January 2025

ECONOMIC IMPACT OF EDF'S NUCLEAR FLEET FROM 1976 TO 2024

FINAL REPORT

Economic Insight Ltd

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1. INTRODUCTION AND EXECUTIVE SUMMARY

INTRODUCTION

EDF commissioned us, Economic Insight, to establish the total economic impact of the UK's current nuclear fleet during the operational phase of the nuclear power stations' lifetimes (i.e., from start of generation in 1976 to 2024).

In this report, we set out our key findings in relation to the current nuclear power stations' contributions to the UK in terms of gross value added (GVA) and employment, as well as their broader environmental impact in terms of carbon avoided.

Based on data provided by EDF and our in-house model of the UK economy, we estimated the economic impact of the current nuclear fleet, since start of generation to 2024, on their local economies in terms of GVA and employment. We included **direct**, **indirect** (supply chain), and **induced** (wage) effects. For the current nuclear fleet's impact on the environment, we estimated the carbon avoided since start of generation to 2024, taking into consideration the changing generation mix across the UK.

We find that the current nuclear fleet has made significant contributions to the UK economy and the environment between 1976 and 2024. In particular, we note that 93% of the current nuclear fleet's supply chain spend is within the UK.

1 The current nuclear fleet has contributed £123bn (2024 prices) GVA to the UK economy between 1976 and 2024.

This is made up of:

- **£52bn** (2024 prices) **direct** GVA impact;
- **£31bn** (2024 prices) **indirect** GVA impact; and
- **£41bn** (2024 prices) **induced** GVA impact.

2 The current nuclear fleet has contributed, on average, 31,000 jobs pa to the UK economy when all plants were in operation (1995–2021).

This is made up of approximately:

- **5,000** jobs per annum (pa) through **direct** effects;
- **12,500** jobs pa through **indirect** effects; and
- **13,500** jobs pa through **induced** effects.

3 The current nuclear fleet's clean energy generation has avoided 1.1 billion tons CO_2 eq. between 1976 and 2024.

EDF's nuclear power stations have produced **2,126 terawatt hours** (TWh) of clean energy between 1976 and 2024.

This has **avoided 1.1 billion tons CO_2 equivalent (eq.).**

The **value of emissions avoided in 2024 is £2.8bn** (2024 prices), using the UK Government's 2024 carbon value.

2. CONTEXT

Context: Nuclear power plays an important role in achieving Government's net zero objectives

In January 2024, the Department for Energy Security and Net Zero (DESNZ) published a roadmap for civil nuclear to 2050, where it set out the previous Government's ambition of having up to 24 Gigawatts (GW) of energy capacity to be coming from nuclear by 2050 (compared to about 6GW currently provided by nuclear).

In November 2024, the National Energy System Operator (NESO) published its advice, in response to the Government's formal commission for independent advice to inform its Clean Power 2030 (CP30) action plan. Here, the NESO recommends nuclear plant life extension and expects to see a reduction in Great Britain's nuclear capacity from 6.1GW in 2023 to 3.5–4.1GW in 2030, with scope for more new build beyond 2030. In particular, the NESO states that *"[n]uclear power will play an important role in achieving a clean power system by 2030 and beyond into the 2030s, when a new generation of nuclear plants can help replace retiring capacity and meet growing demand as the economy electrifies."*

In December 2024, the Government set out its Clean Power 2030 Action Plan. In it, the importance of nuclear in achieving CP30 and the long-term net zero objectives was reiterated, e.g. *"[e]lectricity generated by renewables and nuclear power will be the backbone of a clean electricity system by 2030."* Additionally, the Government recognised that new nuclear will play an important role in the transition to net zero *after* 2030, whilst acknowledging the lack of support for new nuclear developments by the Scottish Government.

EDF majority owns and operates the eight currently active nuclear power stations in the UK, three of which have already ended generation and started decommissioning (**Dungeness B**, **Hunterston B**, and **Hinkley Point B**). In December 2024, EDF decided to extend the operating life of **Heysham 1** and **Hartlepool** to 2027 and of **Heysham 2** and **Torness** to 2030. **Sizewell B** is due to generate electricity until 2035, as illustrated in *Table 1* below.

EDF also part-owns the only new nuclear plant under construction at **Hinkley Point C** and plans to develop another plant at **Sizewell C** are at an advanced stage.

