

The voice of the energy industry

Funding the Future



The UK's energy transition in a global context

Part of The Clean Growth Gap – a series of reports and economic analysis from Energy UK, supported by Oxford Economics

Executive Summary: The UK's Energy Transition in a Global Context

Net Zero presents knotty challenges of global collaboration and competition. This is especially true in our world of globally connected finances, where investment flows across borders to where it can be put to best use. These flows are shaped by the decisions of governments around the world, and if we are to understand how to attract investment to the UK, we must first appreciate how the UK compares to other countries.

“Funding the Future” - the second in Energy UK’s “The Clean Growth Gap” series - sets out what governments around the world have done to attract investment in their clean economies and what this means for the UK as it considers its next steps in the energy transition.

China dominates global activity, boasting nearly half of the world's clean technology investments in 2022.

Investment is key to the energy transition

Investment is the way the world will fund the transition to a Net Zero economy and in turn shape all our futures. The UK's energy security, future prosperity and the potential to achieve our climate goals are all reliant on the ability to attract investment. Around the world, this investment mostly comes from the private sector (60% in 2022 according to The International Energy Agency (IEA)¹), but government action and strong policy support is vital to unlocking it.

The world is investing

China dominates global activity, boasting nearly half of the world's clean technology investments in 2022. Its \$546 billion spend in low carbon technologies was over three times the spend of the European Union which totalled \$180 billion in 2022 (Fig. 1). The United States came in third, with \$141 billion invested.

Governments have made significant, long term financial commitments

There has been a recent flurry in new, large scale investment incentive regimes. The \$369 billion Inflation Reduction Act in the United States and the European Union's REPower EU initiative (€270 billion) and Recovery and Resilience Fund (€250 billion) are by far the largest. Multi-billion dollar incentives in other key markets including Japan, China and India make the competition for clean investments even more intense.

There has been a recent flurry in new, large scale investment incentive regimes.

This is already having an impact

Even though these schemes are very new, signs of a surge in activity are emerging. Bloomberg NEF has found that since the introduction of the IRA, automotive and battery sectors have announced 20 times more funds for new factories than in 2021². Equity price data suggests that markets viewed the passage of the IRA as being something that would notably boost US clean technology companies' future profits.

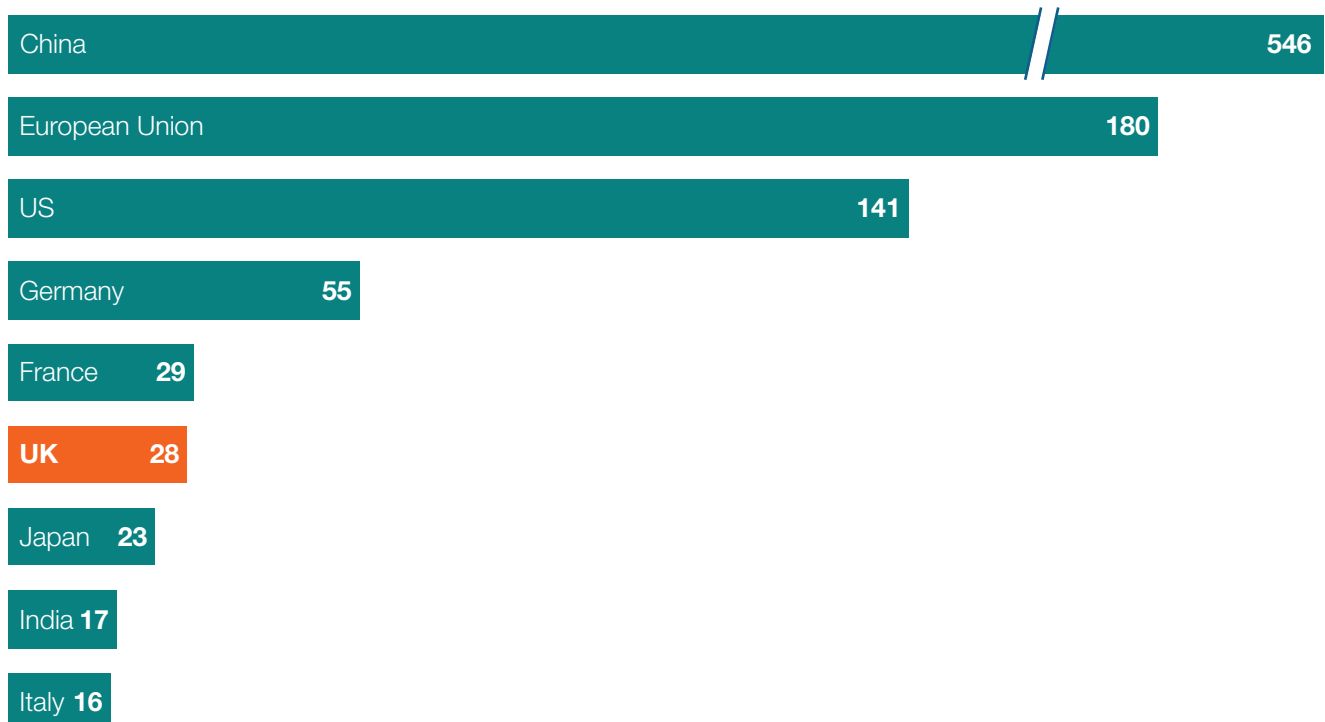
Since the passage of the IRA, automotive and battery sectors have announced 20 times more funds for new factories than in 2021.²

