There is no perfect energy source. Each and every one has its own advantages and compromises. This series will explore the pros and cons of various energy sources. Learn about other forms of energy generation here.

Last August, I posted an article on Thorium reactors, a form of nuclear power that supposedly overcomes many of the concerns associated with traditional nukes. Despite my admittedly anti-nuclear bias, I had heard enough good things about this technology to want to learn more and share what I learned. The technology has attracted an enthusiastic following, many of who feel that this is the best of all currently available alternatives. Supporters claim that it sufficiently addresses the numerous issues that have made nuclear a less attractive, if not outright frightening option.

Among the concerns about traditional nuclear are the following:

1. Proven risks of dangerous meltdowns (e.g. Fukushima. Japan is now shutting down all reactors).
2. Very long time required for approval and construction.
3. Potential terrorist target.
4. Too big to be liable, taxpayers will likely pick up the cost of an accident.
5. Highly centralized and capital intensive.
7. High level of embedded CO2 in concrete and steel.
8. Dangerous radioactive waste lasts 200 – 500 thousand years.
9. No operating long-term waste storage sites in the U.S.
10. Shipping nuclear waste poses an increased potential risk of spills or interception by terrorist groups.
11. Fissile material can be converted into nuclear weapons.
12. High construction costs generally requiring subsidies and loan guarantees.
13. Competes with renewables for investment dollars.

Unlike conventional light water reactor designs, the liquid fluoride thorium reactor (LFTR) is a type of molten salt reactor (MSR), that was first demonstrated in the 1960s. It is generally considered inherently safer, cleaner and more economically viable than conventional reactors, but was not chosen by DOE as the technology of choice because it did not produce weapons grade material as a byproduct, something DOE was looking for at the time. That would be considered an advantage today. (11)

This design is less radioactive and more proliferation resistant. Its reaction in a molten-salt reactor (MSR) does produce U233 but that is apparently not a weapons-grade material. Thorium is about four times more abundant in nature than uranium (6). The largest reserves are in Australia, India, and the U.S.

LFTR reactor cores are not pressurized. Any increase in temperature results in a reduction in power, thus eliminating the problematic runaway meltdown scenario. If the fluid should get too hot, a salt plug at the bottom of the tank simply melts dumping the entire mess in to a storage vessel directly below the reactor. (1,4)

The question of waste (8,9,10) is also far better. Thorium produces about a thousand times less waste throughout the supply chain than uranium. It is mostly consumed in the reaction. Of the remaining quantity, which is quite small (I’ve been told it’s about the size of a coke can for every billion kilowatt hours), 83 percent is safe within ten years and the remaining 17 percent requires 300 years of storage before it becomes safe. While that is still a long time, it is far more manageable than the 10,000 years required for today’s spent fuel.

It is expected to cost far less than conventional reactors and because of its simplicity, it can be assembled in a factory (2) scaled down to the point where one can be carried on the back of a tractor-trailer and used in a
The technology already has a large following at sites like Nuclear Green and Energy From Thorium.

Pros:
- Carbon-free operation
- Inherently far safer than conventional light water reactors
- Abundant fuel (thorium)
- Chemically stable
- Currently being developed in China and by US companies like Flibe
- Very small amount of low-level radioactive waste. Should be much easier to manage.
- Concentrated energy source, requiring far less land than solar
- Runs round the clock, good base-load and load-following source
- Less suitable for weapons proliferation that conventional nuclear
- Relatively low cost and scalable
- Could potentially be used in a distributed manner
- Technology is currently at the demonstration phase
- Requires less cooling water than conventional reactors

Cons
- Non-renewable fuel
- Still produces hazardous waste (though far less)
- Can still facilitate proliferation of nuclear weapons
- Quite different than current technology
- Primarily conceived as a centralized plant
- Like all big plants, could be a terrorist target
- Technology not ready for prime time yet
- Competes with renewables for investment dollars

Because of the first two items on the cons list, I consider thorium to be ultimately unsustainable in the very long term, though I do believe it can play a significant role for several generations, if needed. For me, the perfect energy source requires no fuel and, like nature, produces no waste. But those that meet that criteria today (e.g. wind, solar) are intermittent and have a low energy density which means they require quite a bit of land, which is also a problem. I suggest you become familiar with thorium energy, as I expect you will be hearing more about it in the future.

What about other energy sources?
- Pros and Cons of Wind Power
- Pros and Cons of Fusion Power
- Pros and Cons of Tar sands oil
- Pros and Cons of Solar Heating and Cooling
- Pros and Cons of Concentrating Solar Power
- Pros and Cons of Solar photovoltaics
- Pros and Cons of Natural Gas
- Pros and Cons of Fuel Cell Energy
- Pros and Cons of Biomass Energy
- Pros and Cons of Combined Heat and Power
- Pros and Cons of Clean Coal
- Pros and Cons of Algae Based Biofuel
Pros and Cons of Liquid Fluoride Thorium Power
Pros and Cons of Tidal Power
Pros and Cons of Nuclear Energy

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A con to add: thorium will take decades to develop and roll out at best according to all independent experts. Also, - the pro of "relatively low cost" is totally unknown. It may be way more expensive or cheaper, but no one knows - land use is also an unknown as there is no viable design at this time - there are zero thorium commercially viable reactors in the world despite decades of development, especially by India

P.S. I've put together a list of links to numerous independent reports from various sources including MIT, the UK’s National Nuclear Laboratories, IEER, and many others for those interested:

Thorium Nuclear Information Resources
http://kevinmeyerson.wordpress...