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GEM*STAR: Time for an Alternative Way Forward

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The presumption that nuclear reactors will retain their role in global energy production is constantly being challenged - even more so following recent events at Fukushima. Nuclear energy, despite being "green," has inexorably been coupled in the public mind with three paramount concerns: safety, weapons proliferation, and waste (and then ultimately cost). Over the past four decades, the safety of deployed fleets has greatly improved, yet the capital and political costs of a "nuclear energy option" appear insurmountable in several countries. The US approach to civilian nuclear energy has become deeply entrenched, first through choices made by the military, and then by the deployed nuclear reactor fleet. This extends to the research agencies as well, to the point where basic sciences and nuclear energy operate in separate spheres. But technologies and priorities have changed, and the time has arrived where a transformative re-think of nuclear energy is not only possible, but urgent. And nuclear physicists are uniquely positioned to accomplish this. This talk will show that by asking, and answering,"what would an accelerator-driven civilian nuclear energy program look like," ADNA Corporation's GEM*STAR design directly addresses all three fundamental concerns: safety, proliferation, and waste - and also the final hurdle: cost. GEM*STAR is not an "add-on" (to either Project-X, or GEN III+), but rather a base-line energy production capacity, for either electricity or transport fuel production. It integrates and advances the molten-salt reactor technology developed at ORNL, the MW beam accelerator technologies developed by basic sciences, and a reactor/target design optimized for accelerator driven-systems. The results include: the ability to use LWR spent fuel without reprocessing or additional waste; the ability to use natural uranium; no critical mass ever present; orders-of-magnitude less volatile radioactivity in the core; more efficient use of, and deeper burn of actinides, without additional waste; proliferation resistance (no enrichment or reprocessing); high-tolerance to "beam-trips"; and ultimately, and perhaps most importantly, lower cost electricity or diesel fuel than any currently envisioned new energy source.