Socio-economic Impacts of Hydropower

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BiGGAR Economics

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BiGGAR Economics was commissioned by the British Hydropower Association to assess the potential economic impact of hydropower in the UK. The objectives of this study were:

- Consider the strategic benefits of delivering more hydropower
- Quantify the economic benefits that the hydropower sector generates for the British economy through its role in electricity markets
- Assess the potential economic impacts of constructing additional capacity
- Highlight the local and community impacts generated through growth in the sector, including local energy networks.

This study builds on analysis by the University of Birmingham on the technical and commercial feasibility of increasing the hydropower resource in the UK. The findings presented in this report are a summary of the analysis completed by BiGGAR Economics.

The full report, including the methodologies applied, is available on the BiGGAR Economics website.

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Hydropower in the UK

There is currently around 2 GW of traditional hydropower in the UK (excluding pumped storage hydro).

Hydropower refers to schemes that use the natural flow of water to generate electricity. It is the longest running renewable energy technology, estimated to have prevented the emission of 160 million tons of CO_2 since 1920. Schemes can be divided into three categories:

01 **Run of River:** electricity is generated from the flow of water. This can include pico (less than 5 kW) and micro (less than 100 kW) schemes as well as much larger schemes.

02 **Dams or Reservoir Storage:** water is stored in a dam or reservoir and released when demand is high.

03 **Pumped storage (not considered in this report):** water can be pumped from a lower reservoir to a higher one when electricity supply is high and released when demand is high. This technology is beyond the scope of this study, but is considered as part of a study undertaken by BiGGAR Economics for Scottish Renewables.

A comprehensive recent study undertaken by researchers at the University of Birmingham found that the current hydropower capacity of the UK (excluding pumped storage) was equal to 2,045 MW.

The vast majority of these schemes are located in **northwest Scotland** and **north Wales,** where the mountainous terrain is uniquely well-suited to hydropower schemes.

