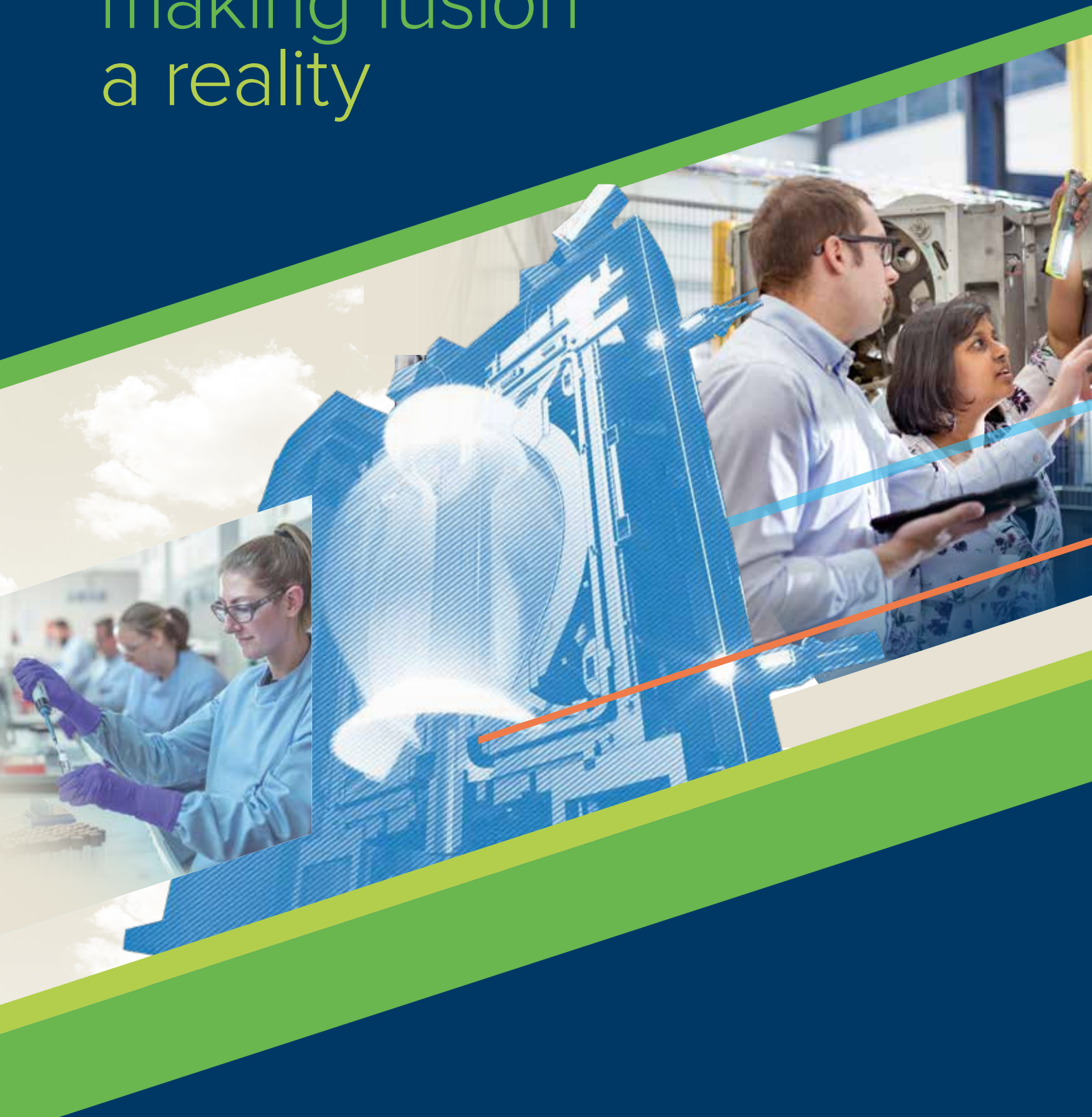
DEVELOPING WORLD LEADING TECHNOLOGY
TO CREATE THE ULTIMATE,
LOW-CARBON ENERGY SOURCE

