NWS08-2008-000046

Abstract for an Invited Paper for the NWS08 Meeting of the American Physical Society

Generation-IV Nuclear Energy Systems HAROLD MCFARLANE, Idaho National Laboratory

Nuclear power technology has evolved through roughly three generations of system designs: a first generation of prototypes and first-of-a-kind units implemented during the period 1950 to 1970; a second generation of industrial power plants built from 1970 to the turn of the century, most of which are still in operation today; and a third generation of evolutionary advanced reactors which began being built by the turn of the 20^{th} century, usually called Generation III or III+, which incorporate technical lessons learned through more than 12,000 reactor-years of operation. The Generation IV International Forum (GIF) is a cooperative international endeavor to develop advanced nuclear energy systems in response to the so-cial, environmental and economic requirements of the 21^{st} century. Six Generation IV systems under development by GIF promise to enhance the future contribution and benefits of nuclear energy. All Generation IV systems aim at performance improvement, new applications of nuclear energy, and/or more sustainable approaches to the management of nuclear materials. High-temperature systems offer the possibility of efficient process heat applications and eventually hydrogen production. Enhanced sustainability is achieved primarily through adoption of a closed fuel cycle with reprocessing and recycling of plutonium, uranium and minor actinides using fast reactors. This approach provides significant reduction in waste generation and uranium resource requirements.