Hydropower in numbers

2,045 MW

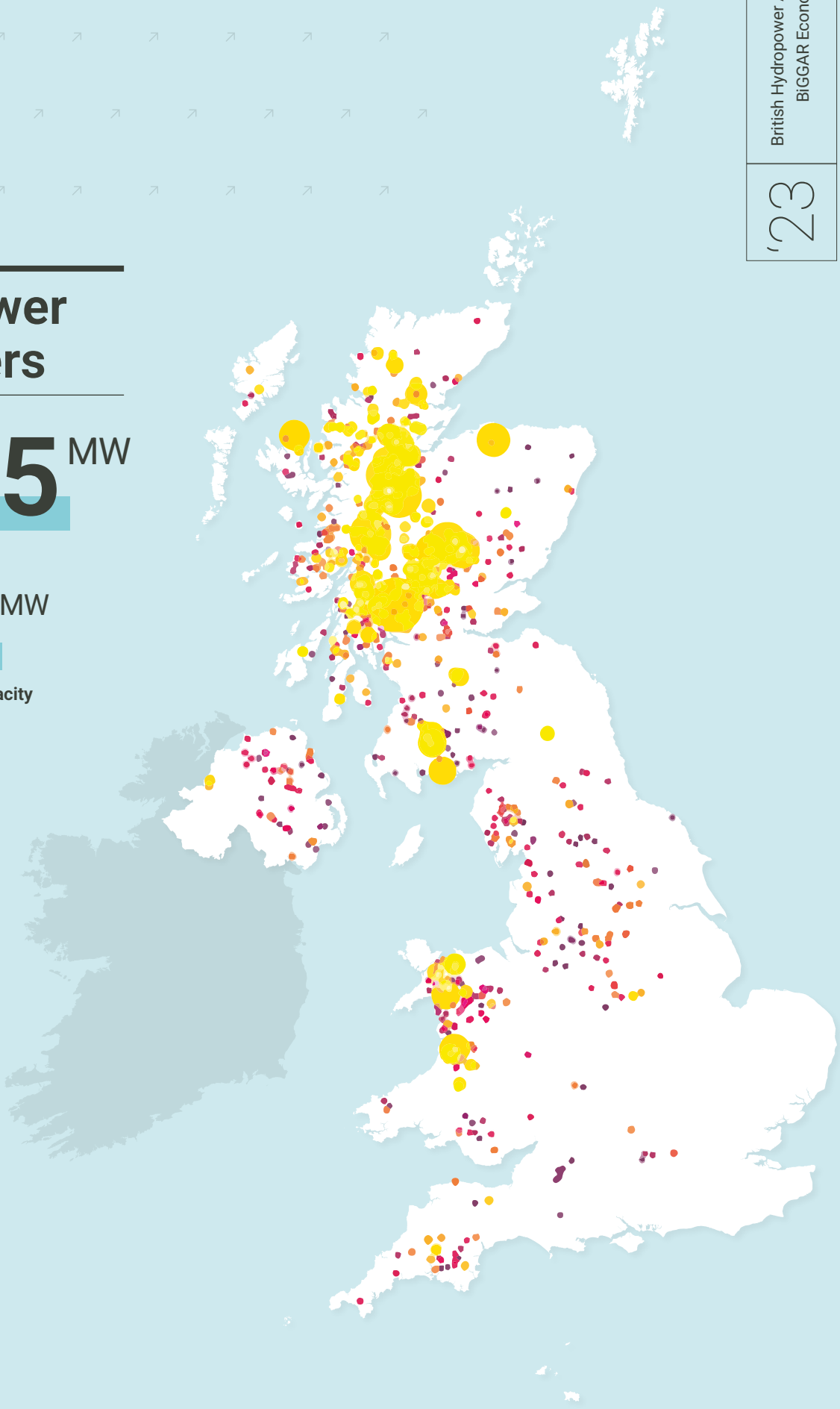
Current capacity

1,000 MW

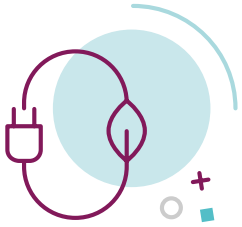
Estimated additional capacity with £140/MWh CfD

62%

Current hydropower that has been operating for at least 50 years



Strategic Case



To meet the UK Government's Net Zero by 2050 target, substantial increases in clean, renewable energy are required.

As the main technologies which are likely to do this, solar and wind, are intermittent, a diverse portfolio of low carbon energy generation assets are needed to support the grid. As an established and proven technology, hydropower is well-placed to add considerable benefit. In addition, it produces more energy during the winter when demand is highest.

The British Energy Security Strategy identified the following challenges for the UK's energy security:

01 **Reducing reliance** on Russian fuel imports while maintaining security of supply

02 **Moderating the impact** of global commodity price rises on the UK economy and businesses

03 **Increasing energy independence** to mitigate the impact of international energy market trends

04 **Maintaining the UK's commitment** to reach Net Zero by 2050.

Changes in the support environment surrounding hydropower has seen a reduction in activity, with development in the sector rapidly declining in recent years.

The current Contracts for Difference mechanism has not supported any new hydropower developments due to the strike price set and minimum capacity restrictions. This has resulted in investment, skills and experience moving away from the hydropower sector in the UK. Closures of schemes such as the Feed-in Tariffs (FiT) mean that the price per unit of energy is no longer fixed for generators or inclusive of a premium. As such, there is greater uncertainty about future revenues, making returns less predictable and making schemes difficult to finance.

However, there is potential for the sector to contribute more.

As part of the report undertaken by University of Birmingham, it was estimated that an Administrative Strike Price (ASP) of £140 per MWh could lead to an additional capacity of 1 GW being built over the next 15 years.

