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2012 New Hampshire

"Thousand year energy plan"
powered by THORIUM

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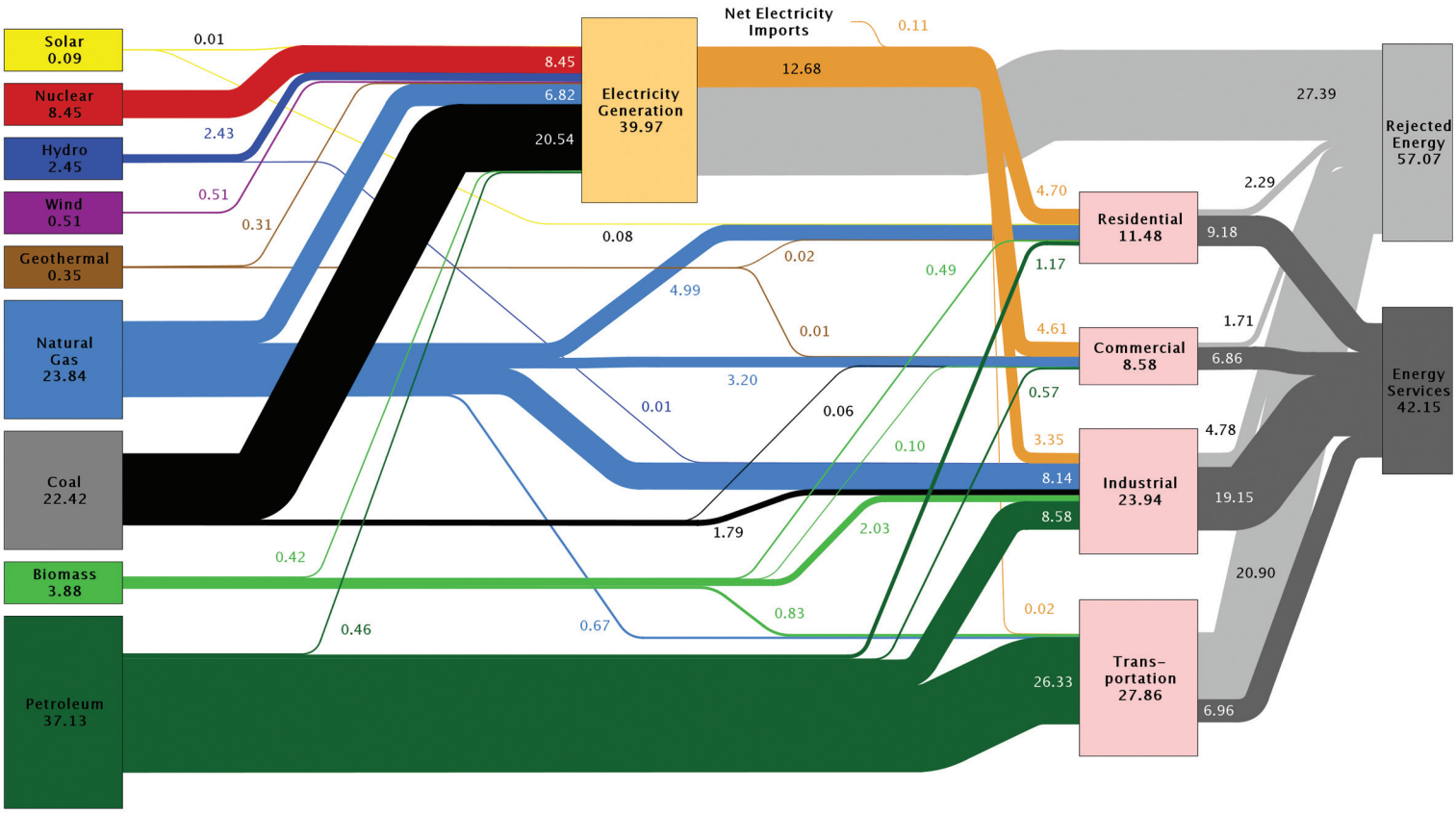
Estimated U.S. Energy Use in 2008: ~99.2 Quads