Table 1: EDF nuclear power stations, capacity and operational status

Power stations	Capacity	Status
Hinkley Point B	965MW	Defueling: operational 1976 - 2022
Hunterston B	965MW	
Dungeness B	1.1GW	Defueling: operational 1983 - 2021
Heysham 1	1.1GW	Online since 1983: expected to start defueling in 2027
Hartlepool	1.2GW	
Torness	1.2GW	Online since 1988: expected to start defueling in 2030
Heysham 2	1.2GW	
Sizewell B	1.2GW	Online since 1995: expected to start defueling in 2035

Source: EDF

Background: EDF's nuclear power stations

In 2009, EDF (80%) and Centrica (20%) took ownership of British Energy Group plc. This included the eight nuclear power stations in the UK, as well as one coal-fired power station, Eggborough, which was divested.

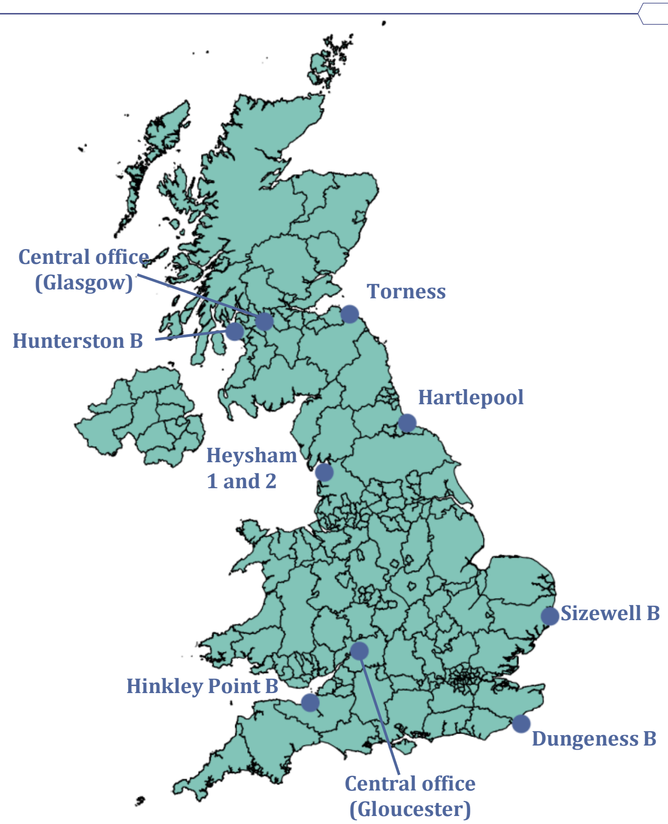
Since then, EDF has invested £8bn in its nuclear fleet, with a further £1.3bn planned over next three years (2025-2027). This has led to over 35% more electricity being generated than initially forecast at the time of acquisition, through successful asset life extensions and improved operational performances.

There is significant variation across the eight EDF nuclear power stations (illustrated in *Table 1*) in terms of their size, complexity and operational stage.

For example, they have been built with different reactors and to different specifications, where: (i) seven nuclear power stations have **Advanced Gas-cooled Reactors** (**AGR**), including Hinkley Point B, Hunterston B, Dungeness B, Heysham 1, Hartlepool, Torness, and Heysham 2; and (ii) one has a **Pressurised Water Reactor** (**PWR**), specifically Sizewell B.

Figure 1 illustrates how the EDF sites are distributed across the UK, including EDF's central support offices in Gloucester and Glasgow.

Figure 1: Location of EDF nuclear and head office sites



Source: Economic Insight based on EDF information

Background: Output of EDF's nuclear power stations

The key output of each of EDF's nuclear power stations is the electricity they generate. Whilst this is an important factor in explaining the contribution of EDF's nuclear power stations to the UK economy, it is important to recognise that this does not fully explain both the magnitude of the overall impact or the variation in impact between sites.

