

# UK Nuclear Fleet Strategy Update

28 September 2022

There have been dramatic changes in the energy sector since our last strategy update in September 2021. Gas and power prices have rocketed during the last 12 months, with Winter 22/23 electricity prices currently forecast to be in the region of £600 per MWh.

The sharp rise in wholesale gas and power prices is feeding through to extremely high consumer bills, causing rising inflation and a cost of living crisis. Even with the Government intervention many customers are likely to face extreme difficulty this winter.

The Russian invasion of the Ukraine has also thrown sharp focus on security of supply with an increasing interest in nuclear power as a fundamental part of our energy mix to provide home-grown, dependable, zero carbon supply.

All of this is happening at a time of significant change for the UK's nuclear fleet as older stations move into the defueling stage. This update to interested stakeholders provides some background information on the existing UK nuclear fleet and a summary of key priorities over the coming years.

**To support UK energy security, the priority is to sustain as much output as possible from the 5.5GW of generating capacity available – at Heysham 1, Hartlepool, Torness, Heysham 2, and Sizewell B power stations:**

- 2022 nuclear output is forecast at over 42TWh, around 5% ahead of plan
- Power from the nuclear fleet for 2022 has been delivered to the market at an average realised price which is significantly below current market prices
- To support fair electricity prices EDF is talking to Government about a voluntary pricing mechanism for its nuclear output
- EDF will invest £1 billion to help sustain output over 2023-25
- We are committed to reviewing the case to extend generation at Hartlepool and Heysham 1 (2.2GW) beyond March 2024 in the next few months
- EDF has kept part of West Burton A coal fired power station available until 31 March 2023, following a Government request.

**Beyond the significant work in place at Hinkley Point C, and proposals for Sizewell C, EDF is committed to exploring long-term growth options:**

- A decision to extend Sizewell B by 20 years is due in 18 months
- Plans are developing to host Advanced Modular Reactors at Hartlepool and EDF is keen to explore options for Heysham's long-term future in Lancashire
- EDF's West Burton A site in Nottinghamshire is on the short-list to host the UKAEA's fusion pilot project
- Working with "Great British Nuclear" to help Government develop ideas on how to bring the 24GW of new nuclear policy goal to life.

**Preserving nuclear skills is one of the top priorities, alongside financing and planning, that is required for the UK to re-build its nuclear capability:**

- £40million going into training in 2022 alone and new offices acquired at Gloucester Business Park, Aztec West in Bristol and Glasgow
- Development of a centralised technical skills organisation to provide technical support to current and future nuclear opportunities
- Delivering the defueling obligations for the 14 reactors in the AGR fleet, over the 2022-2032 period, will help preserve skills.

## Summary

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### Preserving and Developing Skills

## The UK's existing nuclear fleet

### Supporting UK energy security

The UK's existing fleet of nuclear power stations has been accountable for supplying 15-20% of the country's electricity for decades.

In November 2021, the fleet reached 2,000TWh of generation; to put this in context, total UK electricity demand in 2021 was 300TWh. This was a major milestone for all those working in the UK nuclear sector and a demonstration of the value of the reliable zero carbon power the fleet has provided the UK.

Though the energy crisis has focused minds on gas and power prices and security of supply, we remain driven by the role nuclear plays in helping the UK's objective to reach Net Zero by 2050. Recent [independently assessed analysis](#) examined the lifetime carbon footprint of two operating UK nuclear power stations (Torness and Sizewell B) and found them to be directly comparable to offshore wind.

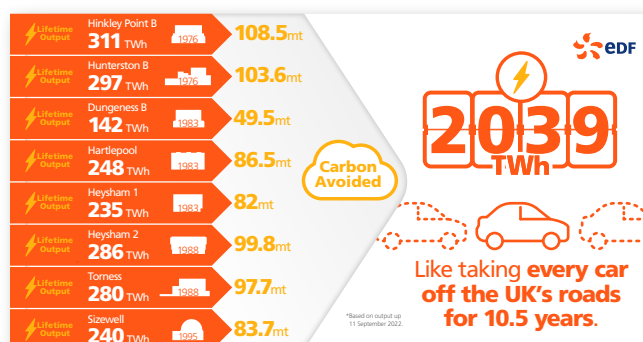
They were found to produce c10g of CO<sub>2</sub> per kilowatt hour when every aspect of the lifecycle was taken into account from construction to decommissioning. The International Panel on Climate Change considers technologies which produce 12g, or less, of CO<sub>2</sub> per kilowatt hour as low carbon, meaning the UK's nuclear fleet has officially been generating low carbon electricity for decades.

