the AP600 to produce 1,000 MWe in roughly the same footprint, resulting in a lower cost per kilowatt of power produced.

The company’s engineers focused on a simplified design for the AP1000 in order to reduce the cost of building, operating and maintaining the reactor. Half as many safety-related valves, 85 percent less control cable and 35 percent fewer pumps make for a streamlined plant — but how is safety affected?



Risk assessment calculations performed as part of the design process found that the AP1000 has a maximum core damage frequency of 2.41 × 10-7 per plant per year; or in other words, each plant should experience one incident involving damage to the reactor’s core every 4,149,377 years.

Automation plays a leading role in Westinghouse’s passive core cooling system with the use of explosively- and DC-operated valves to trigger the procedures that remove heat from the reactor after it is shut down. These valves don’t rely on hydraulic or compressed air systems, and are triggered even if the reactor operators take no action.

Modular Design, Fast Construction, Lower Cost

Westinghouse designed the AP1000 so that modules can be built simultaneously, and shipped via rail or barge. Construction time is projected to be 36 months from when concrete is first poured, considerably faster than earlier designs. Westinghouse claims that the short construction timeline will play a big part in reducing the overall cost of the plant, making nuclear plants more competitive against current fossil-fuel power generators.

The massive Sanmen Nuclear Power Plant in Zhejiang, China will be the first site to power up the AP1000, with six units due to begin operating there in 2013.