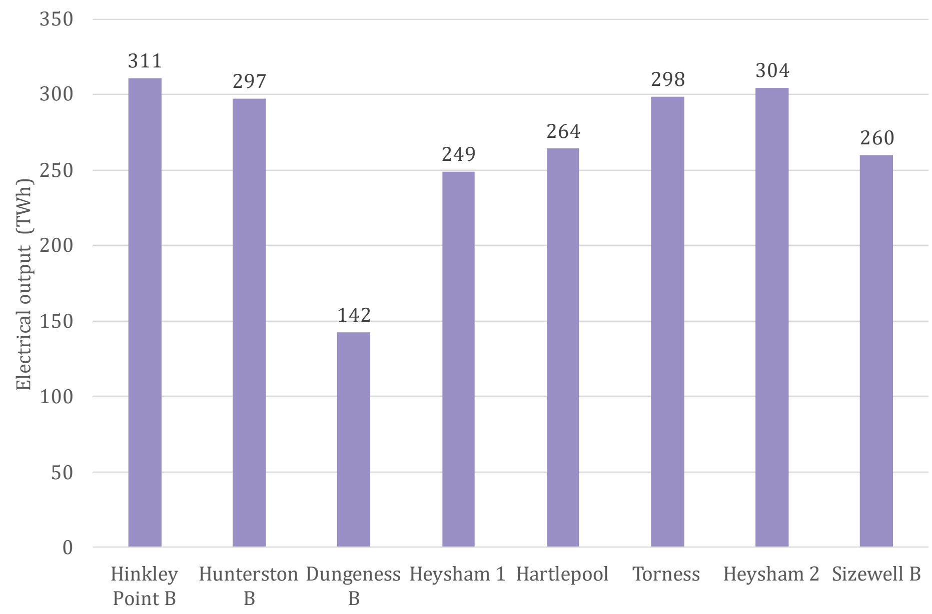
Several other factors, such as the costs involved in generating said electricity, the nature of the supply chains of the nuclear power stations, and the timing of the electricity they generate are important determinants of the economic benefit of the operation of EDF's nuclear power stations to the UK economy.

Figure 2 shows that the eight EDF nuclear power stations generated a total of **2,126 TWh of electricity** between 1976 and 2024. We note that:

- **Sizewell B** (in operation since 1995) has already exceeded the electrical output of **Heysham 1** (in operation since 1983) despite being in operation for over 11 less years.

- **Dungeness B** (in operation between 1983 and 2021) has generated less electricity than the other EDF nuclear power stations in the UK. As the first commercial AGR design (which has never been replicated), Dungeness B has faced more technical challenges than other sites with more mature designs.

Figure 2: Electrical output of EDF nuclear power stations, 1976–2024 (TWh)



Source: Economic Insight analysis of EDF data

2,126 TWh is circa 8 times the UK's 2023 electricity consumption.

Methodology for estimating the economic and environmental impact of EDF's nuclear power stations

Methodology for estimating the economic impact

Our estimation of the economic impact of EDF's eight nuclear power stations and its central support offices relies on detailed site-level analysis, using data from a variety of sources including EDF, the Office of National Statistics (ONS), and the International Atomic Energy Agency (IAEA).

To understand the contribution of EDF sites to the UK since 1976, we have undertaken **economic impact modelling**. More specifically, we estimate three types of economic impact, for each year between 1976 and 2024:

Direct effects, *which are the immediate impacts that arise from the operations of the EDF sites and include aspects such as the number of staff employed by EDF, and the immediate value created by the activities undertaken at the sites.*

Indirect effects, *which are the effects that arise through supply chains that support the EDF sites. Suppliers buy inputs from their suppliers, and their suppliers buy inputs from others, and so on, creating further economic impacts that can ripple through the local economies.*

Induced effects*, which arise through EDF employees and the companies in the supply chains spending their wages in the economy, creating further impacts.*

We quantify the types of economic impact using two metrics:

- **gross value added** (**GVA**); and
- **jobs/employment**.

We use a combination of data supplied to us by EDF and our in-house model of the UK economy. Further details of this modelling approach are given in the *technical appendix*, including external validation of our approach by Prof Anthony Glass.

We note that, whilst we have taken steps to ensure the analysis is as robust as possible, estimating impacts necessarily relies on assumptions, and the precision of estimates can vary. Typically, we have greater confidence in estimates of direct impacts, as these tend to rely more closely on data provided by EDF.

Methodology for estimating the environmental impact

Our evaluation of EDF's environmental impacts rests on the methodology set out by the European Commission for estimating greenhouse gas emissions avoided, with the methodology adapted to apply to a historical (rather than forward-looking) context. Additionally, we have made use of lifecycle assessments of power sources' emissions to ensure that emissions associated with the construction and decommissioning of plants are also considered.

