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Fission Fusion Hybrids: a nearer term application of Fusion M. KOTSCHENREUTHER, P. VALANJU, S. MAHAJAN, B. COVELE, University of Texas — Fission-fusion hybrids enjoy unique advantages for addressing long standing societal acceptability issues of nuclear fission power at a much lower level of technical development than a competitive fusion power plant. For waste incineration, hybrids burn intransigent transuranic residues (with the long lived biohazard) from light water reactors (LWRs). The number of hybrids needed is 5-10 times less than the corresponding number of fast reactors (FRs). The highly sub-critical hybrids, with a thermal/epithermal spectrum, incinerate $> 95\%$ of the waste in decades rather than the centuries needed for FRs. For fuel production, hybrids can produce fuel for 3-4 times as many LWRs with no fuel reprocessing. Thorium fuel rods exposed to neutrons in the hybrid reach fissile concentrations that enable efficient burning in LWR without the proliferation risks of reprocessing. The proliferation risks of this method are far less than other fuel breeding approaches, including today's gas centrifuge. With this cycle, US Thorium reserves could supply the entire US electricity supply for centuries. The centerpiece of the fuel cycle is a high power density Compact Fusion Neutron Source (major+minor radius $\sim$ 2.5-3.5 m), which is made feasible by the super-X divertor.

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