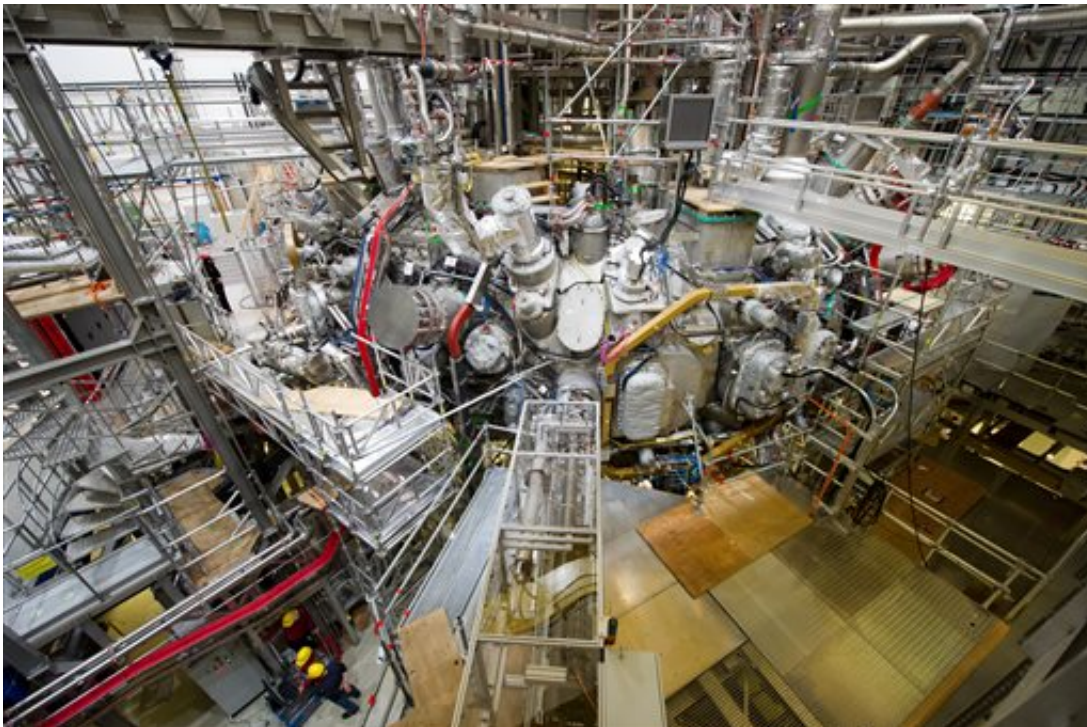


Scientists in Germany switch on nuclear fusion experiment (Update)

February 3 2016



This Dec. 10, 2015 file photo shows the nuclear fusion research center at the Max Planck Institute for Plasma Physics where the first plasma has been produced at the "Wendelstein 7-X" in Greifswald, Germany. Scientists are poised to flip the switch on an experiment that could take them a step closer to the goal of generating clean and cheap nuclear power. Researchers at the institute plan to inject hydrogen into a doughnut-shaped device to produce a super-hot gas known as plasma. A test on Wednesday, Feb. 3, 2016, will show whether the 400-million-euro (US \$ 435-million) device can handle hydrogen, which would be the fuel in future fusion reactors. (Stefan Sauer/dpa via AP, File)

Scientists in Germany flipped the switch Wednesday on an experiment they hope will advance the quest for nuclear fusion, considered a clean and safe form of nuclear power.

Following nine years of construction and testing, researchers at the Max Planck Institute for Plasma Physics in Greifswald injected a tiny amount of hydrogen into a doughnut-shaped device—then zapped it with the equivalent of 6,000 microwave ovens.

The resulting super-hot gas, known as plasma, lasted just a fraction of a second before cooling down again, long enough for scientists to confidently declare the start of their experiment a success.

"Everything went well today," said Robert Wolf, a senior scientist involved with the project. "With a system as complex as this you have to make sure everything works perfectly and there's always a risk."

