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Prospects for Attractive Fusion Power FARROKH NAJMABADI, University of California, San Diego — During the past ten years, the ARIES Team, a national team involving universities, national laboratories, and industry, has studied a variety of magnetic fusion power plants (tokamaks, stellarators, ST, and RFP). In this paper, we present the top-level requirements and goals for commercial fusion power plants developed with consultation with US utilities and industry. We will review several ARIES designs and discuss the candidate options for physics operation regime as well engineering design of various components (e.g., choice of structural material, coolant, breeder). For each option, we will discuss (1) the potential to satisfy the requirements and goals, and (2) the critical R&D needs. In particular, we will discuss fusion R&D issues which are similar to those of advanced fission systems. For tokamaks, our results indicate that dramatic improvement over first-stability operation can be obtained through either utilization of high-field magnets (e.g., high-temperature superconductors) or operation in advanced-tokamak modes (e.g., reversed-shear). In particular, if full benefits of reversed-shear operation are realized, as is assumed in ARIES-AT, tokamak power plants will have a cost of electricity competitive with other sources of electricity. Emerging technologies such as advanced Baryon cycle, high-temperature superconductor, and advanced manufacturing techniques can improve the cost and attractiveness of fusion plants.

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