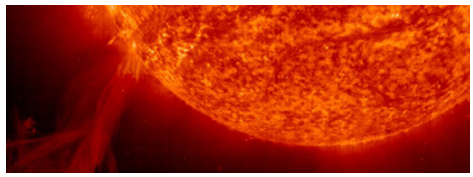
FACT SHEET

What is Fusion Power?



Introduction

Fusion is the same process that powers the sun.

Fusing two hydrogen atoms releases enormous amounts of energy – the result of the world's most famous equation, $E=mc^2$. The energy released from that fusion reaction could be used to generate electricity, just like any power plant operating today.

Fusion holds the promise of providing a nearly inexhaustible supply of energy.

Even better, no pollutants or greenhouse gases are emitted, and there is no threat of a nuclear meltdown like there is with the nuclear fission reactors of today.

Fusion is clean, safe, secure and abundant, and it will completely revolutionize the world's energy system when commercialized.

Why do we need fusion?

- The U.S. relies upon a range of energy sources to fuel its economy. But, the current energy mix contributes to climate change, which presents national security concerns for the United States.
- Scientists estimate that global greenhouse gas emissions will need to peak and decline over the next few decades to deal with the climate crisis. Current energy technologies can contribute, but fully scaling-up low-carbon technologies will require technological breakthroughs.[1]
- Incremental improvements will not solve the climate problem; phasing out greenhouse gas emissions from America's economy will require transformational change in energy technologies.

There is broad agreement that an 'all of the above' strategy on energy. We need new baseload power that is carbon-free. Today, nuclear power can meet that – but we will also need research and development into new technologies. American leadership is on the line.

ASP Board Member
Gov. Christine Todd Whitman

- Fusion has the potential to meet the needs of tomorrow's economy by providing carbon-free base load power.
- As a source of cheap, abundant, base load power, fusion could be harnessed for more than just electricity, including a range of industrial processes.
- It is not an exaggeration to say that fusion power would revolutionize America's economy.

The Benefits of Fusion

- Energy from fusion produces no greenhouse gases or air pollutants. Only clean power is generated during fusion.
- Fusion does not rely upon a chain reaction. Unlike nuclear fission, there is no chance of a runaway reaction that could lead to a meltdown. In the event of an equipment failure, the small amount of fuel available stops reacting instantly and the plant cools automatically. [2]
- Fusion produces energy by fusing together two hydrogen isotopes – deuterium and tritium. These two isotopes are virtually inexhaustible.[3]
- Deuterium comes from ocean water, and tritium, though limited today, will be produced from lithium as a byproduct of the reaction. Fusion therefore holds the promise of complete energy security.
- The only byproducts of the fusion process are helium and a fast neutron, which carries the heat to make steam, meaning there is none of the long-lived radioactive waste produced by conventional nuclear fission reactors.
- The positive spillover effects of the U.S. fusion program are already being felt. Fusion scientists are making advancements in superconductors, super-power lasers, new high-efficiency semiconductor light sources, large and small-scale robotics, and supercomputing and modeling.

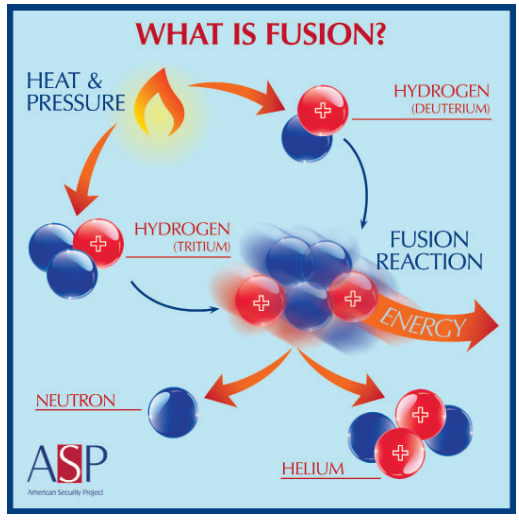
The U.S. continues to fall behind in its scientific competitiveness.

As one major example, research into fusion power could lead to safe, affordable, clean, and sustainable energy,. Yet other nations such as China and South Korea are pushing much harder than we to commercialize fusion.

If we don't set it as a national priority ourselves, we are in danger of losing this race, too.

ASP Board Member
Norman R. Augustine

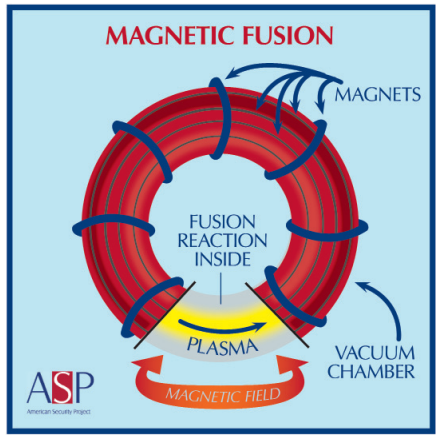
Approaches to Fusion



By pushing together and fusing two hydrogen atoms, enormous amounts of energy could be produced, which is at the heart of the world's most famous equation, $E=mc^2$. The heat energy released from a fusion reaction could be used, like power plants today, to spin a steam generator to make electricity.

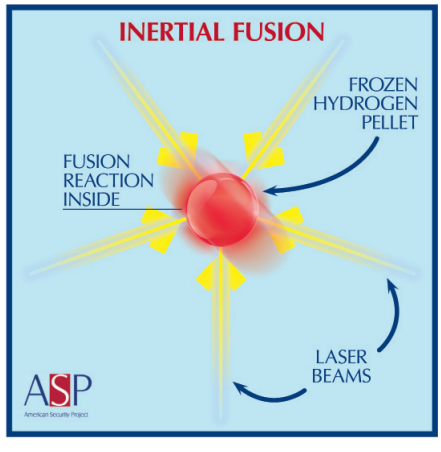
There is important progress being made towards this goal from the two main approaches to fusion energy – magnetic confinement fusion and inertial confinement fusion. Both approaches have plans to commercialize fusion energy in the coming years.

Magnetic Confinement Fusion (MCF)



- With MCF, magnetic fields confine a hot plasma in a donut-shaped machine called a "tokamak."
- Plasma is a hot gas that is needed to force hydrogen atoms to fuse together.
- Once the atoms fuse together, energy is released, which can be harnessed to produce electricity like ordinary power plants.
- The leading magnetic fusion energy institutions in the U.S. are located at MIT, Princeton Plasma Physics Laboratory, and General Atomics.

Inertial Confinement Fusion (ICF)



- Inertial confinement fusion uses lasers to heat and implode a fuel pellet, which contains hydrogen.
- The National Ignition Facility (NIF) in California is the leading ICF facility in the world.
- The NIF is working towards achieving "ignition" - producing more energy out than is put in.
- After the NIF proves "ignition" is possible, the next step is to build a full-scale demonstration power plant.

Further Reading

WHITE PAPER: Fusion Power – A 10 Year Plan to Energy Security

Factsheet: Inertial Confinement Fusion at the National Ignition Facility

Map: Fusion's Reach Across America

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Endnotes

1. Davis, S., Cao, L., Caldeira, K., & Hoffert, M. (2012). Rethinking wedges. Environmental Research Letters, 1-8.

2. Princeton Plasma Physics Laboratory. (2012). Fusion Advantages. Retrieved October 2012, from PPPL web site: http://www.pppl.gov/fusionadvantages.cfm

3. Princeton Plasma Physics Laboratory. (2012). Fusion Advantages. Retrieved October 2012, from PPPL web site: http://www.pppl.gov/fusionadvantages.cfm