

9/28/08

## Sustainable High-Tech Global Civilization by Mid-Century

Marty Hoffert, Prof. Emeritus of Physics (Earth Systems Group), NYU, New York

Energy first: Avoiding more than two degrees Celsius global warming to forestall irreversible polar icecap disintegration, coastal inundation and other adverse climatic impacts from the fossil fuel greenhouse, increasingly coal-driven as oil and natural gas resources are depleted and production rates peak, requires a revolutionary transformation of global energy systems to provide 10-30 TW of carbon-neutral primary power by midcentury. Phaseout of fossil fuel CO<sub>2</sub> emissions by midcentury as global energy demand doubles or triples is the engineering challenge of the century; but doable in principle with mission-oriented research, development, demonstration and deployment by government-industry-entrepreneurial technology teams, international in scope, focused on some combination of (1) coal gasification driving integrated combined power cycles for electricity and hydrogen with carbon capture and storage, (2) nuclear power with reactors and fuel cycles designed for operational safety, environmentally benign waste disposal, nonproliferation to weapons, and longevity of the fuel feedstock and (3) renewable energy source, mainly solar, wind and geothermal, with transmission and storage enabling technologies sufficient to supply electricity demand worldwide. Ideally, by midcentury personal transportation alternatives to petroleum-fueled internal combustion engines are in place -- electric, biofuel and/or hydrogen cars and trucks, as well as carbon-neutral aircraft. Even so, meeting a two-degree or less global warming target implies massive energy end use demand-reducing technologies and lifestyle changes equivalent to Lovins' negawatts.

My utopian vision includes equity for economically developing nations, not only because it's ethically desirable -- humankind, after all, is one global family -- but because it fosters stable human populations, economic development being a most effective contraceptive. The central questions of whether high tech civilization is sustainable, and for how long, in light of available energy resources, and whether it can be made consilient with natural ecosystems in time to stem the tide of humankind's species extinctions, will by midcentury be understood. We might not have implemented the solutions, but the outlines of a world with equity, material well-being, human health and biodiversity will be there. We will be able to answer in the affirmative that we naked apes, evolved as we are as tribal hunter-gatherers on the African savanna, can, even with our limited and irrational reptilian brains and amygdalae, penetrate the dangerous and uncharted waters ahead to a world in which human science and technology coexist in harmony with the natural world. Earth is, of course, our cradle. And some will want to remain forever on the Green Hills of Earth. But as Konstantin Tsiolkovsky put it, "The Earth is the cradle of the mind, but we cannot live forever in a cradle." My vision extends to an Earth by midcentury powered in part by sunlight collected in geostationary orbit beamed to the surface, crewed missions to mars establishing early outposts, and humankind on it's way to bringing the spark of self-awareness to the stars and universe beyond. . . (470 Words)