

Nuclear Engineering Seminar

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What is a FAST nuclear reactor?

Abstract

Nuclear power, produced by fission, is the splitting of large atomic nuclei into two daughter nuclei, giving off heat and fast-moving fission neutrons, which go on to split other nuclei. In water cooled nuclear reactor technology, the fission neutrons at initial speeds of $\sim 70,000,000$ km/hr are slowed by the water molecules to $\sim 8,000$ km/hr by collisions. This yields slow neutrons (thermal neutrons). In a sodium cooled reactors, collisions slow the neutrons to $\sim 10,000,000$ km/hr - but they are still called FAST neutrons. The magnitude of these differences can be appreciated by imagining these neutrons circling the Sun along Earth's orbit. A fission neutron makes the trip in 13 hours, a FAST neutron in 70 hours, whereas a thermal neutron takes 8 years!

This overview of GE Hitachi Nuclear Energy's (GEH) PRISM sodium fast reactor will help the student understand FAST reactor fuel and core design to produce steam to generate carbon free electricity. GEH has a long history with sodium fast reactors. Our current design is based on early U.S. sodium cooled FAST reactor programs. Marketing of the PRISM continues today, with interest from Canada, China, Japan, Kingdom of Saudi Arabia, Korea, and the United Kingdom.

Eric P. Loewen, PhD, has worked for thirty-five years at the intersection of nuclear science and technology in the nuclear navy, nuclear waste processing, a national laboratory, and now as Chief Consulting Engineer, Advanced Plants Technology, GE Hitachi Nuclear Energy (GEH), in Wilmington, NC. His nuclear engineering expertise is complemented by involvement as an active advisor to governmental and industrial organizations such as the DOE Generation IV International Forum, member of the UNM Nuclear Engineering Department Advisory Board, and adjunct professor at VCU. At GEH he is promoting the sodium cooled reactor and electrometallurgical processing of used nuclear fuel as an option for a better future using nuclear energy as well as ensuring a robust career path for GEH's global workforce of technical leaders.

Author of more than 70 publications both technical and policy, he has delivered 80 major nuclear presentations, holds 13 patents, and has held a Senior Reactor Operator license.

Dr. Loewen received his B.A. in Chemistry and Math with a minor in Physics from Western State College in May 1983, and later attained MS, Nuclear Engineering (1992) and PhD, Engineering Physics (1999) from the University of Wisconsin - Madison. Eric is a former President of the American Nuclear Society.