UK Atomic Energy Authority

A **STEP** to making fusion a reality



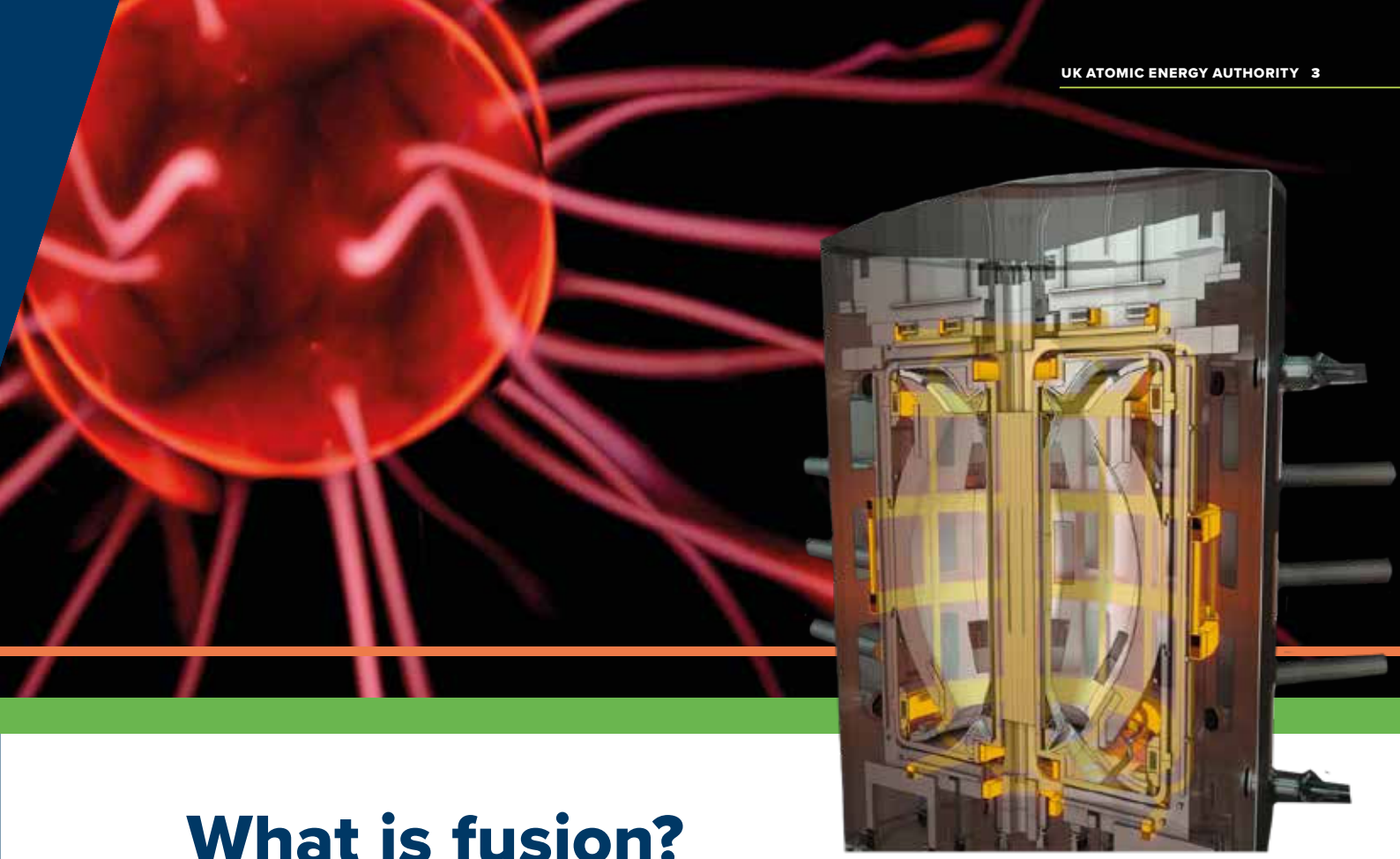
UK Atomic Energy Authority

UKAEA is the country's fusion research laboratory, with a mission to lead the delivery of sustainable fusion energy and maximise the scientific and economic benefit.