These shifts have major implications for the UK

The UK has significant strengths as it faces the challenges of decarbonisation. These include our world-leading universities and financial services, and our early success in offshore wind and established industries (such as in the digital and oil and gas sectors) that can support clean growth. However, the UK ranks 30th out of 38 OECD nations on the average proportion of capital investments businesses are able to recover³ and is yet to see new investment incentive regimes that can meet the scale of global competition. The rest of The Clean Growth Gap series will explore in more detail the importance of clean investment for the UK and how the Government can take action to address it.

The UK is yet to see new investment incentive regimes that can meet the scale of global competition.

Fig. 1: Energy transition investment, 2022 (\$, billion)



Source: Bloomberg NEF; Oxford Economics

How investment incentive regimes vary around the world

Governments in major economies (US, EU, China, Japan and India) are undertaking significant programmes to attract private sector investment into their clean technology sectors. It is vital to understand what is going on in the world around us to appreciate how the UK compares.

United States: America leading the way

The US Inflation Reduction Act (IRA) was introduced in August 2022, and most provisions became effective from 1st January 2023.⁴ The IRA has a total budget of \$369 billion for the period 2023 to 2031 with the majority of the funding (\$216 billion) in the form of tax credits for corporations. These are designed to catalyse private investment in clean technology, transport, and manufacturing. However, these figures are only budgets and actual sums spent may be larger or smaller depending on the extent to which various tax credits are used.

The IRA uses a range of incentives to encourage private sector investment, including loans and grants, as well as tax credits.

Corporate Tax Credits

Corporate Tax Credits make up the majority (59%) of total IRA funding. Investment Tax Credits (ITC) and Production Tax Credits (PTC) allow businesses to deduct a percentage of the cost of low-carbon energy systems from their federal tax bill.⁵ Renewable energy projects are eligible for either the ITC or PTC, but not both (Fig. 2).

Various labour requirements need to be met in order to qualify for tax credits and bonus credits of an additional 10% are available for i) projects that meet domestic content requirements and ii) are located in deprived communities or brownfield sites.

The IRA has a total budget of \$369 billion for the period 2023 to 2031 with the majority of the funding (\$216 billion) in the form of tax credits for corporations.

Fig. 2: Technologies eligible for Investment and Production Tax Credits

Eligible for ITC or PTC	Eligible for ITC	Eligible for PTC	Technology Specific Tax Credits
<ul style="list-style-type: none"> • Solar • Wind • Tidal • Municipal solid waste • Geothermal 	<ul style="list-style-type: none"> • Energy storage technologies • Microgrid controllers • Fuel cells • Geothermal (heat pump and direct use) • Combined heat & power • Microturbines • Interconnection costs 	<ul style="list-style-type: none"> • Biomass • Landfill gas • Hydroelectric • Marine and hydrokinetic 	<ul style="list-style-type: none"> • Clean Hydrogen (intensity of less than 0.45 kg CO₂e/kg H₂) • Nuclear

Investment Tax Credit: 30% tax credit relief (from 2025 the rate is 6% for projects over 1MW).

