FOREWORD
SPECIAL ISSUE ON SMALL MODULAR REACTORS

Guest Editor

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This special issue of *Nuclear Technology* addresses the rapidly emerging topic of small modular reactors (SMRs). The issue features invited, peer-reviewed papers describing several SMR designs of importance to the United States and two papers that address topics relevant to all SMR designs: economic competitiveness and licensing considerations. Small modular reactors are not new to the nuclear industry. In fact, the very earliest nuclear reactors had very modest sizes for marine propulsion and for prototyping commercial designs, which later escalated rapidly into very large plants with capacities exceeding 1000 MW(electric). Global interest in smaller-sized plants has seen an enormous growth in the past few years, especially for those that use modularized reactor units. This dramatic increase in interest is attributed to a number of converging factors, including increasing interest in nuclear power for abundant clean energy, the challenges of financing very large plants in tight economic environments, and the potential for significantly enhanced plant safety or robustness. As a consequence of these factors and additional factors that are highlighted in many of the papers within this issue, several new and traditional reactor suppliers are racing to complete new SMR designs to meet the anticipated global demand.

The first six papers in this issue were selected to represent several of the different classes of SMRs being pursued in the U.S., including water-cooled, gas-cooled, and liquid-metal–cooled designs. All designs are relatively mature, and most of the designs are being developed by U.S. vendors. The exception to this is one very small foreign design that has been pursued for construction in Alaska. Additional new designs have emerged since this issue was initiated; however, the new designs share most of the features and benefits of the designs described in this issue.

The first three papers describe SMR designs based on light water–cooled reactor (LWR) technology. Because of the familiarity of the industry and the regulator with LWRs, it is expected that LWR-based SMRs will likely be the first to be ordered and constructed. The first of the three LWR SMR papers provides a detailed retrospective look at the International Reactor Innovative and Secure (IRIS) design, which was developed by a Westinghouse-led international consortium until 2010. The greater level of detail in this paper is partly a reflection of the longevity of this design, since it was the first of the current generation of LWR-based SMRs to emerge more than ten years ago, but also because it typifies the basic design philosophies used by other SMR designers and the anticipated benefits of SMRs. Also, because Westinghouse is no longer pursuing IRIS, design details are openly available. The other two LWR SMR papers describe new designs that are actively moving toward licensing: one being developed by a new upstart reactor vendor and one that is being developed by a traditional vendor. Both of these papers are relatively brief, due in part to the companies' focus on design completion and also due to concerns for commercially important proprietary information.

The next three papers move beyond LWR technology and describe SMR designs based on helium coolant or sodium coolant. Although licensing of these non-LWR technologies is considered more challenging, all three of the designs are relatively mature and the vendors have had numerous prelicensing discussions with the U.S. Nuclear Regulatory Commission. The value of the non-LWR designs is that they bring the opportunity to expand nuclear energy to additional energy markets such as those requiring high-temperature output for process heat applications or favorable neutron economies for improved fuel and waste management. Interestingly, the two sodium-cooled SMRs included in the issue anchor the two ends of the effective SMR power range with one rated at 10 MW(electric) and the other at 300 MW(electric).

This special SMR issue is concluded with two cross-cutting papers: one describing the financing and economic competiveness aspects of SMRs and one discussing licensing considerations unique to SMRs. Both of these topics are central to the viability of SMRs in the commercial market. Additional economic and licensing studies continue to emerge from a diverse range of organizations but were not able to be included in this issue.

It should be noted that this special issue of *Nuclear Technology* was initiated in early 2010. Since that time, significant events have occurred that have affected the pace of the nuclear renaissance in the U.S., such as the serious impact of the earthquake and tsunami on the Fukushima Daiichi nuclear plant in Japan, the defaulting of Solandra on a federally backed loan guarantee, and the continued sluggish response of the U.S. economy. While these factors have given pause to the previously anticipated resurgence of nuclear power, they have significantly increased customer interest in SMRs because of their recognized potential for enhanced safety and their affordability in terms of increased financing options. If the numbers of SMR vendors and interested customers are any indication, I believe that SMRs will have a bright future.