ABSTRACT

Chemical engineering analyses are underway for a commercial-scale [1000 MW(e)] divinyl benzene foam-based Inertial Fusion Energy (IFE) Target Fabrication Facility (TFF). This facility is designed to supply 500,000 4 mm o.d. targets per day – coated via interfacial polycondensation, dried with supercritical CO_2, sputter coated with Au and/or Pd, filled with deuterium-tritium (DT), layered at cryogenic temperatures and injected into the fusion chamber. Such targets would be used in a direct-drive IFE power plant.

The work uses manufacturing processes being developed in the laboratory, chemical engineering scale-up principles and established cost estimating methods. The plant conceptual design includes a process flow diagram, mass & energy balances, equipment sizing and sketches, storage tanks and facility views.

The cost estimate includes both capital and operating costs. Initial results for a TFF dedicated to one 1000 MW(e) plant indicate that the costs per target are well within the commercially viable range. Larger TFF plants [3000 MW(e)] are projected to lead to significantly reduced costs per injected target. Additional cost reductions are possible by producing dried, sputter-coated empty shells at a central facility that services multiple power plants.

The results indicate that the installed capital cost is about $100M and the annual operating costs will be about $20M, for a cost per target of about $0.17 each. These design and cost projections assume that a significant process development and scale-up program is successfully completed for all of the basic unit operations included in the facility.