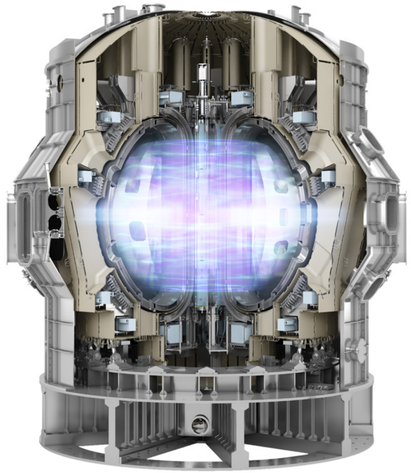
JT-60SA

JT-60SA (Japan Torus-60 Super Advanced) is a fusion device resulting from an international agreement in the field of science and technology between Europe and Japan, known as “Broader Approach”. On a political level, it is considered a fine example of science diplomacy, strengthening the ties between two parties in the field of fusion. Together they have developed the most powerful fusion device to date, using magnetic confinement, to study plasma operations. The host of this prestigious experiment is Japan’s National Institutes for Quantum Science and Technology (QST), located in Naka.

A total of 500 researchers from Europe and Japan have been involved, and more than 70 suppliers have contributed to the manufacturing of its components. Works started in 2007 and were 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 CONTRIBUTES?

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 have also provided resources, components, and services:

- 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’Energie Atomique et aux Energies Alternatives (CEA), France
- Consorzio RXF and CNR, Italy
- Agenzia nazionale per le nuove tecnologie, l’energia e lo sviluppo economico sostenibile (ENEA), Italy

WHAT IS FUSION?

Fusion is the process that powers the sun and other stars. When light atomic nuclei fuse together and form heavier ones, a large amount of energy is released.
Harnessing it on Earth, as an energy source, is a major scientific and technological challenge whose potential benefits are far-reaching:

- **The fuels required are widely available** reducing the risk of any geopolitical tensions and there are enough supplies to last millions of years;
- **Small amounts of fuel can generate plenty of energy:**
  60 kg of fusion fuel can provide the same amount of energy as 250 000 tonnes of oil;
- **No greenhouse gas emissions or long-lasting radioactive waste are produced** and fusion power plants would be inherently safe posing no risk to populations in the vicinity;
- Fusion plants would be able to **complement the power supply from renewables** by providing “baseload” electricity when needed.

€1 billion

is the price we pay in Europe for the energy we import daily

NO CO_2

emissions and no long-lasting radioactive waste are produced with **fusion**

60 kg

of fusion fuel generate the equivalent amount of energy of **250 000 tonnes** of oil

FUSION-SUSTAINABLE **ENERGY FOR THE FUTURE**

How can we address tomorrow’s energy needs?

Energy holds the key to our economic prosperity and social well-being. Today, Europe imports more than 50% of the energy it consumes at a cost of 1 billion EUR per day. We need to lower our dependency on fossil fuels to fight climate change, which is also responsible for economic losses amounting to 433 billion EUR over the last 25 years.

How can we promote growth and a cleaner planet for all?

A sustainable energy mix is the answer, and we are the forefront of developing one of the most promising long-term options: fusion power. Now more than ever, we need to cut down greenhouse emissions, combat climate change, and make the transition to a low-carbon economy.

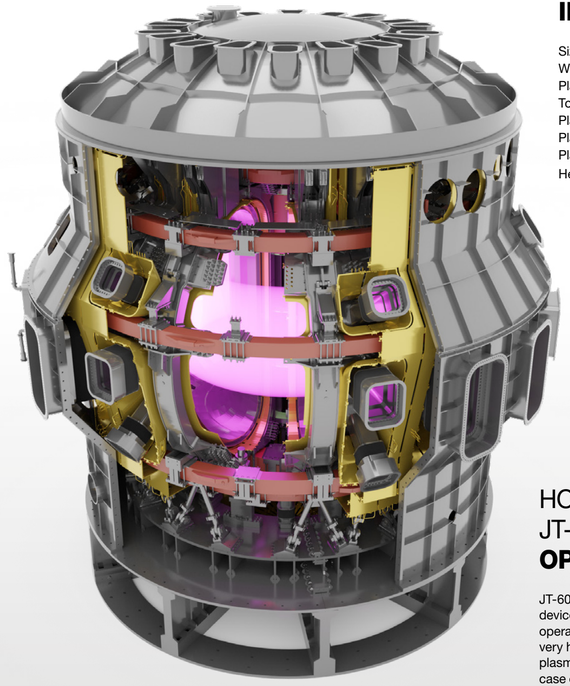
INVESTING **IN FUSION**

Investing in this new energy source will help companies, research organisations, and laboratories, to acquire expertise in new technologies, develop knowhow, and foster international partnerships which will yield significant commercial benefits. The establishment of supply chains are crucial for the manufacturing components in line with industrial standards for paving the way for commercial fusion.

FUSION **ROADMAP**

JT-60SA will help the scientific community to become more familiar with the development and operation of fusion devices, offer experts the possibility to study plasma operations, make available this new valuable knowledge to ITER—the biggest international fusion experiment, under construction in Europe.

THE MACHINE



JT-60SA **IN FIGURES**

Size: **13,7 m diameter x 15,4 m height**
Weight: **2600 tonnes**
Plasma current: **5.5 MA**
Toroidal magnetic field: **2.25 Tesla**
Plasma major radius: **3 m**
Plasma minor radius: **<1.18 m**
Plasma volume: **130 m3**
Heating power: **40 MW (during 100 s)**

HOW WILL JT-60SA **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.

FOR FURTHER INFORMATION
www.f4e.europa.eu
www.jt60sa.org
www.energy.ec.europa.eu

FUSION FOR ENERGY
QST