Among the difficulties is how to cool the complex arrangement of magnets required to keep the plasma floating inside the device, Wolf said. Scientists looked closely at the hiccups experienced during the start-up of the Large Hadron Collider in Switzerland more than five years ago to avoid similar mistakes, he said.

The experiment in Greifswald is part of a world-wide effort to harness nuclear fusion, a process in which atoms join at extremely high temperatures and release large amounts of energy that's similar to what occurs inside the sun.



German chancellor Angela Merkel prepares to press the start button next to the head of the Max Planck Institute for Plasma Physics Sibylle Guenter , left, and Mecklenburg-Western Pomerania governor, Erwin Sellering, right at the Wendelstein 7-X' nuclear fusion research center at the Max-Planck-Institut for Plasma Physics in Greifswald, Germany Wednesday Feb. 3, 2016. Scientists flipped the switch on an experiment they hope will advance the quest for nuclear fusion, considered a clean and safe form of nuclear power. (Bernd Wuestneck/dpa via AP)

Advocates acknowledge that the technology is probably many decades away, but argue that—once achieved—it could replace fossil fuels and conventional nuclear fission reactors.

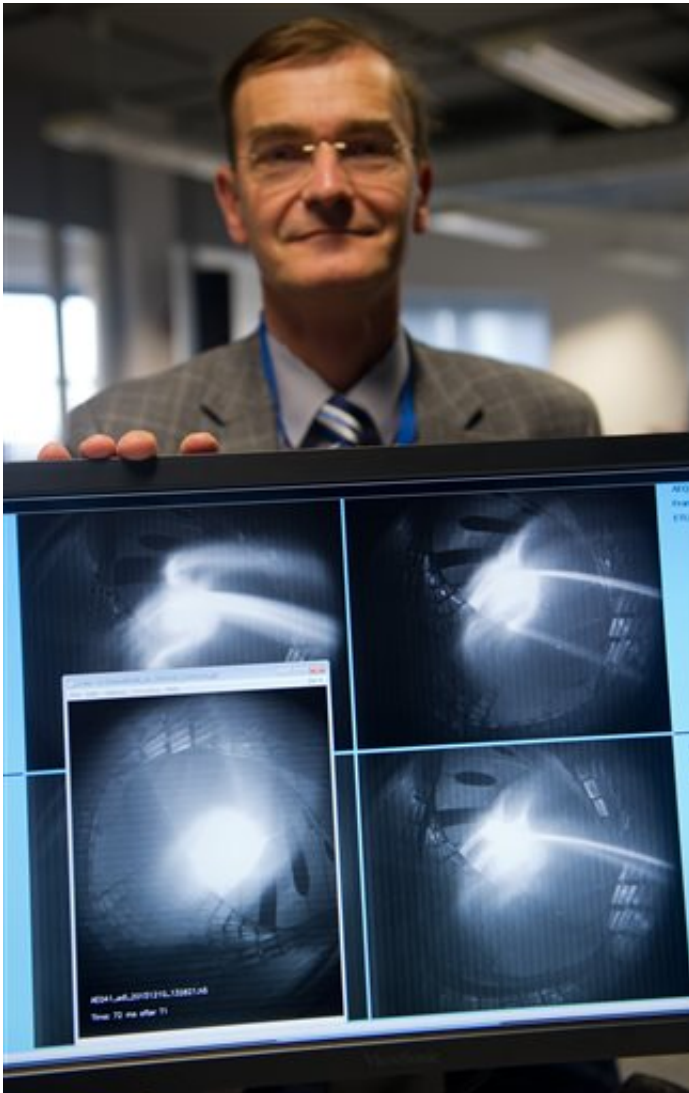
Construction has already begun in southern France on ITER, a huge international research reactor that uses a strong electric current to trap plasma inside a doughnut-shaped device long enough for fusion to take place. The device, known as a tokamak, was conceived by Soviet

physicists in the 1950s and is considered fairly easy to build, but extremely difficult to operate.