Production Tax Credit:⁶ Renewable technologies that began after 2021 and before 2025 receive between 1.3 and 2.6 cents per kWh of zero carbon electricity produced. This amount may be adjusted annually for inflation. After 2025, projects will have to meet wage and apprenticeship requirements to receive this credit or will otherwise receive a credit of 0.5 cents per kWh.

Clean Hydrogen Production Tax Credit: A tax credit of up to \$3 per kg of hydrogen produced is available to projects with a lifecycle greenhouse gas emissions intensity of less than 0.45 CO₂ kilograms per kilogram of hydrogen (kg CO₂e/kg H₂). The credit will be adjusted for inflation. Prevailing wage and apprenticeship requirements need to be met in order to qualify for the full credit.

Nuclear Production Tax Credit: Up to 1.5 cents per kWh for power produced at a qualifying nuclear facility. The credit will be adjusted for inflation. Prevailing wage requirements need to be met in order to qualify for the full credit.

Grants

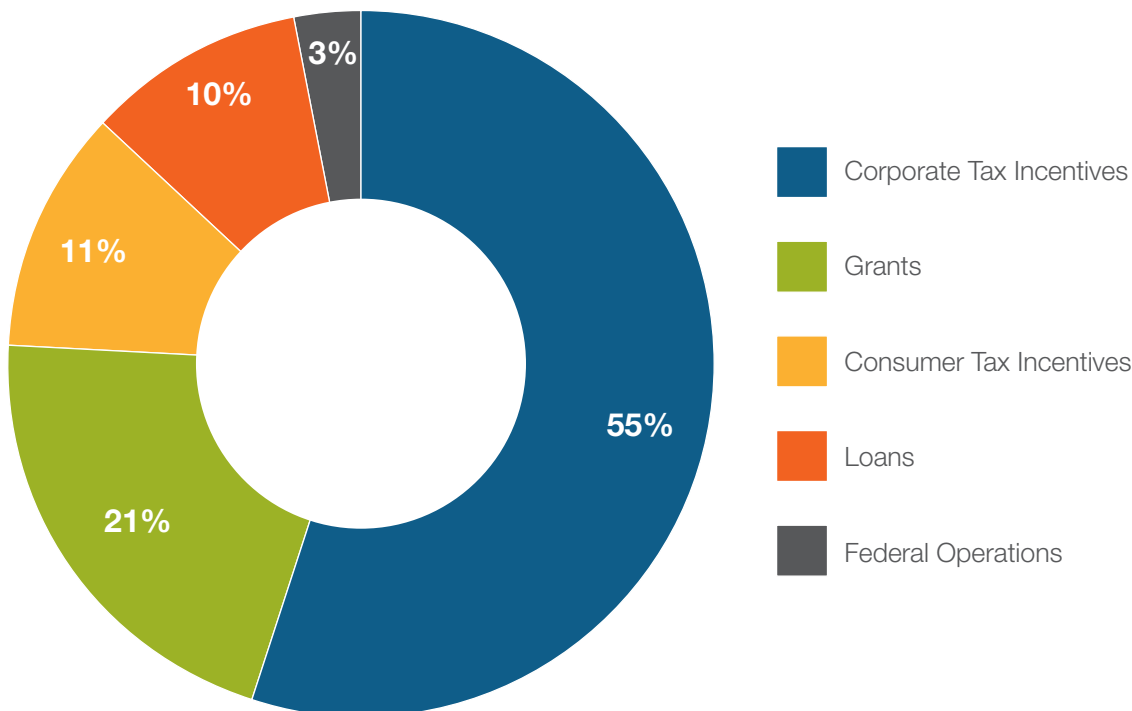
Grants make up 21% of total IRA spending (Fig. 3). One third (\$27 billion) of grants will go towards the 'Greenhouse Gas Reduction Fund'. This will be awarded on a competitive basis to individual clean technology projects as well as projects that reduce greenhouse gas emissions. There will be an emphasis on projects that benefit low-income and disadvantaged communities.

