# BLANKET CONCEPTS FOR ALTERNATE FUSION ENERGY OPTIONS

E.T. Cheng
TSI Research, Inc., P.O. Box 2754, Rancho Santa Fe, CA 92067
etcheng@cts.com

Fusion neutrons, particularly those produced from deuterium and tritium plasmas, have been considered for alternate applications, other than depositing their energies in a blanket designed entirely for electricity generation. An attractive alternate application of fusion neutrons is the so-called fusion-fission hybrid. While a pure fusion blanket consists of only non actinide materials, however, in the fusion-fission hybrid, the blanket contains the uranium and/or transuranium elements. Fusion device is used as a neutron source to sustain the fission reactions occurred in the hybrid blanket. Fission reactions can never be maintained when the fusion neutron source, or the fusion device, is turned off.

The fusion-fission hybrid concept has attractive applications, including destruction of transuranium nuclear waste produced from the operation of light water reactors, and energy extraction from fissionable materials. The former application is aimed to destroy the unwanted byproduct transuranium materials while allowing the uranium fuelled light water reactors to continue generating electricity efficiently. The latter application allows direct use of natural uranium to generate electricity. Blanket concepts with molten salt as coolant and actinide carrying medium designed for these applications had been investigated and reported.

Blanket concepts with solid zirconium actinide mixture, similar to that used in the liquid metal fast breeder reactor concept, have been studied. Results of these studies are compared with the molten salt blanket concepts. Using the results of recent studies, scenarios for future nuclear energy options can be derived. This paper is also to discuss several fundamental questions associated with fusion-fission hybrid, such as: why fusion neutrons are unique in the transmutation of actinides generated in the spent fuel rods of light water reactors, to what extent can a fusion-fission hybrid destroy spent fuel actinides, and what is the advantage of a fusion-fission power plant burning natural uranium.