The Problem - US energy usage will double by mid-century. World usage is growing at 2 to 3 times the US rate, and their usage profile is similar to ours. In the diagram, the light grey shows that today 57.5% of our produced energy is wasted, primarily through electricity generation and automotive ineffiency. To stall worsening climate change, we must drastically diminish greenhouse gas emissions and therefore fossil fuels. Alternative sources such as solar and wind are good, but expensive and lack energy density to replace our existing carbon-based sources, let alone expand to meet future need. Even if the US spends trillions to satisfy our requirements, we still lose because the rest of the world will still be fossil fuel based. We need a low cost, non-carbon, energy-dense solutions that we can also export abroad. Thus, Thorium.

Thorium Energy Overview

Element

- Atomic number/weight = 90/232
- Abundance in the crust – almost 4 times more plentiful than uranium
- Isotope distribution – nearly 100% Thorium - 232. Implies no refining/enrichment necessary
- Half life = 1.39x1010yr. Implies that it is extremely stable in its natural state and can be handled safely
- US has 15% of global reserves of thorium. US has supply buried in desert, enough for first 10 years

By-product of uranium mining. If thorium can be extracted from uranium tailings, then no new mines would be required for some time. Enough Thorium for more than 1000 years

Reactor Properties

- Most popular design is a molten salt reactor (MSR), i.e., a liquid fluoride thorium reactor (LFTR)
- Requires a jump start from a neutron source to get the chain reaction going. Uses closed-loop continuous feed where the generated Uranium – 233 produces the neutrons to sustain it
- Fuel efficiency – nearly 100% consumed with thorium versus 1% with a typical solid fuel uranium reactor. Much more energy delivered with a Thorium than a uranium reactor per unit of fuel input
- Thorium reactor operating pressure near normal atmospheric. Up to 160 atmospheres needed for current reactors, requiring special containment vessels. Thorium implies smaller safer, less expensive, less complicated reactors
- Automatic shut down features. Low fuel will cause loss of critical mass. High temperature will melt a salt plug causing fuel to go to storage tanks where it will solidify. No melt down or explosion causing radioactive fallout. Safe from earthquakes and tsunamis
- MSR reactors can also consume our millions of tons of spent fuel from traditional uranium reactors

Operations

- Scaleable and modular. Can be built as shipping containers. Lends itself to normal manufacturing techniques/ standardized quality control. Volumes of 1+/day are doable like Boeing 747s
- Install almost anywhere. Operating safety precautions needed. Security needed for wastes
- Thorium based electricity as cheap as that from coal, i.e. $0.02/KWH
- No greenhouse emissions. No air pollution. No coal ponds, etc. Much greener
- Cheaper than uranium-based electricity
- Cheaper than solar and wind energy, requires less space. Can operate 24/7
- Hard to remove materials for weapons without shutting down reactor or killing yourself
- Quantity of radioactive waste from a thorium reactor would be one hundredth that of a uranium reactor Waste decay rates are 1000 times shorter than uranium wastes or better

Need Fulfillment

- US would no longer need to fashion its entire foreign policy around oil. No more oil wars
- Global population will grow from 6.7B people today to 9B by 2050
- Energy consumption per person is increasing
- Low cost/local energy source would propel manufacture, creating jobs
- Program would cut oil imports to near zero, while increasing exports
- Low cost abundant energy propels prosperity and diminishes population growth in third world

Program

2010	2015	2020	2060
Development	Build Manufacturing	Produce/Export	Fossil fuel plants replaced*

- Assumes one 100MW LFTR produced per day
- Funding? – Current Nuclear Waste Fund has about $25B. If Congress redirected, no effect on budget
- New industry about the size of the US aircraft industry
- Chinese Academy of Sciences announced 1/25/11. We invented this technology. We should lead