3. GVA CONTRIBUTIONS

Direct GVA effect

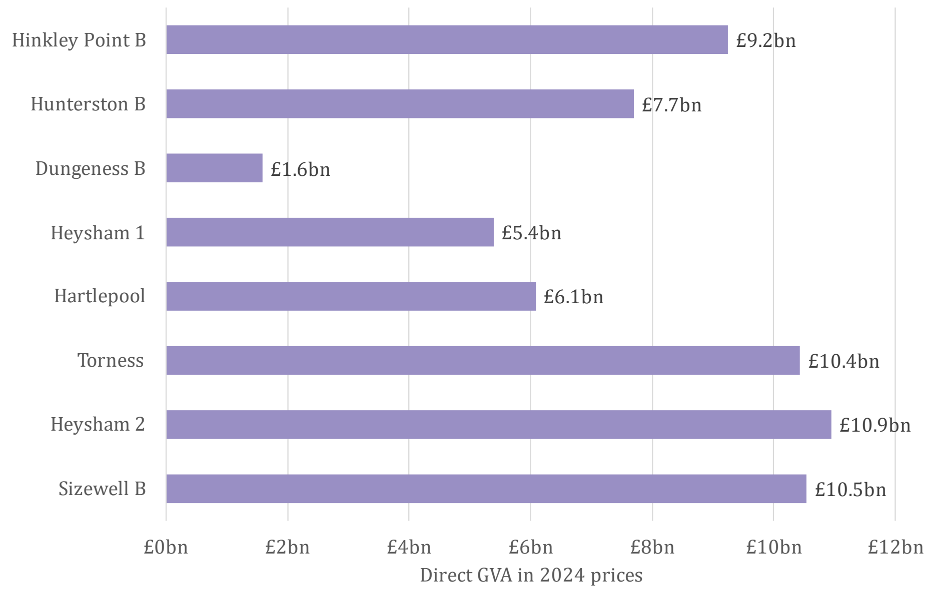
Direct GVA is the economic value created by the activities that are undertaken at a specific site. It is equal to the sum of employment costs and operating surplus (where operating surplus is defined as income, less all operating costs other than those related to capital, i.e. excluding depreciation charges). This captures the value that operations at a site add to the inputs that are bought from suppliers.

The definition of direct GVA should be kept in mind when considering the local impact of sites. For example, a larger operating surplus (all else equal) will not benefit the local economy. Rather, benefits to the local economy are felt through direct employment (one component of direct GVA), and the knock-on effects through local suppliers (estimated subsequently).

Figure 3 shows the direct GVA for each of the eight EDF sites between 1976 and 2024 (2024 prices) stands at **£52bn** (2024 prices) combined. These direct impacts are assigned fully to where each site is located.

The direct GVA of each plant is highly correlated with the plant's electrical output. Hence, the direct GVA of Dungeness B is smaller than that of other sites as it has lower electrical output (see *Figure 2* for total electrical output per plant). This occurs as there is little variation in total operating and employment costs across plants. Consequently, differences in electrical output, and so income, drive the variation in direct GVA between sites.

Figure 3: Direct GVA effect of EDF sites, 1976–2024 (£bn, 2024 prices)



Source: Economic Insight analysis of EDF data

Supply chains

The knock-on GVA impacts of activities at sites are in part determined by supply chains, particularly where suppliers are based.

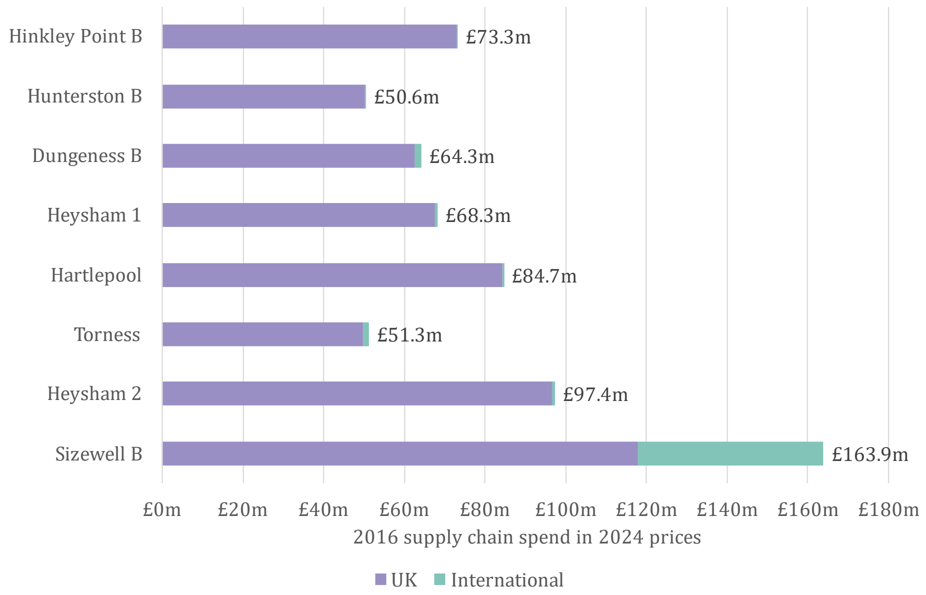
As can be seen in *Figure 4*, the eight EDF sites purchased a significant amount of goods and services from suppliers within the UK in 2016. Based on our analysis of supplier data, we calculate that only approximately 7% of spend across all sites was with international suppliers. Therefore, it can be expected that the UK will accrue most of the knock-on effects arising through supply chains.