The rest of the grant money (\$55 billion) is being allocated by the federal government to projects that will be crucial to enabling Net Zero, including grants for the domestic production of electric vehicles (EVs), zero-emission home renovation and pollution reduction grants to air pollution agencies and local governments.

Loans

Loans make up \$40 billion (11%) of total IRA spending. Technologies eligible for the loans include renewable energy projects, carbon capture, nuclear energy, critical minerals processing, manufacturing, and recycling.

Fig. 3: Energy and climate change funding in the Inflation Reduction Act



Source: McKinsey; Oxford Economics

European Union: a changing tune from Brussels

Green Deal Industrial Plan

Largely in response to the US IRA, in February 2023 the European Commission unveiled a 'Green Deal Industrial Plan'. This is based on four pillars: a predictable regulatory environment, enhancing skills, open trade and access to funding. The funding predominately consists of previously announced measures, e.g., €250 billion of the Recovery and Resilience Fund for the green transition fund, and €270 billion through REPower EU (detailed below).⁷ Moreover, there are also funds available through other programmes such as Horizon Europe, Invest EU or the Innovation Fund. Although this total funding exceeds that of the US IRA's, these programs and funds have a wider scope than the green transition making it hard to compare the generosity of the two regimes. Compared to the US IRA however, a lower level of funds will be directed towards incentivising private investment in low carbon energy.

Removing Red Tape

The Net-Zero Industry Act is an initiative stemming from the Green Deal Industrial Plan which aims to scale up the manufacturing of clean technologies. A central pillar within this is the simplification of the administrative and permit-granting processes for investment in Net Zero technologies. Permits must be assessed within 12 months for projects with a capacity of under 1GW, and within 18 months for those above. Priority will be given to 'strategic projects', i.e. investments, which could boost EU supply chain competitiveness or reduce over-dependence on single countries for imports.

Relaxation of State Aid Rules

The only new measure in the Green Industrial Plan regarding funding is the 'Temporary Crisis and Transition Framework' (TCTF) which relaxes State aid⁸ rules until end-2025. However, funding for this must come from individual EU member states, rather than the EU itself.

With the TCTF, EU member states may grant aid for investments relating to the Net Zero economy (e.g. batteries, solar panels, wind turbines, heat pumps, electrolysers, CCUS, key components and critical raw materials to produce such equipment). The following aid is now allowed:

- "Anti-relocation" aid worth up to 15% of the firm's investment costs, with a cap of €150 million.⁹
- In certain instances, "Matching" aid on an individual basis to "match" a subsidy available for an equivalent investment outside the European Economic Area (EEA).¹⁰ To qualify some investment must be located in an EEA assisted area (i.e., an economically deprived area).

For both types of aid, the investment must last at least five years (three years if an SME) and the aid must be granted by the end of 2025. Companies must demonstrate that the investment would not take place in the EEA without the aid.¹¹

REPower EU

Launched in May 2022, the REPower EU Plan is aimed at rapidly decreasing the European Union's dependency on Russian fossil fuels following the invasion of Ukraine. The Plan will involve an investment of approximately €300 billion. The majority of this funding (95%) will go into speeding up and scaling up the clean technology transition.¹² To support this, €225 billion in loans have been made available through the previously announced Recovery and Resilience Facility (RRF). Furthermore, additional grants of €72 billion will be made available to finance investments and reforms, some of which will come from the Innovation Fund and frontloading Emission Trading Scheme (ETS) allowances.

China: a centrally planned transition

In 2022, China spent \$546 billion on clean technology investment, the largest expenditure in the world. In June 2023, China unveiled a \$72.3 billion package of tax breaks over four years for EVs and other green cars.¹³ The purchase tax amounts to as much as \$4,170 per vehicle.