2050

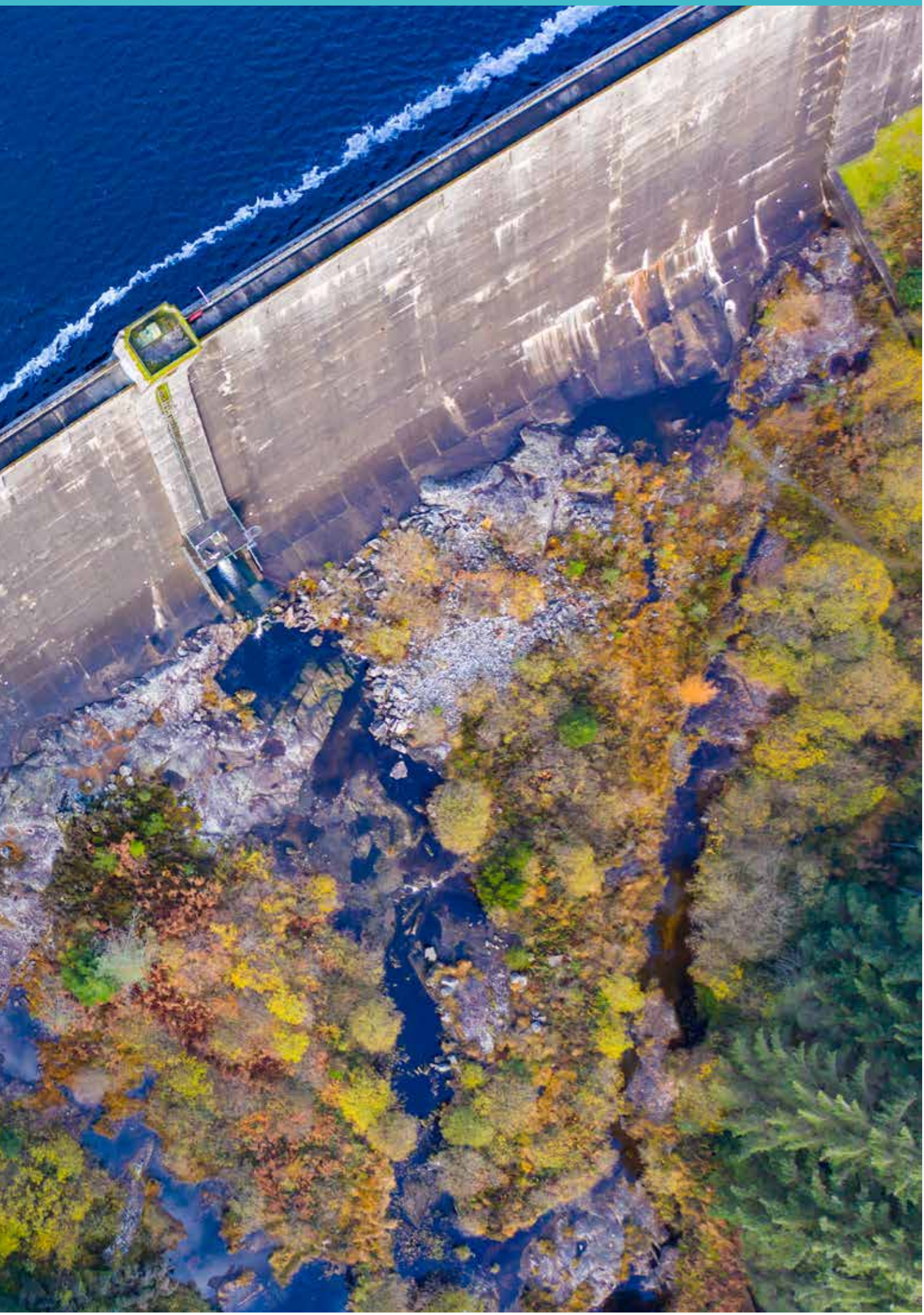
Target date for UK to reach Net Zero

80%

Share of electricity from intermittent sources by 2050

677 TWh

Expected electricity demand in 2050



Savings to UK consumers

Across the year it is estimated that hydropower reduced the wholesale cost of electricity for UK consumers by £275 million in 2019.

In 2019

7.2 TWh

Electricity produced by hydropower

£**275** million

Wholesale electricity cost reduced by hydropower

The price for UK electricity is determined by the highest value the market needs to pay to meet the electricity demand in any given hour.

Hydropower reduces the wholesale price of electricity for UK consumers by pushing more expensive peaker plant generation out of the system. The expensive generation is usually carbon-intensive such as coal or gas fired generation.

It is more expensive to add electricity to the grid at times of high demand. The high demand results in an increase in the sensitivity of the price to any changes in supply.

Periods of high demand include the early evening when people switch on the oven to make their evening meal. It typically costs 4 times as much to add 1 GW of electricity to the system at 5pm than in the middle of the night. Hydropower with reservoir storage is able to come online during these daily peaks in demand and reduce the need for the most expensive generation to come online.

The demand is also higher in the winter, which coincides with higher periods of rainfall and therefore hydropower output. In December 2019, hydropower produced three times as much output than in May.

Role in a crisis

Hydropower has an even greater impact for UK consumers during a crisis.

In 2022, the price of energy increased dramatically as a result of the Russian invasion of Ukraine and problems with nuclear output in France. This added significant pressure to the UK economy, raising inflation and forcing the UK Government to subsidise domestic energy bills through the Energy Price Guarantee.