UKAEA hosts a number of facilities at its main campus at Culham in Oxfordshire, including JET (Joint European Torus) which has set world records for fusion performance, and MAST-U (Mega Amp Spherical Tokamak-Upgrade) which is leading the world in research into compact fusion devices.

In addition the newly opened FTF (Fusion Technology Facility) in Rotherham, South Yorkshire, is playing an important role in solving the key challenges facing fusion through its advanced testing capability.

Culham is also home to OAS (Oxfordshire Advanced Skills), a training centre offering young people high quality engineering and technology apprenticeships. OAS currently has more than 120 apprentices undertaking training across a range of subject areas.



What is fusion?

Fusion is the process that takes place in the heart of stars and provides the power that drives the universe.

To produce energy from fusion on earth, a combination of hydrogen gases – deuterium and tritium – are heated to temperatures of more than 150 million degrees celsius. At this temperature, the gas becomes a 'plasma' and releases a huge amount of energy which can be used to generate electricity.

Interior of JET tokamak at UKAEA in Oxfordshire

Why fusion?

The UK government is committed to net zero by 2050 and in order to achieve that we will need new ways to meet our growing energy demands.

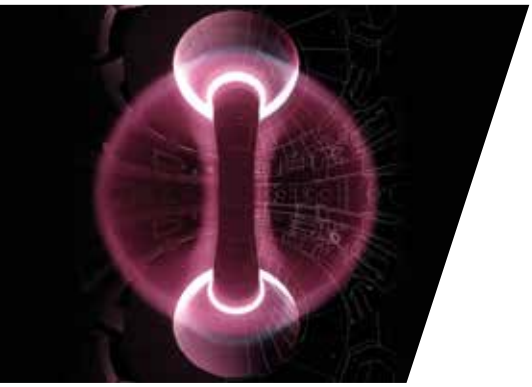
Fusion offers the opportunity to produce virtually limitless energy that will power low-carbon economies across the world.

Fusion can be one part of the long-term solution, alongside a continued increase in the supply of energy from renewable sources including wind and solar power.

"Fusion will play its part alongside renewables, to maintain net zero in the second half of this century"

PROFESSOR SIR IAN CHAPMAN
CEO, UKAEA

UK Government fusion strategy



The Government published its fusion strategy in Autumn 2021, building on the previously published Ten Point Plan for a Green Industrial Revolution and the 2020 Energy White Paper.

The strategy has two overarching goals:

01 For the UK to demonstrate the commercial viability of fusion by building a prototype fusion power plant in the UK that puts energy on the grid

02 For the UK to build a world-leading fusion industry which can export fusion technology around the world in subsequent decades

STEP is key to the achievement of these two goals

Value of STEP

DESIGN & PROTOTYPING

Design and build prototype fusion energy plant

COMMERCIAL CAPABILITY

Stimulate industrial capability to deliver commercial fusion

OPERATION

Achievement of UK Government fusion energy goals

Capability to lead in a commercial market

What is STEP?

STEP's mission is to deliver a UK prototype fusion energy plant, targeting 2040, and a path to commercial viability of fusion.

STEP will demonstrate the ability to generate net electricity from fusion. It will also determine how the plant will be maintained through its operational life and prove the potential for the plant to produce its own fuel.