Joint ventures between public and private investments (often occurring as a result government mandates) have also helped to increase investment. For example, in May 2020, China Energy signed a cooperation agreement with Donghu Development Zone and Wuhan ITRI of Geo-resources and Environment Co. to establish a hydrogen industry fund in Donghu with a budget of \$146 million for the first phase.¹⁴

The Chinese government has announced that it aims to have 1 million hydrogen-powered cars on its roads by 2030, served by 1,000 refuelling stations.¹⁵ The city of Beijing plans to offer a subsidy of as much as \$741,405 for each new hydrogen power charging station which meets certain requirements. It has also promised subsidies to facilities that generate and store hydrogen power.¹⁶

China's centralised model of government also means that any targets that the country sets are likely to be a particularly powerful signal for investors. The latest 5-year plan (2021-2025) indicated that the state will be accelerating the development of non-fossil fuel energy and increasing its proportion of total energy consumption to about 20%.¹⁷

Japan: catching up at pace

In 2021, Japan announced its \$18 billion ten-year Green Innovation Fund. Over the next 10 years, the government aims to realise \$1 trillion in public-private investment to finance Japan's green transition.¹⁸ In order to realise these levels of investment the government plans to raise \$144 billion through issuing sovereign bonds. The initial plan for the funds raised from the bonds is to target technologies that are still in development such as ammonia, hydrogen, CCS/CCUS etc. where private sector engagement is yet to be substantial.

In 2021, Japanese tax reform introduced tax incentives for products that accelerate decarbonisation. Projects where the investment does not exceed \$500 million and that pass other eligibility requirements can receive a 5% to 10% tax credit or 50% special depreciation.¹⁹

India: a new competitor

In 2023, the Indian government promised to make \$4.3 billion in investments towards the country's energy transition.²⁰ Initiatives include:

- \$1 billion of central government money in electricity transmission lines which can transport 13GW of solar energy from the Himalayas to more populated regions.
- The National Green Hydrogen Mission which has a total financial outlay of \$2.4 billion. Electrolyser manufacturing incentives have been allocated \$540 million whilst green hydrogen production incentives have been allocated \$1.6 billion.²¹ The programmes are scheduled to be implemented between financial year (FY) 2025-26 and FY 2029-30.
- \$455 million in viability gap funding for battery storage companies. This scheme is designed to cover risks that projects won't turn out to be economically viable.²²

How do these different schemes compare?

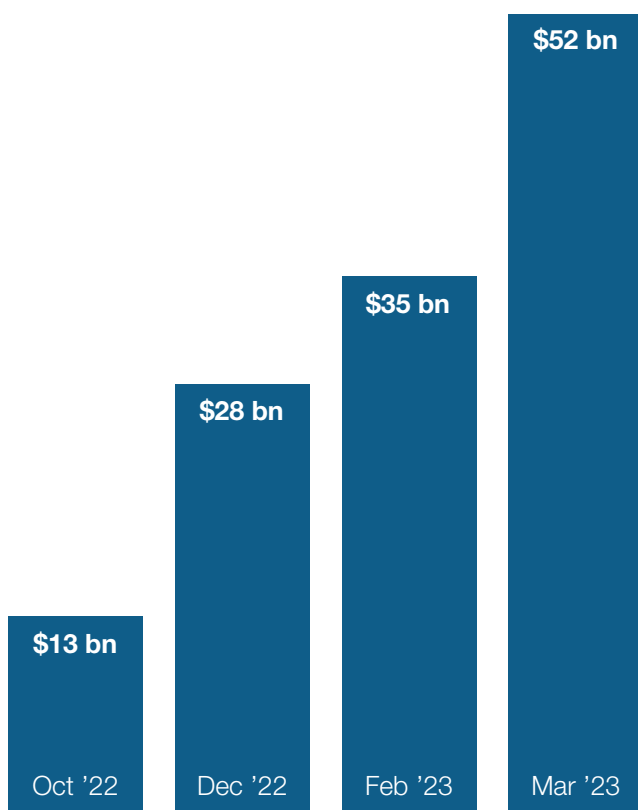
Tax credits such as those provided by the US IRA tend to be quicker to disperse and are less cumbersome for firms than a subsidy-based scheme such as the EU provides. The administrative burden associated with subsidies means that large, established companies are more likely to apply, rather than smaller start-up companies which are often more innovative.²³ Moreover, compared to EU subsidies (and India and Japan's incentives), US IRA funding is less technologically selective which creates more room for new technology to develop.

However, many of the incentives provided by the US IRA are conditional on local content requirements. For example, all steel that is used in a structural function must be mined, produced or manufactured in the US. This can push up costs of projects and can undermine the price-reducing effects of the subsidy.