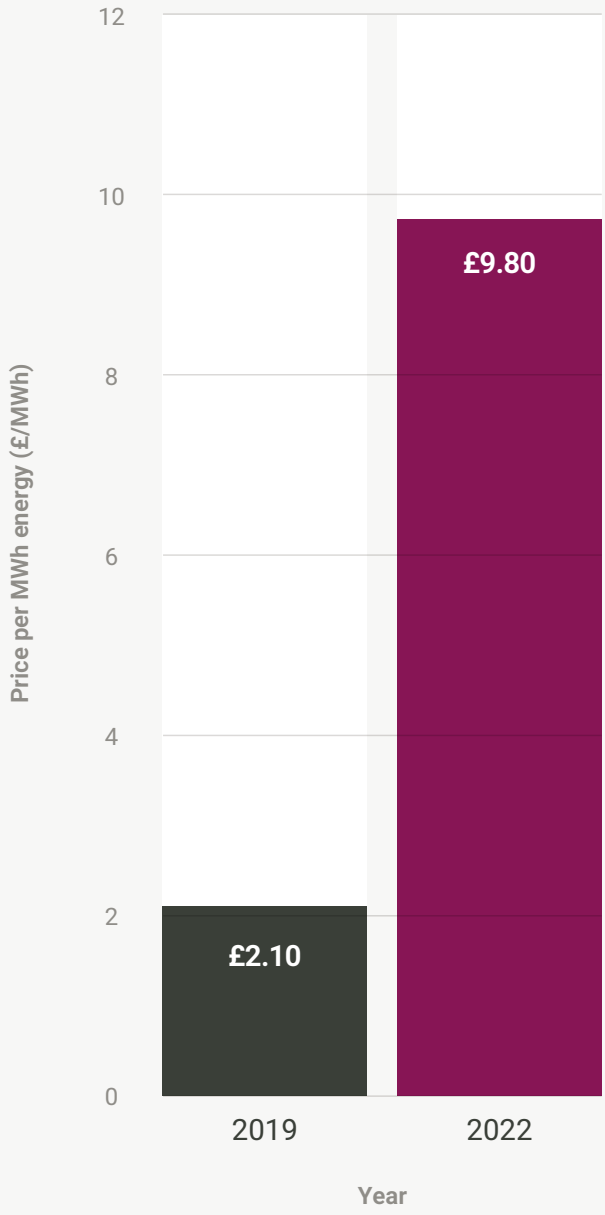
Hydropower played an important role in mitigating against prices rises. The peaker plant that was displaced by hydropower was even more expensive in 2022 than in 2019.