STEP high-level schedule

2021 | 2025 | 2030 | 2035 | 2040

Concept (till 3/24)

- Concept / reference plant design
- Programme development
- Site selection
- Transition to target operating model

Detailed design & mobilisation

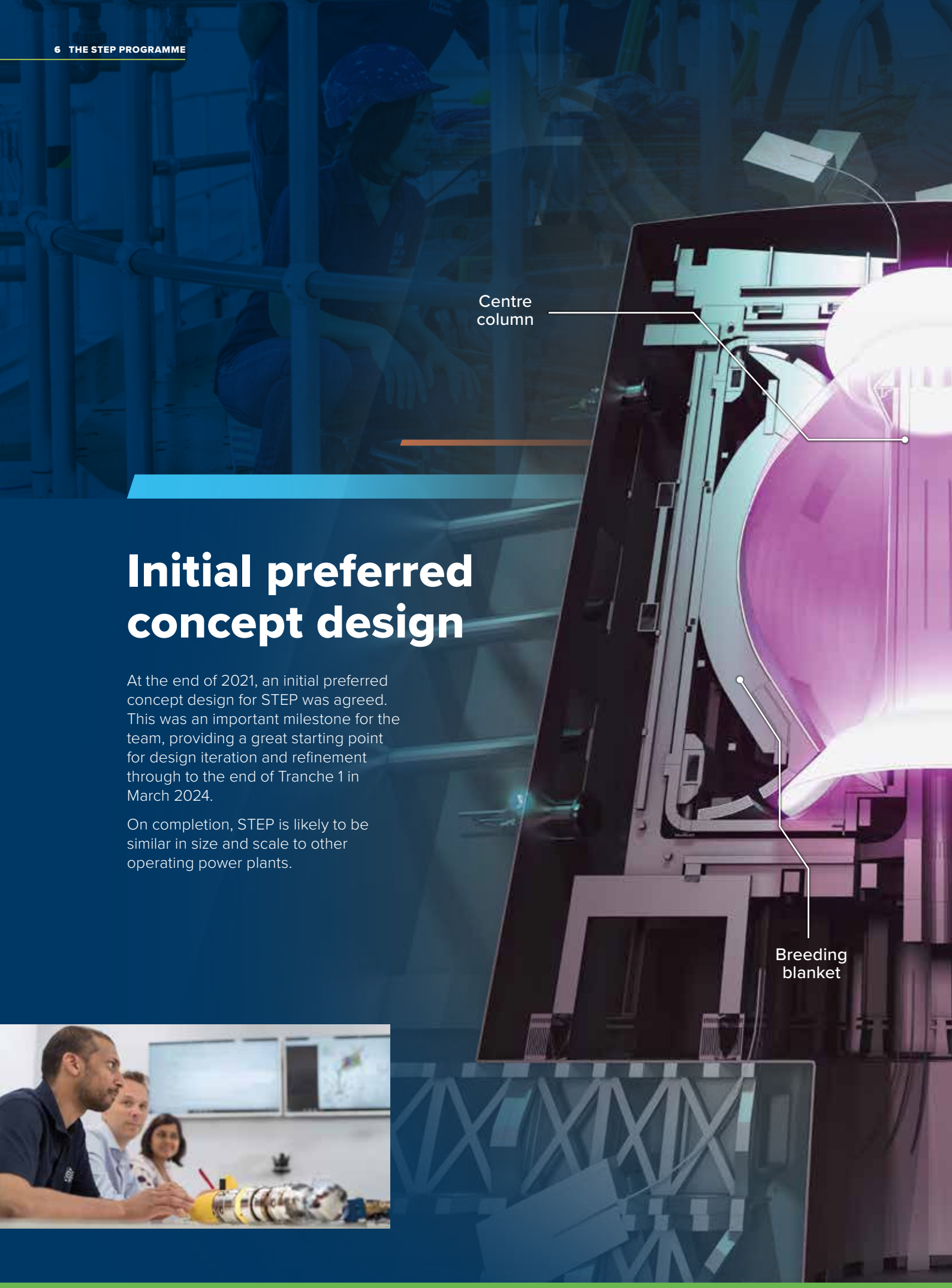
- Engineering design
- Long lead procurement
- Early manufacture
- Secure permissions and consents

Main construction

- Full plant manufacture and assembly
- Full site development
- Equipment and system testing