The UK Government defines nuclear as zero carbon at the point of generation ([UK Fuel Mix Disclosure](#)). When compared to gas generation, the UK's nuclear fleet is estimated to have prevented more than 700 million tonnes of CO<sub>2</sub> going into the atmosphere. This is the equivalent of taking all of the UK's cars off the roads for 10 years. All of this power has been generated from a relatively small operational footprint of under one square mile located in the UK.

Output from the existing fleet peaked in 2016 at 65TWh and by 2028 could be down to just 10TWh, from one station alone – Sizewell B. This is excluding Hinkley Point C, which is due to have the first of its two reactors online by mid-2027.

Despite this trend, the priority of EDF's Generation business is to support UK energy security by sustaining as much safe, reliable and commercially viable output as possible while efficiently defueling those stations that have ceased generation.

Due to EDF's strategy of forward-selling its output, the average realised price for the nuclear fleet's power in 2022 has been delivered to the market at an average realised price much lower than current and forecast market prices.



The nuclear industry values price stability and EDF is working with the UK Government to agree a fair price for its nuclear output which will help break the link between gas and electricity prices. The goal is to stabilise the price of power to customers at affordable levels, while supporting a fair return on investment for the generating fleet.

Since EDF acquired the UK operating fleet in 2009, for over £12billion, it has invested over £6billion helping support safe and reliable generation through extended operating lifetimes. Through sustained investment and careful stewardship all the AGR stations have operated beyond their original 25-30 year design lives.

We continue to invest to ensure their reliability over this coming winter and beyond and intend to invest a further £1 billion in maintenance, inspections and plant upgrades over the next three years.

Four of the seven stations in the AGR fleet continue to generate – along with Sizewell B this is a combined 5.5GW of capacity.

This year the fleet is on track to provide more than 42TWh of zero-carbon power, which is a little higher than 2021. Output over the 2023-25 period is likely to be in the range of 80-90TWh.

## Outlook for the four generating AGR stations

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As an energy supplier to around 5 million UK homes, EDF is acutely aware of the energy supply crisis exacerbated by Russia's control of gas supplies in Europe. We firmly believe that achieving Net Zero, ensuring long-term security of supply and reducing reliance on gas needs a firm base of new nuclear, alongside wind and solar.

In the short-term, though, it is absolutely right that we look at how we can optimise the lifetimes of the remaining AGRs to provide secure, 24/7, zero carbon electricity and help reduce the UK's dependence on gas.

There are four generating AGRs in the fleet.

Hartlepool on Teesside and Heysham 1, in Lancashire, share the same design and are due to continue generating until at least March 2024, representing 41 years of operation.

Torness power station, in East Lothian, and Heysham 2, in Lancashire, also share the same design and are the most modern AGRs, starting operations in 1988. They are also the highest performing assets in the AGR fleet, having generated a higher average annual output than the five other stations.

The expected end of generation for Torness and Heysham 2 is March 2028, according to our review taken in Q4 2021. These forecasts come with a +/- 2 year proviso.

The actual end of generation dates for these four power stations will be determined by the condition of the graphite making up the reactor cores, which is regularly inspected, and subject to rigorous assessment by the independent regulator. Inspections provide reassurance and allow us to meet external regulations. For example, our power stations are required to meet global earthquake regulations – this means we have to prove we can shut down the reactors during a major earthquake, a 1 in 10,000 year event – much larger than the UK has ever experienced or expects to happen.