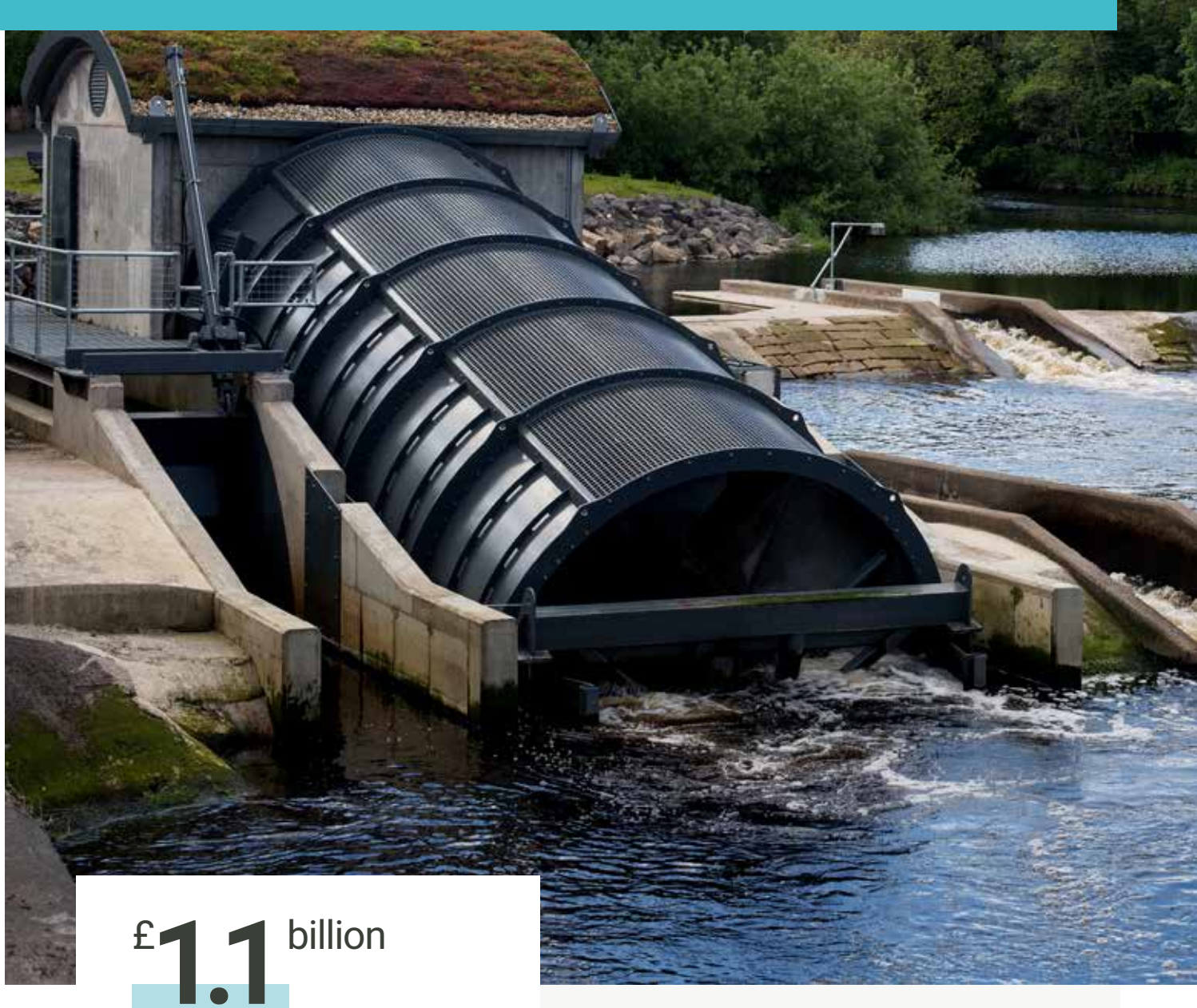
On average it cost £9.80/MWh to increase the supply of electricity by 1 GW in 2022, compared to £2.10/MWh in 2019.

476%

Average increase of wholesale price of electricity between 2019–22

Cost of supplying an additional 1 GW to the Grid





£1.1 billion

Reduction in wholesale electricity cost in 2022 due to hydropower

Hydropower helped to mitigate against this increased volatility. The price of electricity was particularly volatile during the early evening and it was at these times that records were broken in the electricity market. Hydropower reduced the need for this expensive generation by increasing its production in the early evening.

The electricity market in 2022 was particularly volatile during the winter months. This is because the demand for gas for heating was much higher in these months and the supply of this gas was more expensive as a result of the Russian invasion of Ukraine.

Hydropower produced 250% more electricity in the winter of 2022 than in the summer months due to increased rainfall. This is another example of the patterns of production of hydropower benefit the UK electricity market.

On average, hydropower reduced the wholesale cost of electricity by £200,000 at 5pm every day.

£200 thousand

Average reduction in wholesale costs at 5pm

Investment and support

There is more hydropower resource that can be exploited across the UK.

It is estimated that a Contracts for Difference ASP of £140/MWh would enable an extra 1 GW of hydropower to be constructed and contribute to the energy security of the UK. This would come from new small scale hydro projects and upgrades to existing facilities. The vast majority of new schemes would have a capacity of less than 5 MW. Therefore, the restrictions on CfD eligibility would need to change to accommodate smaller schemes and release their potential.

The UK has the skills and expertise to secure the majority of the contracts associated with this construction. Civil engineering required for hydropower schemes is the largest element of this cost and will be primarily sourced from the UK. There will also be opportunities for UK manufacturers and electrical engineers. In total it is estimated that the construction of these projects will result in £4.2 billion of spending with UK firms. The UK captures a greater share of the capital investment costs in hydro than other renewable technologies.