Commissioning / operation

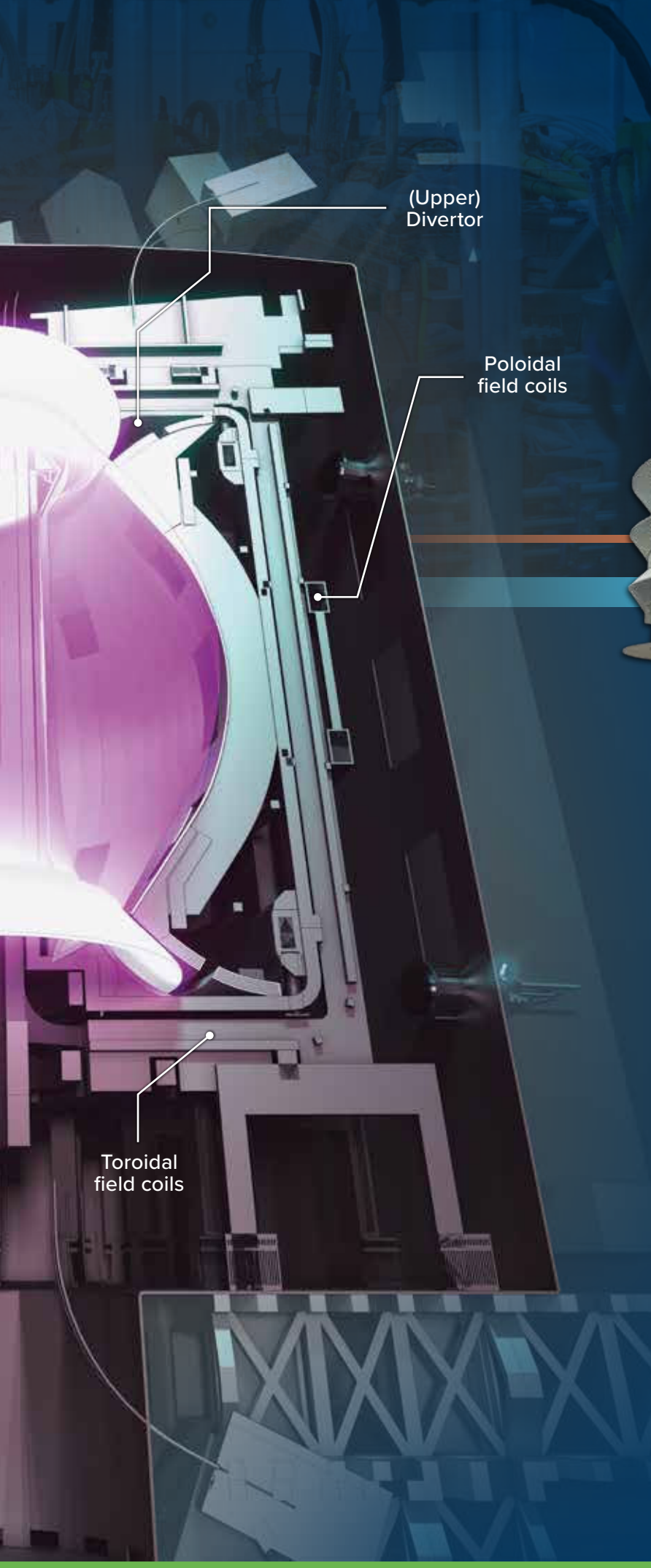
- Non-active and active commissioning
- Prototype operations