Figure 4 also illustrates that there is a large variation amongst sites in their total spend. This reflects the level of activity at each EDF site.

- **Sizewell B** (the largest spender in the UK) had a spend in 2016 that was nearly 2.4 times that of **Torness** (the smallest spender in the UK).
- Similarly, **Sizewell B** (also the largest spender overall) had a spend in 2016 that was over 3.2 times that of **Hunterston B** (the smallest spender overall).

This variation reflects that **Sizewell B** underwent a planned outage for refuelling and maintenance in 2016, while all reactors at **Torness** and **Hunterston B** were online for over 90% of the year.

Figure 4: Total spend on suppliers by EDF sites in 2016 (£m, 2024 prices)



Source: Economic Insight analysis of EDF and ONS data

Note: a further £373m of supply chain spend cannot be allocated to a specific plant; approximately 11% (£41m) of this relates to international suppliers.

Indirect and induced GVA effect

The total GVA contribution of EDF sites to the UK is **£123bn** (2024 prices), which is made up of the following impacts:

- direct: **£52bn** (2024 prices, 42% of the total);
- indirect: **£31bn** (2024 prices, 25% of the total);
- induced: **£41bn** (2024 prices, 33% of the total).

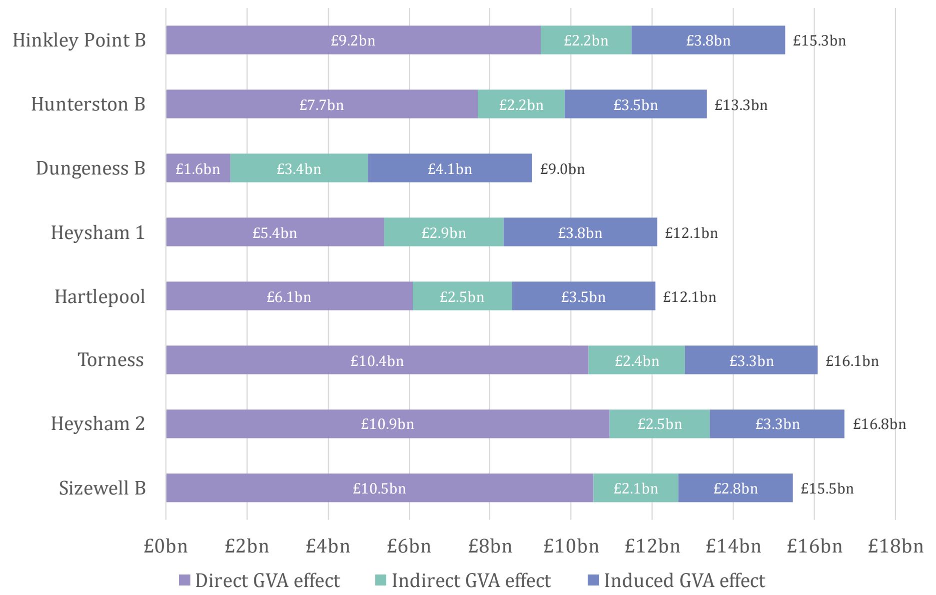
As *Figure 5* shows, the EDF sites have significant knock-on effects on the UK economy, when measured in terms of GVA.

Given their large supply chains, as was shown in *Figure 4*, the sites have significant indirect impacts. In addition, induced impacts are also significant, with these arising through employees of EDF sites and suppliers.

The differences between power stations' total GVA contributions are consistent with potential benefits from the technological evolution of reactor designs.

- The lowest total GVA contribution coincides with the earliest reactor design built at **Dungeness B**, as the first commercial AGR site.
- The highest total GVA contributions were made by **Heysham 2** and **Torness**. These sites use the most mature AGR design, an evolution of the design of **Hinkley Point B** and **Hunterston B**.

Figure 5: Total GVA impact of EDF sites at a national level, 1976–2024 (£bn, 2024 prices)



Source: Economic Insight analysis of EDF and ONS data

Note: the central support offices account for negative direct GVA at –£10.3bn but contribute £11.0bn and £12.6bn in GVA through indirect and induced effects.

