Aol Energy.

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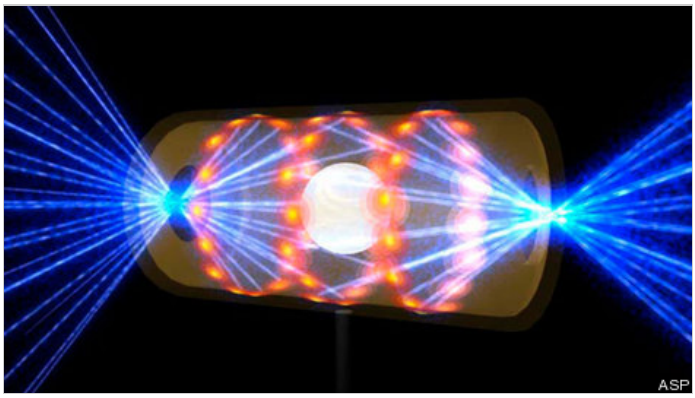
Technology

Fusion For The Future

By **Andrew Holland**



America faces a series of significant challenges regarding how we produce and use energy over the next several decades. Our current energy system undermines our national security, is economically unstable, and environmentally unsustainable.

Although the recession has reduced energy demand, in the longer term the US is expected to see a 20% increase in total energy demand and a 30% increase in electricity demand by 2035.

Meanwhile, our existing infrastructure is aging. Of the approximately 1400 coal-fired generators, 104 nuclear reactors, and over 5000 natural gas power plants, almost all will have to be replaced or substantially retrofitted over the next 40 years.

These challenges will require our politicians, scientists, and business leaders to make a series of choices about what we want our energy system to look like in 2030 and 2050.

Fundamentally, this represents a choice: either business as usual or a new course that firmly establishes American leadership in clean, sustainable energy production.

Renewable power, like wind and solar, together with increased efficiency and conservation measures, must be a part of the new energy paradigm. But, when you look beyond the medium term, there are real questions about whether a modern grid can support the intermittency and unpredictability of a grid that is more than half-powered by renewables.

Electricity from fusion could provide the baseload power necessary to overcome this.

> *“ At the heart of fusion energy is the world's most famous equation, E=mc^2.*

Fusion energy is obtained by forcing together atomic nuclei from deuterium, a form of hydrogen easily separated from ordinary seawater, and tritium (another form of hydrogen).

A single gram of fuel can yield 90,000-kilowatt hours of energy. Put another way, it would take 10 million pounds of coal to yield as much energy as one pound of fusion fuel. This energy will become heat to make steam running a conventional electric generator.

Fusion is clean, safe, and sustainable. The supply of fuel (extracted from seawater and lithium) is essentially limitless, due to the small amounts of fuel required. Unlike traditional nuclear power, there is no chain reaction and there is no possibility of a meltdown. A fusion reaction releases no pollutants or greenhouse gases and leaves no dangerous spent fuel.

Fusion is happening in laboratories in America and around the world. But, achieving a commercially viable fusion reaction remains a great engineering challenge. The problem is that initiating fusion requires bringing the fuel to extremes of heat or pressure. Initiating and containing that reaction – commonly done with either magnets or lasers – has always required putting more energy in than comes out.

However, experiments planned for this year and next within the National Ignition Facility at Lawrence Livermore National Laboratory are expected to yield pulses of fusion energy greater than that used by the huge laser array to trigger them. Achieving this "ignition" will be an important milestone on the way to commercialized power from fusion.

The leaders of the main US national labs say they are now ready to start building pilot plants to test how to progress toward commercialization. For the first time, we can foresee a road to commercial fusion power plants.

Even though fusion energy can provide ultimate energy security for America, a lack of leadership, political will, and strategic planning by the US government could allow China or others to be the first to successfully commercialize this new industry. Only a few weeks ago the Chinese announced that they are planning to train 2,000 scientists to pursue research and development into fusion. We could choose to sit back and let other countries lead – but that would cede the world's next great industry to foreign companies and foreign workers.

Fusion is not a panacea, and it is not without cost. But, we know that our aging energy infrastructure will require America's utility companies to replace the current generation of power plants with something. Why not a true energy of the future?

This is not some far-away dream; the choices we make today will shape the energy system of tomorrow.

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Photo Caption: *NIF Hohlraum - This artist's rendering shows a NIF target pellet inside a hohlraum capsule with laser beams entering through openings on either end. The beams compress and heat the target to the necessary conditions for nuclear fusion to occur. Ignition experiments on NIF will be the culmination of more than 30 years of inertial confinement fusion research and development, opening the door to exploration of previously inaccessible physical regimes.*