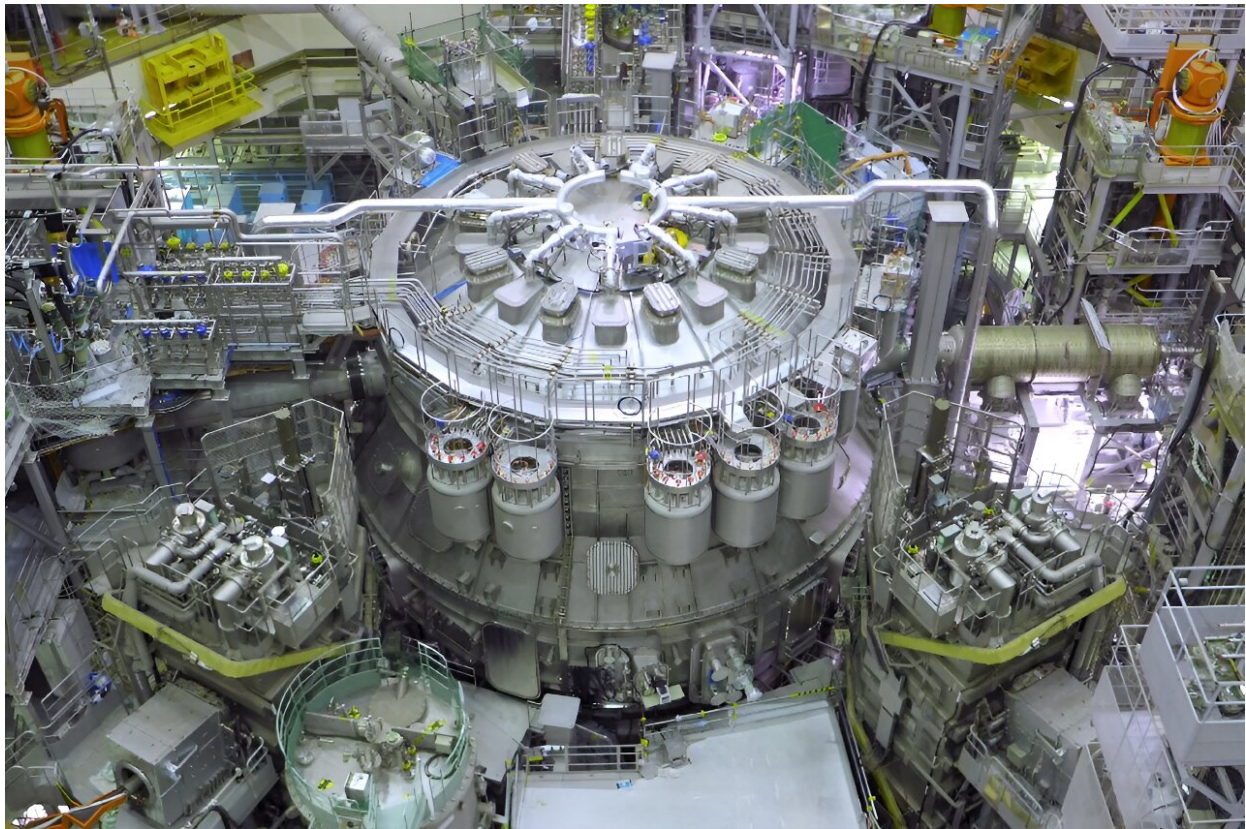


Japanese experimental nuclear fusion reactor inaugurated

December 1 2023



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Fusion differs from fission, the technique currently used in nuclear power plants, by fusing two atomic nuclei instead of splitting one.

The goal of the JT-60SA reactor is to investigate the feasibility of fusion as a safe, large-scale and carbon-free source of net energy—with more energy generated than is put into producing it.

The six-story-high machine, in a hangar in Naka north of Tokyo, comprises a donut-shaped "tokamak" vessel set to contain swirling plasma heated up 200 million degrees Celsius (360 million degrees Fahrenheit).

It is a joint project between the European Union and Japan, and is the forerunner for its big brother in France, the under-construction International Thermonuclear Experimental Reactor (ITER).

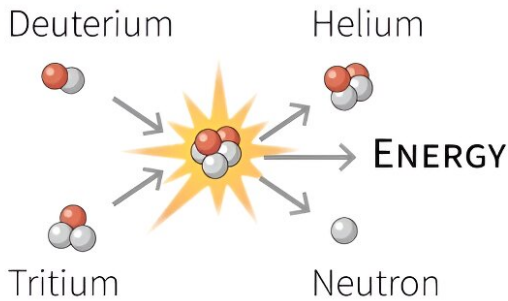
The ultimate aim of both projects is to coax hydrogen nuclei inside to fuse into one heavier element, helium, releasing energy in the form of light and heat, and mimicking the process that takes place inside the sun.

Researchers at ITER, which is over budget, behind schedule and facing major technical problems, hope to achieve nuclear fusion technology's holy grail, net energy.

Fusion vs fission

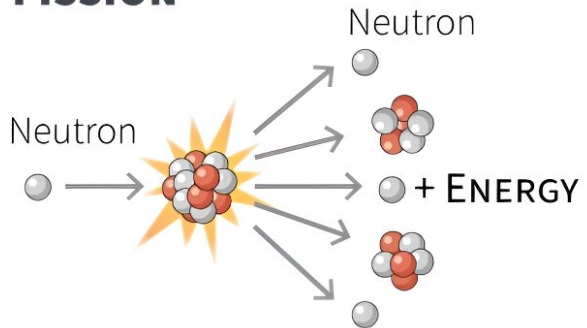
Nuclear reactions that produce massive amounts of energy, but have different processes

FUSION



Joins 2 or more lighter atoms into a heavier one

FISSION



Splits a larger atom into 2 or more smaller particles

Sources: US Energy Dept, Duke Energy, EIA



Graphic comparing nuclear fusion vs fission, two physical processes that produce massive amounts of energy and yield millions of times more energy than other energy sources.

Sam Davis, deputy project leader for the JT-60SA, said the device will "bring us closer to fusion energy".

"It's the result of a collaboration between more than 500 scientists and engineers and more than 70 companies throughout Europe and Japan," Davis said at Friday's inauguration.

EU energy commissioner Kadri Simson said the JT-60SA was "the most advanced tokamak in the world", calling the start of operations "a milestone for fusion history".

"Fusion has the potential to become a key component for energy mix in the second half of this century," Simson added.

The feat of "net energy gain" was managed last December at the National Ignition Facility at Lawrence Livermore National Laboratory in the United States, home to the world's largest laser.

The US facility uses a different method to ITER and the JT-60SA known as inertial confinement fusion, in which high-energy lasers are directed simultaneously into a thimble-sized cylinder containing hydrogen.

The US government called the result a "landmark achievement" in the quest for a source of unlimited, clean power and an end to reliance on carbon-emitting fossil fuels that cause climate change as well as geopolitical upheaval.

Unlike fission, fusion carries no risk of catastrophic nuclear accidents—like that seen in Fukushima in Japan in 2011—and produces far less radioactive waste than current power plants, its proponents say.

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