In light of the severity of the energy crisis and the results of recent graphite inspections, EDF will look to review the case for a short extension for Heysham 1 and Hartlepool to generate beyond the current forecast of March 2024. This will depend on the results of graphite inspections over the coming months. It is important that preparations for defueling continue so that if the stations do end generation in the next 18 months we are operationally ready to start defueling.

This is in line with the Public Accounts Committee's recommendation in May that we work with the UK Government and the Office for Nuclear Regulation, to establish what the lifetimes at the remaining operating stations will look like. Our overall objective is to maximise zero carbon output from these key national assets, as long as it is safe and commercially viable to do so and while EDF maintains ongoing Government and regulatory support.

Though this is an update on the nuclear fleet, it is worth noting that, in response to a request from UK Government and National Grid, we have extended the availability of two units at West Burton A coal-fired station to 31 March 2023. The station will then join EDF's other coal-fired station, Cottam, in decommissioning.

## Defueling the AGR Fleet

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EDF has agreed with the UK Government that it will defuel all seven AGR stations before they are transferred, on a rolling basis, to the Nuclear Decommissioning Authority (NDA) from 2026 onwards.

With the UK Government, and by extension the tax-payer, as our client, we are working hard to meet performance targets while driving value for money and minimising costs. Operationally, defueling is an extension of the refuelling we have been carrying out for more than 40 years, though at a greater volume and faster pace. The programme will require the very best of our operating expertise and innovative ways of working as we aim to deliver defueling safely and cost effectively. Performance at the NDA's Sellafield facility is also key to successful defueling and we continue to collaborate closely with them as volumes start to increase.

### **There has been a great deal of progress in our defueling programme over the past year:**

- Three of EDF's stations are now in the defueling phase. Generation ended this year at both Hunterston B, in North Ayrshire, and Hinkley Point B, in Somerset. Over the past 46 years they generated more than 600TWh of electricity combined. Along with Dungeness B, which entered defueling in June 2021, these sites have now reached the next phase of the nuclear lifecycle.
- Substantial fuel route upgrades have been carried out at Hunterston B and Hinkley Point B to enable us to increase the rate of defueling and make the process more cost efficient. Similar upgrades are also underway at Heysham 1 and planned for Hartlepool and Dungeness B.
- We secured regulatory approval for the defueling safety cases for Hunterston B and Hinkley Point B. Work on cases for the rest of the fleet is progressing.
- Defueling is now actively underway at Hunterston B with more than 10% of the spent fuel removed from the first reactor.
- A pre-defueling outage is complete at Hinkley Point B and active defueling commenced in September. More than 600 fuel channels will require managing over the next 3-4 years.
- There has been excellent progress at Dungeness B from a standing start. Due to the unique design issue which resulted in the station's end of generation, limited defueling preparation work had been carried out while the station was still generating. The defueling safety case has been completed and is with the ONR for assessment, putting the station on schedule for the start of active defueling by mid 2023.
- We supported the National Audit Office's first report into AGR decommissioning and gave evidence to the Public Accounts Committee earlier this year. We will continue to engage in this process as defueling progresses.

## Transfer of the AGR Fleet to Magnox

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Once each site has been defueled they will be transferred to the NDA for its subsidiary, Magnox, to carry out the next stages of decommissioning. This will include a period of deconstruction, before a safestore facility is built to house the reactors for a passive period before final site clearance. It is a contractual performance milestone that this transfer takes place within one year of the power station being declared as "fuel free".

The first station due to transfer is Hunterston B in around 4 years' time with the rest of the fleet due to transfer on a rolling basis over the next decade, depending on end of generation dates and overall performance.

We are committed to working closely with the NDA and Magnox to ensure we are able to carry out a "seamless transfer" of the sites and to identify efficiencies that will benefit the tax payer.

### **Examples of progress over the year are:**

- EDF and Magnox are working to the strategic assumption that it will be possible for Hunterston B and Hinkley Point B to share existing Intermediate Level Waste stores at the "A" sites, rather than build new facilities. This will be subject to regulatory approval.
- We carried out a public consultation on the decommissioning proposals for Hunterston B and will do the same in the communities around Hinkley Point B before the end of the year.
- We are developing a plan for Hunterston B to help people who work there understand what opportunities will be available once the site is transferred in 2026.
- A range of joint work streams have been set up to coordinate activities including supporting Magnox in securing site licences and integrating IT systems. Progress is reported to the UK Government on a regular basis.