Early indicators show that incentives are having an impact

Many countries around the world have legally binding Net Zero targets and know that increasing their clean technology supplies will be crucial to meeting these. Most will want to attract private sector funding to pay for the cost of the investment. The private sector will be there, companies are looking to invest in clean technology projects as they know returns will be delivered in the long-term. So, it becomes a matter of where these companies choose to invest. If governments are successful in attracting this private investment, this will increase the rate at which they can develop their own green industries and achieve Net Zero. To the extent that they cause capital to leave other jurisdictions, these incentives will hinder the development of other countries' (such as the UK's) clean technology industries. Furthermore, by decreasing the cost of producing clean technologies, incentives can further undermine the development of other countries clean technology industries.

Fig. 4: Announced US electric vehicle and battery manufacturing investments since the passage of the Inflation Reduction Act



Source: Oxford Economics; Bloomberg NEF

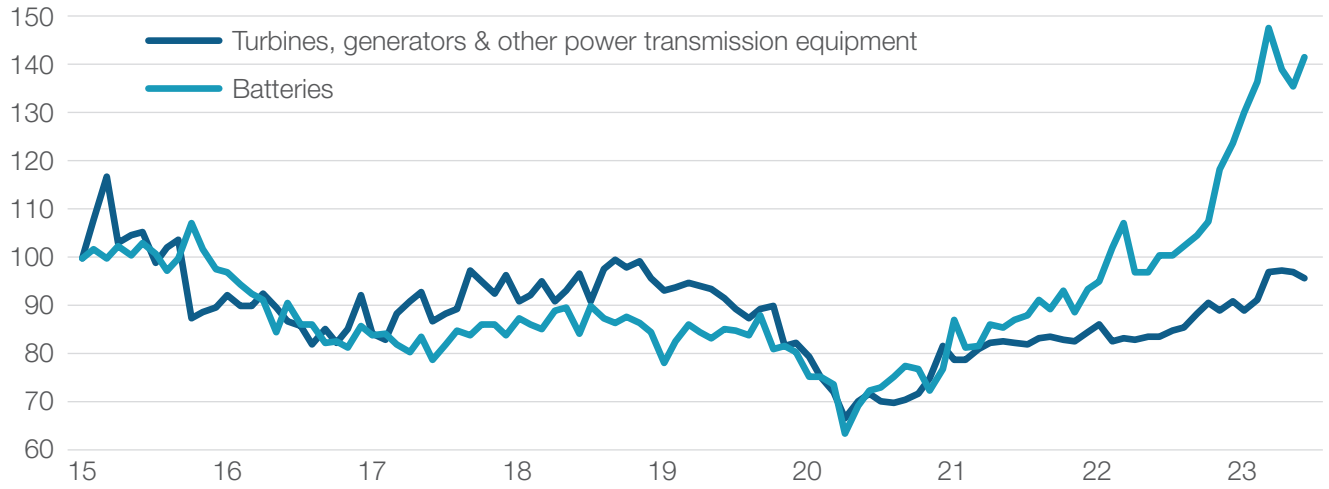
Therefore, it is important to investigate the preliminary evidence on whether the schemes are successful in attracting private sector investment. Our analysis focusses on the impact of the IRA on boosting investment in clean technology in the US. We have selected this example because it was one of the first, and because of its size. It should be stressed that given the Act only came into operation in January, it is too early to have a definitive answer about the impact of the IRA - however the following early indicators suggest that it is associated with a significant expansion of clean investment in the US.

In April of this year, Bloomberg NEF announced that since the passage of the IRA, automotive and battery sectors have announced \$52 billion in planned new factories (Fig. 4). It estimates this is more than 20 times the amount announced in 2021.²⁴

The following three data sources have been selected because of their timeliness:

1. The first is a keyword search of global media mentions of new low carbon technology sites in the US. (Technologies include solar, batteries, EVs, nuclear and offshore and onshore wind.) These have nearly doubled since the act has come into presence.²⁵ Average monthly media mentions for new clean technology sites/plants in the U.S were 4,400 between January 2020 and July 2022; monthly mentions rose to 9,700 between August 2022 and June 2023.
2. The second is monthly data on manufacturers' shipments of power transmission equipment and batteries (Fig. 5, on page 9). The uptick in shipments, particularly evident in batteries, may be indicative of the US IRA facilitating a boost in production through an increase in investment. However, it's not possible to draw strong conclusions here as other factors such as the post pandemic recovery and the easing of supply chain bottlenecks could also be at play.

