Severn Edge STEP

A Vision for the UK's
First Fusion Power Plant

Our Vision

In the 1950s, the South West of England led the world in the development of nuclear power production, with the World's first purely civil nuclear power station at Berkeley. Now with the Government's commitment to develop fusion power, Oldbury on Severn and Berkeley are uniquely placed to be trailblazers once again and at the forefront of the low-carbon revolution.

Building on our expertise in advanced engineering, construction, aerospace, digital and cyber, we aim to be the crucible that turns the fusion-power vision into reality – through the development of the UK's first commercial fusion prototype, that will showcase the UKs' global leadership in this transformative technology.

This is coupled with the technological heritage of the Western Gateway region, including a specialist and capable workforce, world-class universities and our ideal geographical location, offering strong transport links and easy access to the South Wales steel supply chain and the manufacturing heartlands of the Midland's Engine. Add to that our proximity to the UKAEA's Centre for Fusion Energy at Culham, and it is clear that our region is ideally placed to become a World-renowned centre for the UK fusion industry.

Why Now?

The UK stands at the threshold of an unprecedented challenge, to comprehensively decarbonise its energy supply by 2050, during which time demand for electricity is forecast to at least double what it is today. Globally, the challenge to decarbonise is immense and it is why we need to exploit all our low carbon energy technologies to achieve this goal, including fusion and it is why fusion is detailed in the Government's recently published Energy White Paper and Ten Point Plan for a Green Industrial Revolution.

The UK has been world leaders in fusion research and development for many years, centred at the Culham Centre for Fusion Energy in Oxfordshire. Recent advances in technology and several scientific breakthroughs has turned fusion power from a scientific challenge (can it be done?), into an engineering challenge (what's the best way to do it?) and globally, there is increasing confidence that a clear path to commercial fusion can now be found.

The STEP opportunity

STEP (Spherical Tokamak for Energy Production) is an ambitious UK programme to design and build a prototype fusion power plant.

The Government has recently announced that it wants the UK to have a Fusion Power Plant producing electricity by 2040 and has committed an initial £222M for STEP, with the potential for several £bns of future investment.

The siting process for STEP has begun and there is a realistic possibility that the UK's first Nuclear Fusion Power Plant and associated facilities could be developed and built at the Oldbury and Berkeley sites.

What is Fusion?
Fusion technology uses the same principles that power our sun, fusing hydrogen isotopes to make helium and abundant energy.

What are the benefits of fusion power?

- **Energy efficiency:** Fusion is very efficient in its fuel use, often described as 'high yield'. One kg of fusion fuel produces the same amount of energy as 10 million kg of coal.
- **No carbon emissions:** The only by-product of fusion reactions is a small amount of helium - the same gas used in children's party balloons. There is the potential to capture this for use as a valuable resource in medicine and science.
- **Abundant Fuels:** Fusion uses Deuterium, which can be easily extracted from water, and Tritium, to be produced inside the fusion core using Lithium. Even with the future widespread adoption of fusion power plants, fuel supplies would last for many thousands of years.
- **Safety:** A chain-reaction or meltdown type incident is not possible in a fusion power plant. The fusion process requires continual active measures to sustain it, so will not become uncontrolled in the event of a system failure – it would simply stop producing power.
- **Less radioactive waste:** There is no radioactive waste by-product from the fusion reaction. Only reactor components become radioactive; the level of activity depends on the structural materials used. Research is being carried out on suitable materials to minimise decay times as much as possible.

Why Oldbury / Berkeley?

Berkeley hosted the world's first purely civil nuclear power station and, together with Oldbury, remains uniquely positioned to deliver the world's first fusion power station.

Both sites bring their own unique benefits and together provide an exceptional strategic fit with land and facilities to support the STEP fusion plant, associated offices, training facilities and related future businesses and opportunities.

At Oldbury, it is the abundance of land within a site already recognised in national and regional policy terms as being potentially suitable for the development of a new nuclear power station, with the additional potential for re-use / recycling of key infrastructure from the former Oldbury Power Station. The site benefits from access to cooling water and related infrastructure, grid connectivity and transport links, as well as early site characterisation works carried out, which identified it as suitable for a large twin unit nuclear fission power station.

The Berkeley site, another former nuclear site, boasts a Science & Technology Park (with room for expansion) where skills, learning and education are at its heart - reflected by its associated University Technical College, and all underpinned by a rich nuclear heritage. Once again, regional and local policies all align favourably with future redevelopment to support future development.

The wider South West is also a thriving centre of advanced engineering, ready to deliver the needs of a future fusion industry. From lithium produced in Cornwall that will be used to power a fusion power plant; to construction excellence in Somerset that will be used to build it; through to World leading materials and engineering expertise around Bristol, South Gloucestershire and Gloucestershire, siting STEP in our region gives the UK its best chance of building a World leading fusion industry.