## New nuclear – options for long term growth

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The UK Government's target is to reach up to 24GW of nuclear capacity by 2050, requiring an extensive programme of new infrastructure, both large reactors as well as small and advanced modular reactors. EDF will play its part, collaborating across the sector to help open up our sites for development in support of the UK's challenging ambition.

### Sizewell B – a 20 year life extension opportunity

Sizewell B power station in Suffolk started operations in 1995 and has a design based on standard pressurised water reactor technology in common use around the world, differing from the seven other stations in the fleet.

Sizewell B is currently scheduled to generate power until 2035 and EDF is exploring a 20-year life extension opportunity to take output to 2055. This will protect jobs and importantly the UK energy security as the site provides 3% of the nation's electricity demand.

Sizewell B's long-term operation will be key in supporting the UK's 'Net Zero' climate change ambition and helping to develop Sizewell C.

Work on the extension started in April and involves key partners including Westinghouse, Jacobs, GE, Framatome and Atkins, some of these partners have worked with Sizewell B since the start of the station's operation.

Sizewell B will engage with industry regulators the Office for Nuclear Regulation and the Environment Agency throughout the process. Equipment will be systematically checked and areas where investment will be required to maintain and further enhance safe and reliable generation will be identified.

Key upgrades to support long term operation will include updating some of the station's IT infrastructure. In addition, the programme is considering its wider impact, for example, what skills and supply chains will be needed to support operation to 2055.

Work is progressing well to complete the Technical and Safety Review by the middle of 2023 with a final investment decision to be made by EDF in 2024.

### Investing in New Nuclear

EDF has shown the investment that nuclear power can bring to an area. Hinkley Point C in Somerset is halfway through construction and has already trained more than 800 apprentices and invested more than £4bn in the region. Across the UK an estimated 74,000 people will have worked on the project, and there are currently around 8,000 on site. EDF is working with Government on Sizewell C, a proposed replica of Hinkley Point C, with a final investment decision due in 2023.

As the AGR fleet enters defueling, and progress is made with Hinkley Point C and Sizewell C, EDF has also started exploring options elsewhere, involving collaborating with technology providers.

Both Hartlepool and Heysham were designated as two of the eight sites for development in the UK Government strategy announced in April. This year EDF has accelerated its involvement in exploring options to develop these sites, as well as other projects.

As the owner of many of the UK's existing sites we have an opportunity and responsibility to explore future development to help meet the Government's 24GW target, while decarbonising UK power production and industrial activity.

The Committee for Climate Change said in its most recent update that "decarbonisation of industry, transport, buildings and agriculture have progressed too slowly...industry must use electricity or hydrogen instead of fossil fuels".

We believe Hartlepool is the most suitable site in the UK for High Temperature Gas Reactors (HTGR) - a type of Advanced Modular Reactor (AMR). HTGRs could help decarbonise industries on Teesside which need the heat and steam they could produce.

One or more HGTRs at Hartlepool – the Hartlepool Heat Hub – could secure hundreds of jobs at the site, and provide some of our employees, suppliers and the wider industry on Teesside with longer term employment security. We are already discussing opportunities with a number of potential developers and our plans have attracted the support of the UK Government, with funding recently announced.

In Lancashire, where we operate Heysham 1 and Heysham 2, and employ more than a thousand people, we believe that we have a site well suited to Small Modular Reactors. Government direction on how the site should be re-developed will be welcome as the UK's nuclear strategy develops.

We are delighted to see the West Burton A site on the shortlist for the UKAEA's fusion project. It is a perfect fit for a site that has been providing electricity for the country and jobs for Nottinghamshire since the mid-60s, a core part of 'Megawatt Valley'.

EDF believes three reasons make West Burton's bid stand apart. The project will regenerate the area, the site is ready with the grid connections and other infrastructure needed, and the region is supportive. Transitioning from an area known for coal-fired power to nuclear fusion would be a powerful example of clean technology replacing fossil fuels.

