ON THE NEED FOR U.S. IMPLEMENTATION OF THE INTEGRAL FAST REACTOR

George S. Stanford — February, 2010

The IFR ties into a very big picture -- international stability, prevention of war, and avoiding "proliferation" (spread) of nuclear weapons.

- The need for energy is the basis of many wars, including the ones we are engaged in right now (Iraq and Afghanistan). If every nation had enough energy to give its people a decent standard of living, that reason for conflict would disappear.

- The only sustainable energy source that can provide the bulk of the energy needed is nuclear power.

- The current need is for more thermal reactors -- the kind we now use.

- But for the longer term, to provide the growing amount of energy that will be needed to maintain civilization, the only proven way available today is with fast-reactor technology.

- The most promising fast-reactor type is the IFR -- metal-fueled, sodium-cooled, with pyroprocessing to recycle its fuel.

- Nobody knows yet how much IFR plants would cost to build and operate. Without the commercial-scale demo of the IFR, along with rationalization of the licensing process, any claims about costs are simply hand-waving guesses.

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Background info on proliferation (of nuclear weapons). Please follow the reasoning carefully.

- Atomic bombs can be made with highly enriched uranium (90% U-235) or with good-quality plutonium (bomb designers want plutonium that is ~93% Pu-239).

- For fuel for an LWR, the uranium only has to be enriched to 3 or 4% U-235.

- To make a uranium bomb you don't need a reactor -- but you do need access to an enrichment facility or some other source of highly enriched uranium..

- Any kind of nuclear reactor can be used to make weapons-quality plutonium from uranium-238, but the uranium has to have been irradiated for only a very short period. In other words, nobody would try to make a plutonium weapon from ordinary spent fuel, because there are easier ways to get plutonium of much better quality.

- Plutonium for a weapon not only has to have good isotopic quality, it also has to be chemically uncontaminated. Thus the lightly irradiated fuel has to be processed to extract the plutonium in a chemically pure form. But mere possession of a reactor is not sufficient for a weapons capability -- a facility using a chemical process called PUREX is also needed.

- Regardless of how many reactors a country has, it cannot have a weapons capability unless it has either the ability to enrich uranium or to do PUREX-type fuel reprocessing.

- Therefore, the spread of weapons capability will be strongly inhibited if the only enrichment and reprocessing facilities are in countries that already have a nuclear arsenal.

- But that can only happen if countries with reactors (and soon that will be most of the nations of the world) have absolutely ironclad guarantees that they can get the fuel they need even if they can't make their own, regardless of how obnoxious their political actions might be.

- Such guarantees will have to be backed up by some sort of international arrangement, and that can only come to pass if there is effective leadership for the laborious international negotiations that will have to take place. (For a relevant discussion, see <http://www.sustainablenuclear.org/PADs/pad0611marsh.pdf>.)

- At present. the only nation that has a realistic potential to be such a leader is the United States.

- But a country cannot be such a leader in the political arena unless it is also in the technological forefront.

- The United States used to be the reactor-technology leader, but it abandoned that role in 1994 when it terminated the development of the IFR.

- Since then, other nations -- China, India, Japan, South Korea, Russia, France -- have proceeded to work on their own fast-reactor versions, which necessarily will involve instituting a fuel-processing capability.

- Thus the United States is being left behind, and is rapidly losing its ability to help assure that the global evolution of the technology of nuclear energy proceeds in a safe and orderly manner.

- But maybe it's not too late yet. After all, the IFR is the fast-reactor technology with the post promise (for a variety of reasons), and is ready for a commercial-scale demonstration to settle some uncertainties about how to scale up the pyroprocess as needed, to establish better limits on the expected cost of production units, and to develop an appropriate, expeditious licensing process.

- Such a demo will require federal seed money. It's time to get moving.

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