4. EMPLOYMENT CONTRIBUTIONS

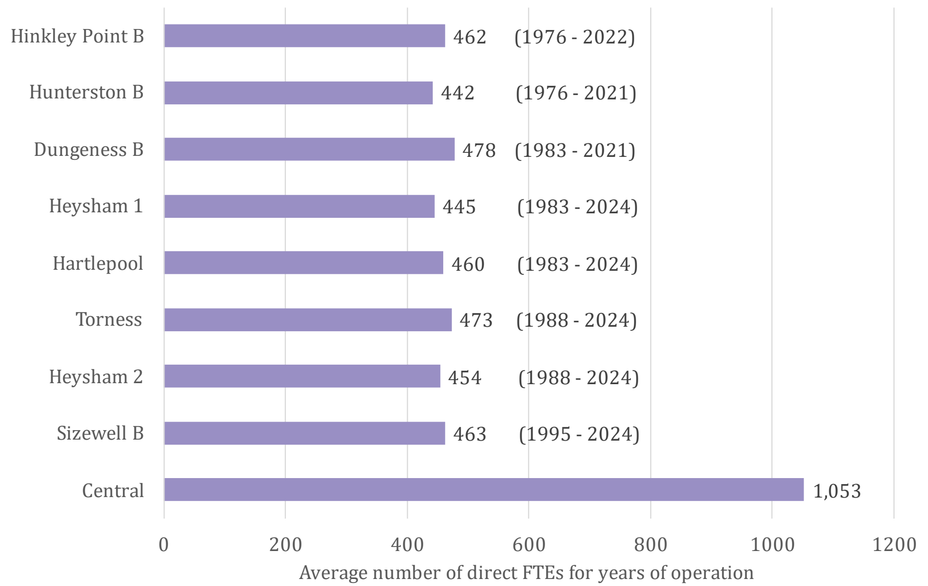
Direct employment effect

When all plants were in operation (between 1995 and 2021), on average, EDF directly employed **approximately 5,000 staff pa** across its sites.

As can be seen in *Figure 6*, the average number of EDF employees varies little by site. On average, EDF's nuclear power stations employed **459 full-time equivalent staff** (FTEs) pa per plant over their operational period. This variation appears unrelated to the electrical output of each site. For example:

- **Dungeness B,** which generated the least electricity per year in operation, on average directly employed 478 FTEs pa when in operation. This is 4.1% above the average of all EDF's nuclear power stations.
- **Sizewell B**, which generated the most electricity per year in operation, on average directly employed 463 FTEs pa when in operation. This is 0.8% above the average of all EDF's nuclear power stations.

Figure 6: Average number of direct employees at EDF sites in their operational years



Source: Economic Insight analysis of EDF data

Note: the central support offices' average number of direct employees is the average over the period when any plant was operational (1976–2024).

Indirect and induced employment effect

On top of the direct employment effects, the EDF sites also have impacts on the economy through:

- indirect employment effects, which arise through supply chains; and
- induced employment effects, which arise through employees of EDF sites and their suppliers spending their wages.

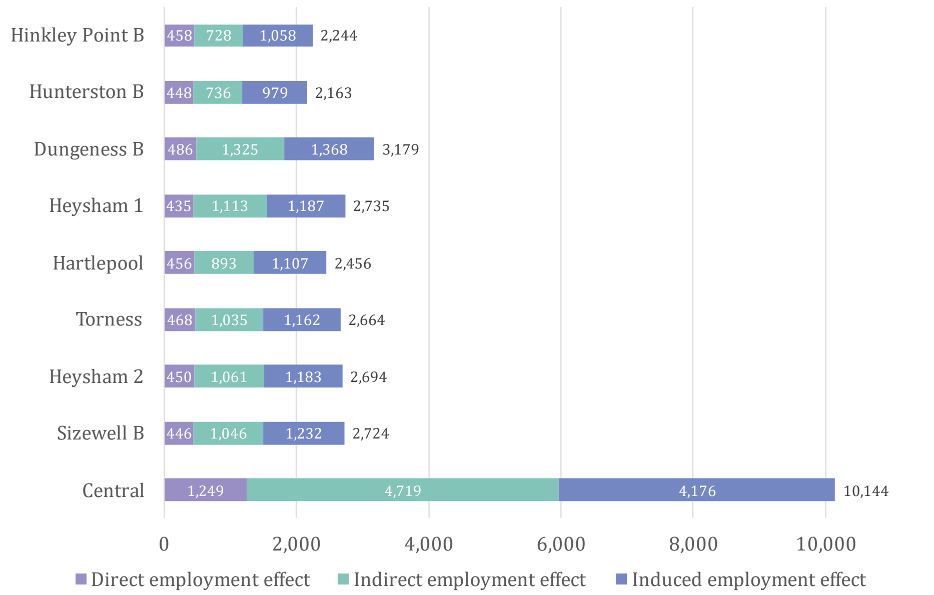
When all plants were in operation (between 1995 and 2021), on average, the total employment contribution of EDF sites to the UK was **31,000 jobs pa**. This is made up of the following effects:

- **direct**: **approximately 5,000 jobs pa** (16% of the total);
- **indirect**: **approximately 12,500 jobs pa** (41% of the total); and
- **induced**: **approximately 13,500 jobs pa** (43% of the total).