High Temperature Expertise
The South West is home to a unique combination of specialist knowledge in high temperature reactor operation, from EDF's technical headquarters in Gloucester, to nuclear project suppliers like Framatome and Cavendish. Siting STEP in the region would ensure that the legacy of over fifty years of high temperature reactor design and operation is not lost to the UK.

Construction
Hinkley Point C, Somerset: The experienced companies and highly skilled people building Hinkley Point C, are key assets to supporting the delivery, operation and maintenance of a fusion power plant.

Education and Training
The complete range of skilled people needed to build the STEP power plant does not yet exist. There will be a need to create completely new knowledge and capability,y in areas as diverse as materials science and augmented reality.

UKAEA has an ambitious goal to create 1000s of STEM apprenticeships and has already allocated resources to support an apprentice training scheme. From day one, UKAEA would work with SGS Berkeley Green to bring the scheme into reality.

We also have internationally renowned institutions capable of training new entrants and upskilling the existing workforce to meet the demands, including the University of Bristol MSc and Doctoral programmes in nuclear science and engineering, the National College for Nuclear South and two Institutes of Technology.

Regulation
Fusion represents an unparalleled technological leap. Innovative regulation will be essential to ensure that this new technology can realise its potential affordably and in time to impact 2050 climate change targets. The UK has a uniquely adaptable goal-based regulatory system and both of the principle nuclear regulators in England have major offices within the region: The Office for Nuclear Regulation at Cheltenham and The Environment Agency in Bristol.

The Benefits

If selected, the Oldbury/Berkeley nomination would create 1000s of highly skilled jobs, attract £billions in investments, and create a world-leading fusion cluster, requiring huge support from our aerospace, marine, digital, cyber, photonics and construction clusters, significantly boosting our economy.

STEP could be the catalyst for major infrastructure improvements, directly connecting the Forest of Dean, South Wales and beyond, to the fusion science park supporting STEP.

The Nomination (Severn Edge)
Our nomination, known as Severn Edge, is a two-site approach at Oldbury on Severn in South Gloucestershire and at Berkeley, just four miles up the River Severn, in Gloucestershire.

Given the siting requirements set out by UKAEA, our Severn Edge nomination is based on the STEP fusion power plant being located on land currently owned by Horizon Nuclear Power at Oldbury, with the skills, technical and research centres to be located at Berkeley.

A Working Group has been formed with multiple partners across the Western Gateway geography, to investigate the potential for STEP to be sited at Severn Edge, with an initial nomination submitted to UKAEA on 30 March 21.

Although the nomination of a site marks a very early stage in the siting process, we believe that land and facilities around the former Oldbury and Berkley nuclear power stations are likely to form a good basis for the siting of STEP.

The Severn Edge Working Group consists of: Western Gateway, South Gloucestershire Council, Gloucestershire County Council, Stroud District Council, Horizon Nuclear Power, Magnox, SGS College Group, West of England Combined Authority, West of England LEP, GFirst LEP, South West Nuclear Hub and Nuclear South West.

STEP Timeline
(Note: UKAEA has not confirmed exact times and these dates are a guide only)

Phase 1

- **Showstopper assessment** (Pool 1) – June 2021
  Nominations not making the required threshold will be discontinued from the process.
  Severn Edge: Passed

- **Desktop commercial assessment** (Pool 2) – Autumn 2021
  Nominations will be scored and proceed to the next phase with no site discounted, unless a showstopper arises, in which case they will be discontinued from the process.
  Severn Edge: Under evaluation by UKAEA

- **Full desktop assessment** (Pools 3-5) – Autumn 2021
  All criteria will be considered and nominations shortlisted. The lowest scoring nominations will be discontinued from the process.
  Severn Edge: Under evaluation by UKAEA

- **Site assessment** (Pools 3-5) – Spring 2022
  If more than three nomination sites remain, those with the lowest score will be discontinued from the process.

- **Final report stage** (Pools 2-5) Summer 2022
  This stage will include the submission of a final report by each of the remaining three candidate sites, with resources provided by UKAEA.

- **UKAEA Final Review** (3 shortlisted sites) – Autumn 2022

- **Site Selected by Secretary of State for BEIS** – Winter (December?) 2022

Phase 2

- **STEP Concept Design Finalised** – 2024
- **Planning Consent and Detailed Engineering Design Completed** – 2030
  (Building can begin)
- **Construction of Power Plant Completed and commissioned** – 2040

Working Group Members

Points of Contact

[redacted]

Further information

- On fusion technology:
    - Fusion energy | Culham Centre for Fusion Energy (ukaea.uk)
- On the Spherical Tokamak for Energy Production Programme:
    - STEP | Culham Centre for Fusion Energy (ukaea.uk)
- On The open call for sites:
    - STEP | Host STEP in your community (ukaea.uk)