The team in Greifswald, a port city on Germany's Baltic coast, is focused on a rival technology invented by the American physicist Lyman Spitzer in 1950. Called a stellarator, the device has the same doughnut shape as a tokamak but uses a complicated system of magnetic coils instead of a current to achieve the same result.

The Greifswald device should be able to keep plasma in place for much longer than a tokamak, said Thomas Klinger, who heads the project.

"The stellarator is much calmer," he said in a telephone interview ahead of the start. "It's far harder to build, but easier to operate."



In this Dec. 10, 2015 file photo technical director Hans-Stephan Bosch holds up computer images showing the first plasma generated at the "Wendelstein 7-X" nuclear fusion research centre at the Max Planck Institute for Plasma Physics in Greifswald, Germany. Scientists are poised to flip the switch on an experiment that could take them a step closer to the goal of generating clean and cheap nuclear power. Researchers at the institute plan to inject hydrogen into a doughnut-shaped device to produce a super-hot gas known as plasma. A test on Wednesday, Feb. 3, 2016, will show whether the 400-million-euro (US \$ 435-million) device can handle hydrogen, which would be the fuel in future fusion reactors. (Stefan Sauer/dpa via AP, File)

Known as the Wendelstein 7-X stellarator, or W7-X, the 400-million-euro (\$435 million) device was first fired up in December using helium, which is easier to heat. Helium also has the advantage of "cleaning" any minute dirt particles left behind during the construction of the device.

Over the coming years the device, which isn't designed to produce energy itself, will slowly increase the temperature and duration of the plasma with the goal of keeping it stable for 30 minutes, Wolf said.

"If we manage 2025, that's good. Earlier is even better," he said.

Scientists hope that the W7-X experiment will allow them to test many of the extreme conditions such devices will be subjected to if they are ever to generate power.

David Anderson, a professor of physics at the University of Wisconsin who isn't involved in the project, said the project in Greifswald looks promising so far.



German chancellor Angela Merkel presses the start button next to Mecklenburg-Western Pomerania governor, Erwin Sellering, right at the Wendelstein 7-X' nuclear fusion research center of the Max-Planck-Institute for Plasma Physics in Greifswald, Germany Wednesday Feb. 3, 2016. Scientists flipped the switch on an experiment they hope will advance the quest for nuclear fusion, considered a clean and safe form of nuclear power. (Bernd Wuestneck/dpa via AP)

"The impressive results obtained in the startup of the machine were remarkable," he said in an email. "This is usually a difficult and arduous process. The speed with which W7-X became operational is a testament

to the care and quality of the fabrication of the device and makes a very positive statement about the stellarator concept itself. W7-X is a truly remarkable achievement and the worldwide fusion community looks forward to many exciting results."

While critics have said the pursuit of nuclear fusion is an expensive waste of money that could be better spent on other projects, Germany has forged ahead in funding the Greifswald project, costs for which have reached €1.06 billion euros in the past 20 years if staff salaries are included.

Chancellor Angela Merkel, who holds a doctorate in physics, personally pressed the button at Wednesday's launch.

"As an industrial nation we want to show that an affordable, safe, reliable and sustainable power supply is possible, without any loss of economic competitiveness," she said. "The advantages of fusion energy are obvious."

The Polish government, European Union and the U.S. Department of Energy also contributed funding for the project. The U.S. contribution, which included crucial error-correcting coils and imaging equipment, gives American scientists a chance to help develop cutting-edge technology and participate in the experiment, said Edmund J. Synakowski, the agency's associate director for fusion energy sciences.

Although there are about a dozen stellarator experiments around the world, including in the U.S., Japan, Australia and Europe, scientists say the Greifswald device is the first to match the performance of tokamaks.

"If the United States isn't at the table once scientists start asking questions that can only be answered here, then we're out of the game," Synakowski said.

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