At a UK level, these indirect and induced impacts are significant compared to the number of staff directly employed at the sites.

Figure 7 on the right illustrates how these multiplier effects mentioned above are larger than the direct employment effects.

Figure 7: Total average employment impact of EDF sites at a national level, 1995–2021



Source: Economic Insight analysis of EDF and ONS data

For each EDF job there are a further 5.3 jobs in the UK economy, on average.

5. ENVIRONMENTAL CONTRIBUTIONS

EDF's current approach to estimating carbon avoided

EDF estimates the effect of its nuclear power stations on the UK's greenhouse gas (GHG) emissions by considering the quantity of *additional* emissions that would have occurred to generate the same amount of electricity in their absence.

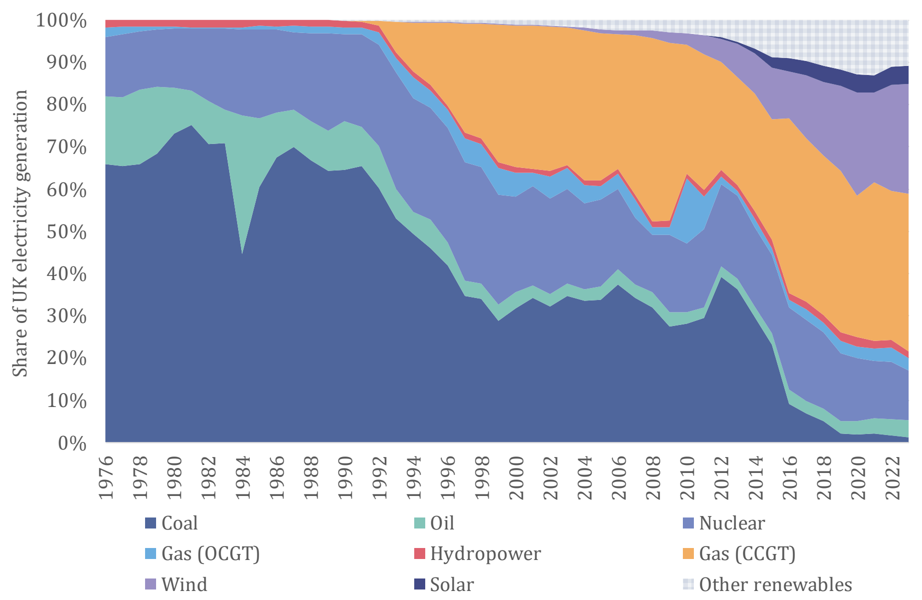
Taking a forward-looking view, EDF compares nuclear energy to the prevailing fossil fuel today and assumes that all electricity generated by its plants would be replaced by combined-cycle gas turbines (CCGT).

As can be seen in *Figure 8*, the actual historical mix of electricity generated in the UK has varied over time. Historically, the UK has relied on coal power plants to generate most electricity, with coal power plants accounting for over 66% of electricity generated between 1976 and 1990. Coal power plants emit significantly more emissions per unit of electricity generated than CCGT plants. Hence, EDF's current approach significantly underestimates the emissions reduction caused by EDF's nuclear power stations in the past.

Therefore, we have developed an alternative method to estimate EDF's carbon avoided.

Emissions reductions are measured in mass of carbon dioxide equivalent (CO_2 eq.), a unit of measure whereby all GHG emissions are converted into a mass of carbon dioxide of equivalent global warming potential.

Figure 8: UK electricity generation mix, 1976–2023



Source: Economic Insight analysis of Our World in Data and DUKES data

Carbon avoided from nuclear operations between 1976 and 2024

Our approach to calculating the emissions reduction caused by EDF's nuclear plants is similar to EDF's, namely: measuring the reduction in mass of CO_2 eq. and assuming all electricity generated by EDF's nuclear power stations is fully replaced.

