



SWR 1000: A Next-Generation Boiling Water Reactor Ready for Deployment

Werner Brettschuh

Framatome ANP GmbH

Kaiserleistraße 29

63067 Offenbach, Germany

werner.brettschuh@framatome-anp.com

The latest developments in nuclear power generation technology mainly concern large-capacity plants in the 1550 -1600 MW range, or very small plants (100 - 350 MW). The SWR 1000 boiling water reactor (BWR), by contrast, offers all of the advantages of an advanced plant design, with excellent safety performance and competitive power generation costs, in the medium-capacity range (1000 - 1250 MW). The SWR 1000 design is particularly suitable for countries whose power systems do not include any large power plants. The economic efficiency of this medium-sized plant in comparison with large-capacity designs is achieved by deploying very simple passive safety equipment, simplified systems for plant operation, and a very simple plant configuration in which systems engineering is optimized and dependence on electrical and instrumentation & control (I&C) systems is reduced. In addition, systems and components that require protection against natural and external man-made hazards are accommodated in such a way that as few buildings as possible have to be designed to withstand the loads from such events. The fuel assemblies to be deployed in the SWR 1000 core, meanwhile, have been enlarged from a 10x10 rod array to a 12x12 array. This reduces the total number of fuel assemblies in the core and thus also the number of control rods and control rod drives, as well as in-core neutron flux monitors. The design owes its competitiveness to the fact that investment costs, maintenance costs and fuel cycle costs are all lower. In addition, refueling outages are shorter, thanks to the reduced scope of outage activities. The larger fuel assemblies have been extensively and successfully tested, as have all of the other new components and systems incorporated into the plant design. As in existing plants, the forced coolant circulation method is deployed, ensuring problem-free start-up, and enabling plant operators to adjust power rapidly in the high power range (70%-100%) without moving the control rods, as well as allowing spectral-shift and stretch-out operation. The considerable gains provided by forced coolant circulation in terms of operational flexibility and fuel utilization mean that the investment and maintenance costs of the pumps are covered after several years of service.

The plant safety concept is based on a combination of passive safety systems and a reduced number of active safety systems. All postulated accidents can be controlled using passive systems alone. Control of a postulated core melt accident is assured with considerable safety margins thanks to passive flooding of the containment for in-vessel melt retention.

The SWR 1000 is compliant with international nuclear codes and standards, and is also designed to withstand the effects of an aircraft crash involving a military aircraft or a large passenger airliner.

Keywords: SWR 1000, advanced BWR, passive safety systems, low power generation cost