

1 December 2023, Barcelona**MEMO: JT-60SA brings fusion energy a step closer****What is JT-60SA?**

JT-60SA (Japan Torus-60 Super Advanced) is a fusion device resulting from an international agreement in the field of science between Europe and Japan, known as the Broader Approach. It is the most powerful fusion device to date, using magnetic confinement, to study plasma operations. The knowledge will be shared with ITER, the biggest international experiment in this field under construction, and will ultimately help scientists to design future fusion power plants.

Where is it located?

The host of this prestigious experiment is Japan's National Institutes for Quantum Science and Technology (QST), located in Naka.

How will it operate?

JT-60SA is a toroidal (doughnut-shaped) device, known as "Tokamak", which operates with hydrogen. When heated to very high temperatures, the gas becomes plasma—the fourth state of matter. In the case of JT-60SA the gas will be heated to 200 million °C and will be magnetically confined for up to 100 seconds with the help of a powerful magnet system consisting of 28 superconducting coils operating in different parts of the machine.

When did works start?

The project started in 2007 and was completed in 2020 with the end of assembly.

Since then, a series of technical improvements were carried out, paving the way for first plasma operations which started at the end of 2023.

Who has contributed?

The European Union and Japan designated two organisations to co-ordinate their respective contribution:

- Fusion for Energy (F4E), the EU body managing Europe's contribution to ITER and the development of fusion energy, located in Barcelona, Spain
- National Institutes for Quantum and Radiological Science and Technology (QST), located in Naka, Japan

A number of European organisations, known as voluntary contributors, have provided resources, components, services and will continue to do so:

- EUROfusion, the European consortium consisting of 31 laboratories in the field of fusion, Germany
- Studiecentrum voor Kernenergie – Centre d'Etude de l'énergie Nucléaire (SCK-CEN), Belgium
- Karlsruhe Institute of Technology (KIT), Germany
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Spain

- Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA), France
- Consorzio RFX and CNR, Italy
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Italy

In total, 500 researchers from Europe and Japan have been involved, and more than 70 suppliers have contributed to the manufacturing of its components.

How much did it cost?

The overall cost of the project for the phase of construction (2007-2020), is estimated to be in the range of 560 million EUR in today's values, shared between Europe and Japan. 80% of the European contribution was provided by the voluntary contributors, while the remaining 20% by F4E, directly funded by the EU budget.

During the phase of operation, starting in 2020, the European contribution so far, is estimated to be in the range of 75 million EUR in today's values, directly provided by the EU budget. F4E has been providing 80% of the European contribution, while the remaining 20% has come from EUROfusion for the supply of hardware.

What will be the impact of JT-60SA?

- All knowledge will be shared with ITER, the biggest international experiment in this field under construction, and ultimately help scientists to design future fusion power plants.
- The experiment will help us to take a step closer to fusion energy, which has the potential to provide abundant, safe, and climate-friendly energy.
- All lessons learnt from manufacturing, operation, repairs will be shared with the scientists, industry, and laboratories participating in the project.
- The experiment has already become a reference in the fusion community offering the new generation of experts with training opportunities, such as the first International Fusion School which was held in September 2023.
- Senior experts from EUROfusion and ITER Organization will also spend time at the JT-60SA facility to provide knowledge, learn and monitor operations.
- The project has fostered a stronger collaboration between companies and laboratories, while in parallel, promoted European know-how abroad.
- Its style of project management, and the creation of teams integrating experts from Europe and Japan, have received praise in nurturing a one team spirit focused on delivery, time efficiency, and cost containment.
- JT-60SA is a fine example of science diplomacy, highlighting the potential of science and technology in building bridges with other parties in areas of strategic importance such as energy and innovation.

Has there been any transfer of know-how from JT-60SA?

In a groundbreaking move towards a sustainable aviation industry, AIRBUS has set its sights on introducing a hydrogen-powered medium-haul aircraft with zero CO2 emissions by 2035.

Drawing from knowledge acquired in two fusion experiments (WEST and JT-60SA), in the fields of vacuum insulation and managing the risk of hydrogen leakage, CEA has signed a contract with AIRBUS to help the company address these technical challenges in designing the aircrafts of the future.