3 Queensferry Crossings

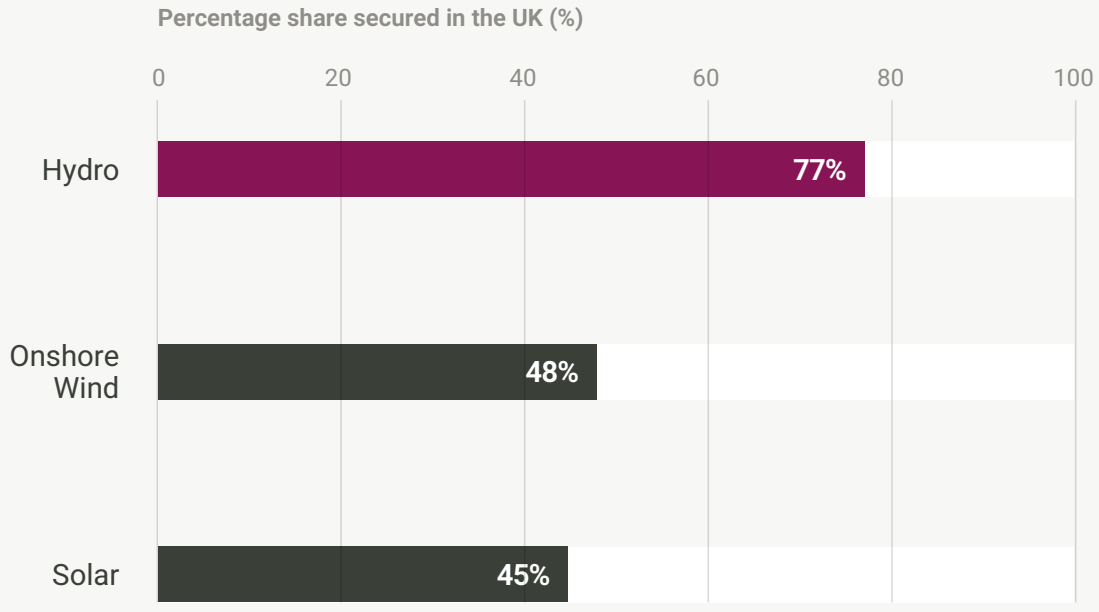
Investment equivalent for construction of 1 GW of hydropower capacity

The 1 GW of hydropower in the UK that was constructed prior to 1960, and is still producing electricity today, required a significant strategic investment in the resilience of the UK electricity market. The next gigawatt of hydropower will require the same. It is estimated construction 1 GW of new hydropower capacity in the UK will require an investment of £5.5 billion. This is equivalent to 3 Queensferry Crossings.

£4.5–7.0 million

Construction costs per MW

Share of Capex by Energy Type



77%

Share of capital spending in the UK

The UK captures a greater share of the capital investment costs in hydro than other renewable technologies.

Economic Impact from Construction

The expenditure on the construction of the additional 1 GW of hydropower capacity will **support employment** and generate **Gross Value Added** for the UK economy.

£4.8 billion

GVA during the construction phase

It is estimated that across the UK economy the construction of these projects will:

- Generate £4.8 billion GVA
- Support 62,160 years of employment

This impact includes those:

- **Directly employed** on the development and construction projects
- **Who supply goods and services** to the projects
- **Supported by the employees** spending their wages in the wider economy