Much of this development will happen under the direction of the UK Government's new vehicle, Great British Nuclear. To make this happen, the organisation requires capability, authority and empowerment to take actions and decisions to drive change, independently of party political frameworks, for the good of UK nuclear. Its' financing and resourcing should be agreed up front.

It could also take on a pseudo-developer or initiator role, act as a vehicle for collaboration, networking and partnership across industry as a critical success factor in expediting future development.

EDF is the UK's nuclear operator, and its people have unrivalled capability and experience in nuclear safety, operation, development and construction. Drawing on this experience, we will do all we can to support Great British Nuclear in its mission.

## Preserving and developing nuclear skills

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The vision of EDF's Nuclear Generation business is to harness our nuclear skills and capabilities to support the industry's transformation.

EDF welcomes the UK Government's renewed commitment to nuclear power and the ambition of increasing capacity up to 24GW by 2050. While these plans present great opportunities for our people, and the wider industry, building enough skills capacity and capability to deliver presents a major challenge. For example, the range of apprenticeships and graduate programmes needed to revive the industry will be significant and require everyone involved to be joined up – operating companies, suppliers, regulators, Trade Unions, educational establishments (Higher Education colleges, Universities, schools) and industry bodies.

It is crucial that preserving nuclear skills is recognised as one of the sector's top priorities, alongside financing and planning, required for the UK to re-build its nuclear capability.

A 20+ year gap in nuclear new build and an aging generating fleet means there is the high potential for a nuclear skills gap leading to increasing competition for nuclear and construction skills from inside the industry and from non-nuclear companies. International competition for skills will also increase as different countries scale up their nuclear programmes. Clarity over sequencing and timing of new developments in the UK will be essential to help skills planning and investment. We stand ready to support the nuclear renaissance and are already working with industry and supply chain to understand future skills demands.

The existing nuclear fleet directly employs around 5,000 people across the UK and EDF has the country's leading group of nuclear engineers and scientists, largely based in the south west of England (Gloucester-Bristol-Somerset) and a satellite office in Glasgow. Hundreds of people have transferred from the existing fleet to help progress at Hinkley Point C, and have also been engaged to help Sizewell C move towards a final investment decision from 2023. From November, up to 1,000 of the country's top nuclear engineers, scientists and support staff will move to new, smaller, headquarters near Gloucester. New modern offices have also been acquired in Aztec West, Bristol and Atlantic Quay, Glasgow.

We have a proven track record of developing careers by setting up routes into the industry through apprenticeships and graduate schemes and supporting the transition of nuclear generation skills to benefit the needs of nuclear new build:

- In 2022, our investment in training across the nuclear businesses is due to be nearly £40million. In 2023 we plan to hire up to 200 new people into the existing fleet to deliver new projects and develop our skills.
- EDF chairs the board of the National College for Nuclear, and leads on a number of activities on the Nuclear Skills Strategy Group.
- Across the nuclear business we have almost 200 apprentices and graduates in training programmes. Thirty-nine more apprentices will join the programme in September this year with that number due to rise by 50% in 2023.
- We have established a centralised technical skills organisation to support the total nuclear lifecycle. The Technical Client Organisation was set up in mid-2020 to provide the skills and capability to support not only the construction and operation of pressurised water reactors such as Hinkley Point C and Sizewell C, but also has the detailed technical skills needed across any nuclear technology. Pooling these niche technical skills into a centre of excellence facilitates their development and helps maintain this unique capability.
- The creation of a new engineering design centre in Bristol will also be pivotal in supporting new nuclear going forward.
- At sites approaching end of generation we are preserving crucial nuclear skills by supporting our people to transfer to other sites, or retrain to stay at their current location through defueling. At Hunterston B and Hinkley Point B, 100% of employees that wanted to remain at the site during defueling were able to do so, while others had support to move into other roles across the business.

Operations and technical support for the existing fleet involves close collaboration with contract partners and suppliers. In 2021 EDF spent £750million to support its operational sites with 1,400 suppliers, over 90% of these being UK-based.

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