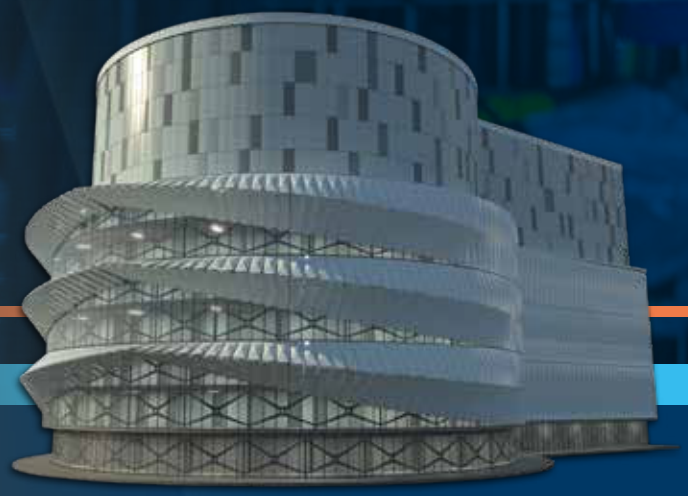


Initial preferred concept design

At the end of 2021, an initial preferred concept design for STEP was agreed. This was an important milestone for the team, providing a great starting point for design iteration and refinement through to the end of Tranche 1 in March 2024.

On completion, STEP is likely to be similar in size and scale to other operating power plants.





The STEP mission is to provide a pathway to commercial fusion energy through the design and build of this prototype plant. To achieve that, STEP needs to balance a range of key features, including:

- Safety and environment
- Confidence in net power
- Confidence in fuel sustainability
- Confidence in availability
- Confidence in overall cost
- Development flexibility
- Confidence in overall schedule.

The ITER site before construction

Choosing a home for STEP

Finding a home for STEP was one of the key objectives of the first phase of the programme and an open call for sites was launched at the end of 2020. Following an extensive siting process which included community and stakeholder engagement as well as technical and socio-economic assessments, the West Burton site was selected by the Secretary of State.

In October 2022 the site was announced as the new home of STEP. West Burton is a former EDF coal fired power station in North Nottinghamshire, on the banks of the River Trent.

The ITER site in Saint-Paul-lez-Durance, France, during construction

What happens next?

Now STEP has a home, the next steps are to build a local team based at site and a presence within the community to establish strong working relationships. An initial phase of stakeholder and community engagement has been undertaken and regular community events will enable the exchange of information to continue as the project develops.

The STEP programme will be subject to a full consenting and planning process before construction begins. This will be in line with the legislation and guidance applicable to major infrastructure programmes, relevant to the successful site.

Fusion Regulation

The existing UKAEA facilities are regulated by the Health and Safety Executive (HSE) and the Environment Agency (EA).

Following the publication of the government's fusion strategy in October 2021, at the same time as a consultation on future fusion regulation, it is anticipated that the Energy Security bill, due to make its way through Parliament during 2023, will enshrine this approach in law for future facilities.

"We're delighted to have made the West Burton site our new home for STEP. It's been fantastic to introduce ourselves to our stakeholders and community and I'm looking forward to working with them to ensure the success of STEP in the decades ahead."

PAUL METHVEN
CEO, UK Industrial Fusion Solutions Ltd
(will deliver STEP as part of UKAEA Group)

Supply chain and skills

STEP will bring significant socio-economic benefits to the community around West Burton. These will include skills and employment opportunities, both in construction and operations, and the development of a local and regional supply chain to provide expertise and services to the STEP site.

Supply chain

It's too early in the programme to know exactly how many jobs and skills opportunities STEP will provide. However, it is safe to say that it's likely to be hundreds through the design phases, thousands in construction and hundreds once the plant is operational.

The STEP team will work with the colleges and universities in the area to maximise opportunities for local people and ensure that the programme provides maximum benefit to its home region.

Skills

One of the government's objectives in its fusion strategy is to 'stimulate industrial capability to deliver commercial fusion' and STEP's home will be central to that. The Culham site, UKAEA's home in Oxfordshire, has been very successful in attracting spin-off and start-up companies to co-locate on the campus. It's envisaged that the community where STEP is built will do likewise.

However, the opportunities for the supply chain are not only within high-tech, adjacent industries. In the future, as work progresses at the West Burton site, the programme will need all kinds of services, from catering to security. This will provide many additional opportunities for local companies to get involved and benefit from the development.


What is fusion?


KINEVE

The UK Atomic Energy Authority's mission is to lead the delivery of sustainable fusion energy and maximise scientific and economic benefit

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Find out more

www.gov.uk/ukaea
www.step.ukaea.uk

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