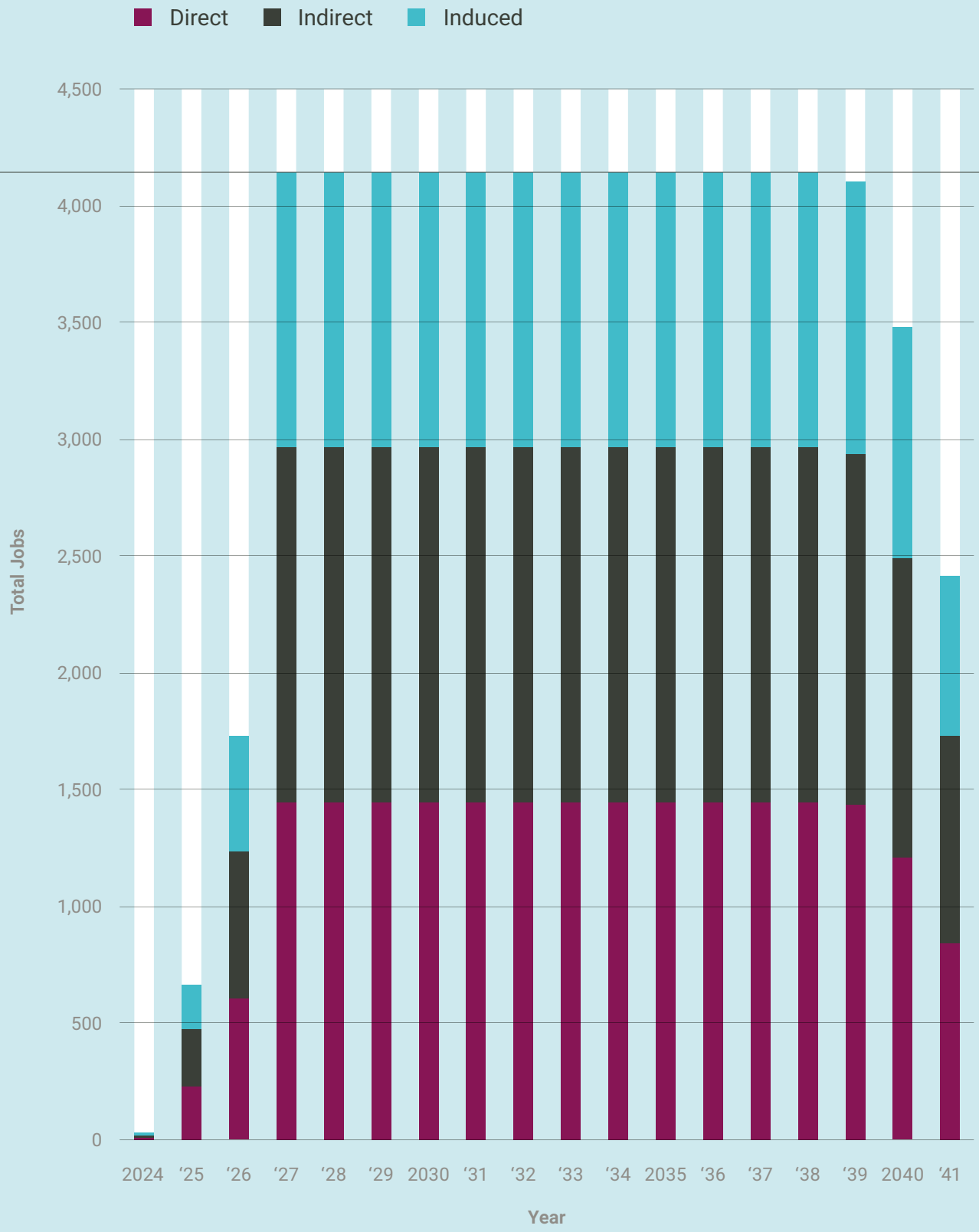
4,100

Jobs support across the UK

There is no detailed programme of construction for these projects and so assumptions have been made regarding the timetable to deliver. If the additional capacity is constructed at a steady rate between 2024 and 2041, this economic activity will support up to 4,100 jobs.

It is assumed that the majority of these projects would use civil contractors from their regional area and the so majority of the people directly employed would be local. The wider supply chain, including the provision of goods and services to the primary civil engineering contractor, would support employment across the UK and enable areas without hydropower potential to also benefit from the economic opportunities during the construction phase.

Split of Construction jobs by direct, indirect and induced



Economic Impact from Operations

The hydro projects across the UK that are still operating 60 years after they were commissioned are able to continue to contribute to the UK electricity network because they have been maintained and cared for over decades.

£61 million

Annual expenditure on O&M

The operation and maintenance (O&M) required for the new projects will also result in additional economic activity. This impact is smaller than the work required for the construction but will be required over the lifetime of the projects.