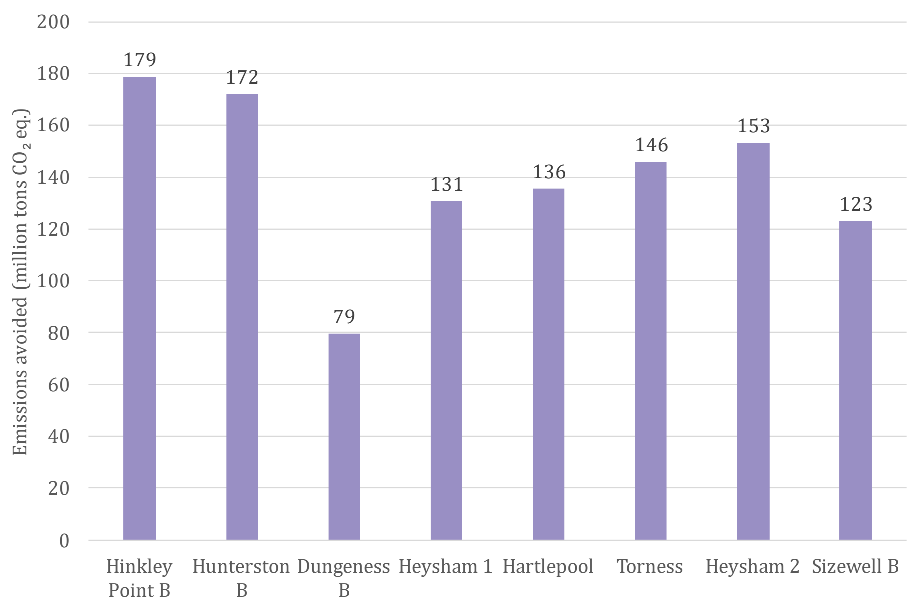
However, we address the changing composition of the UK's electricity grid by assuming that the replacement electricity has the same mix as the UK's electricity mix, without EDF's nuclear power stations, at the time of generation.

Further, to reflect that the construction and supply chains of EDF's nuclear plants are not emission free (as implicitly assumed in EDF's calculation), we estimate lifetime CO_2 eq. emissions per kilowatt hour (kWh) for EDF's nuclear plants using EDF's published figures.

We estimate that EDF's nuclear plants have reduced the UK's carbon emissions by **1.1 billion tons CO_2 eq.** between 1976 and 2024. This is equivalent to over 16 years of UK car emissions and is 51% more than that estimated by EDF.

Figure 9 shows the emissions reduction in million tons CO_2 eq. caused by each of EDF's nuclear plants. Variation in the emissions reduction between sites is largely driven by differences in the amount of electricity generated. However, older plants have an outsized contribution to the emissions reduction. This is because the earlier the electricity was generated, the greater the emissions reduction it resulted in, as the UK grid has become less carbon intensive over time.

Figure 9: Carbon avoided by plant, 1976–2024 (million tons CO_2 eq.)



Source: Economic Insight analysis of EDF, Our World in Data, DUKES, UNECE and IPCC data

In 2024, the value of emissions avoided by EDF was £2.8bn (2024 prices), using the UK Government's 2024 carbon value.

6. TECHNICAL APPENDIX

Input-output modelling

Input-output modelling is a standard technique to estimate the effects of economic activities on whole economies, geographic regions, and industries. It incorporates the interdependencies present in modern economies. For example, an increase in final demand for one type of product will cause an increase in demand for the inputs into production. Subsequently, the wages earned by employees in related sectors will increase demand for other goods and services, thus further increasing demand for final outputs.

More specifically, economic impacts can be broken down into three channels:

- **Direct effects** arise as an immediate impact from the activities being studied. These include the value created by producing the final good or service, and the employment required to do so.
- **Indirect effects** arise through the supply chain. An increase in demand for a final output will also increase demand for its inputs, and the inputs to those inputs, and so forth.
- **Induced effects** arise as a result of increased wages to the employees of the organisation(s) producing the final output, and those in the supply chain.

Whilst standard accounting information can be used to calculate direct effects, input-output modelling quantifies the indirect and induced effects.

Typically, economic impact is measured in terms of GVA, employment, and tax receipts.

- **GVA effects** are expressed cumulatively in 2024 prices using GDP deflators published by the ONS and the Office for Budget Responsibility's October 2024 inflation forecast.
- **Employment effects** are averaged over the years of operation for each site.

Our in-house input-output model has been developed to estimate the economic impacts of organisations/industries defined by the user, on geographic regions of choice. The basis of our model is the set of input-output analytical tables produced by the ONS for the UK as a whole. These tables show the flows of products and services in the economy and are themselves based on the same underlying data that is used to produce estimates of Gross Domestic Product (GDP).

To calculate indirect and induced effects, we rely on EDF's data on spending on inputs from the supply chain and employees' compensation. For years where this data is not available, we estimate indirect and induced effects based on the average of years with available data.

This approach has been externally validated by Prof Anthony Glass, Professor of Managerial Economics, Sheffield University Management School (SUMS), University of Sheffield.

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