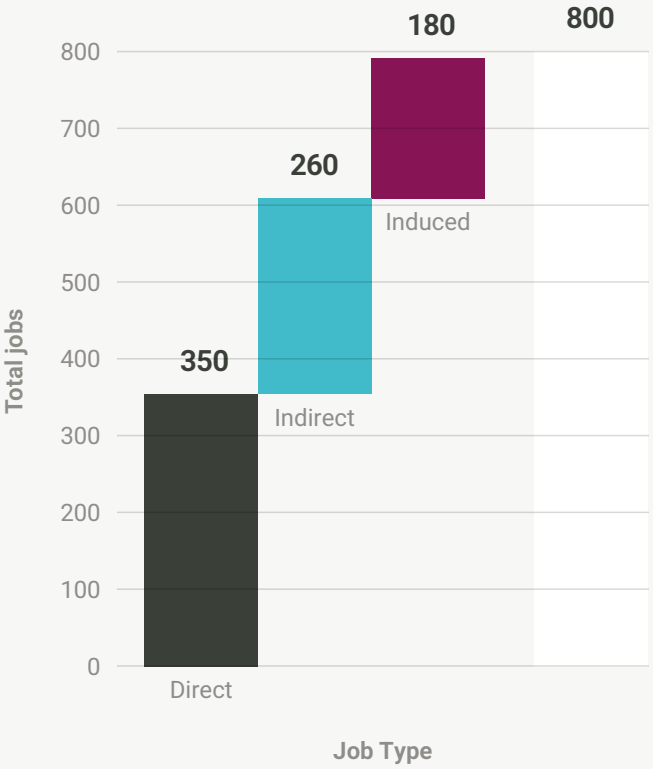
The majority of the economic opportunities during the operations phase will occur locally to the hydro developments. This will include the ongoing maintenance works, installation of replacement parts and the manufacturing of bespoke components.

£**43** million

GVA generated each year throughout the supply chain

It is estimated that if an additional 1 GW of hydropower had been available during 2022, it would have reduced the wholesale cost of electricity by a further **£532 million.**

Split of OPEX jobs by direct, indirect and induced



800

Jobs supported annually across the UK

The direct financial benefits during the operations will also the sustainability of anchor organisations and provide financial resilience to communities. Hydropower can contribute to new drivers of growth in rural areas by allowing for the cross-subsidy of activities.

The main operational benefits from the additional benefits of hydropower would be the contribution to the strategic objectives of the UK and the displacement of expensive peaker plant on the UK electricity network.

Benefits to Communities

The hydro power sector enables communities to realise economic and wellbeing benefits from their natural capital.

600

Homes powered by the Lochaber Community Hydro

20 GWh

Electricity produced across the canal network

Economic Opportunities

The construction and operation of hydropower projects will create employment opportunities in the communities they are built in. The civil engineering in particular are likely to demand skills and services from local companies. This will include plant hire and operation, forestry and land management and support services to the construction industry.

Many of the areas with hydropower potential are projected to experience a decline in population. A lack of economic opportunities is one of the driving factors for this population decline, as young people move away to find economic and educational opportunities elsewhere. Hydropower can help to overcome these issues by providing high-quality employment in rural communities.

Economic Opportunities

- Direct employment on projects
- More sustainable anchor institutions

Energy Transition

- Rural grid reinforcements
- Faster energy transition

Direct Electricity

- Opportunities for smart local grids
- Direct wires and PPAs
- Post industrial canal communities

Local Energy Consumption

Hydropower can also play a role in adding grid flexibility to rural areas through integration of Smart Local Energy Systems (SLES) and direct wires to local industrial users.

SLES take a granular approach to meet specific community-based needs to deliver affordable and clean energy by managing the grid more intelligently. This is achieved by utilising data analytics to deploy renewable energy, such as hydropower more efficiently. For example, demand can be managed to encourage people to use electricity when the hydro scheme is producing a lot of energy, reducing the need to transmit electricity across large distances to other users and shifting demand from when supply is low.

By providing a local source of power, hydropower can contribute to a greater level of flexibility and allow the energy system to be managed more efficiently and cost-effectively. In this way, SLES can protect consumers from costly bills and future energy price increases.

The canal network that runs through the UK's historic industrial heartlands also presents an opportunity for local energy consumption. The hydro schemes currently on the 2,000-mile canal network generate 20 GWh of electricity each year and there is potential for a further 17 GWh. The income from these schemes support the operations of the Canal & River Trust, enable the canals to power nearby buildings and attract manufacturing and industry back into these areas.

Energy Transition

Rural communities face challenges around access to the grid and constrained energy supply , which could be addressed through hydropower.

Rural communities are more likely to have weak grid connections, which means that the volume of electricity that they can use is limited. Increasing the capacity of the local transmission and distribution network is a slow process that can often take several years and it is expensive due to the challenges associated with difficult terrain and the much lower population density. As a result, supporting economic growth and transitioning to Net Zero is more challenging in these areas.

Hydropower can play an important role in connecting rural communities to sources of energy, increasing their sustainability and supporting new uses of electricity, such as heat and transport.

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