Fig. 5: Manufacturers' shipments of generators and turbines, and batteries in the United States (Index January 2015 = 100)

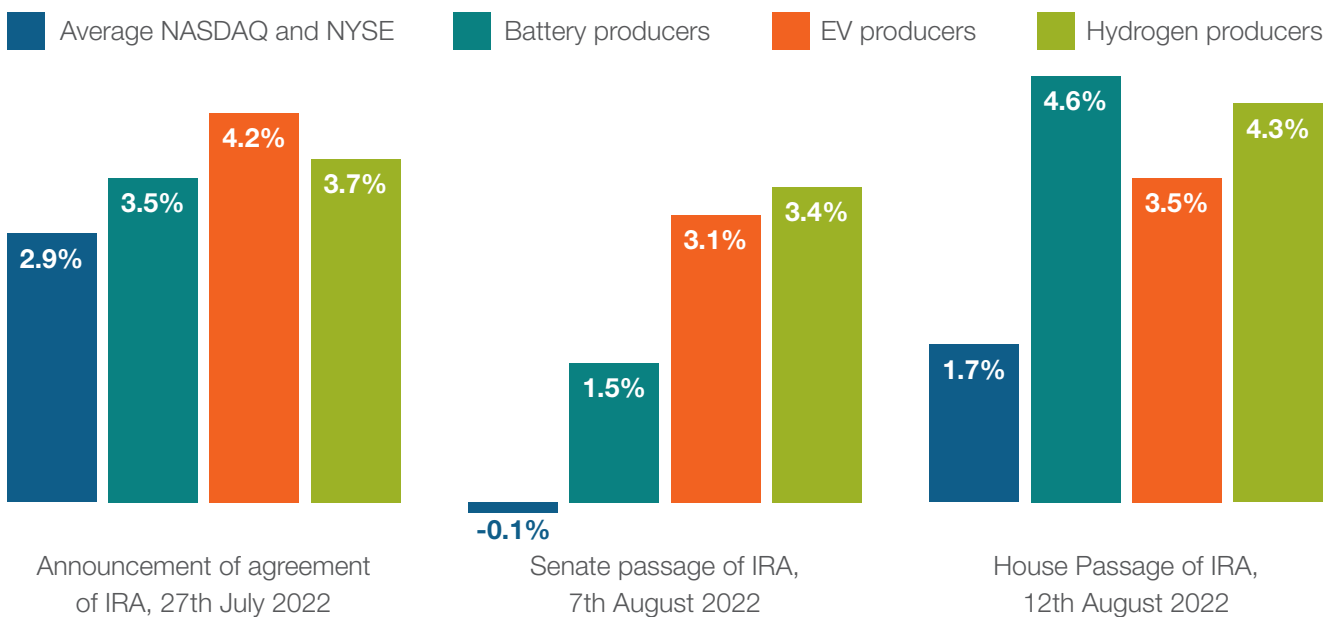


Source: Census Bureau; Oxford Economics

3. The third is an analysis of share-price data for companies specialised in low carbon technologies based in the US. As well as reflecting a company's current performance, share prices also reflect how profitable investors believe the company will be in the future. Therefore, they are a good indicator of the impact of the US IRA on investment in low carbon technologies. For the purposes of this analysis, clean US technology companies listed on the NASDAQ or New York Stock Exchange were selected.²⁶ Figure 6, below, shows the average daily change in equity price of these clean technology producers on key

announcement days for the Inflation Reduction Act. For the three key dates shown below, all three clean technologies reported higher daily changes in equity price than the average of the NASDAQ and NYSE Indices. This finding is consistent with a Brookings analysis which found that on these announcement dates clean energy Exchange Traded Funds had a positive excess return relative to the S&P 500.²⁷ All else being equal, this evidence indicates that markets viewed the passage of the IRA as being something that would significantly boost clean technology company's future profits.²⁸

Fig. 6: Daily change in equity prices, US clean energy companies against NASDAQ / NYSE average

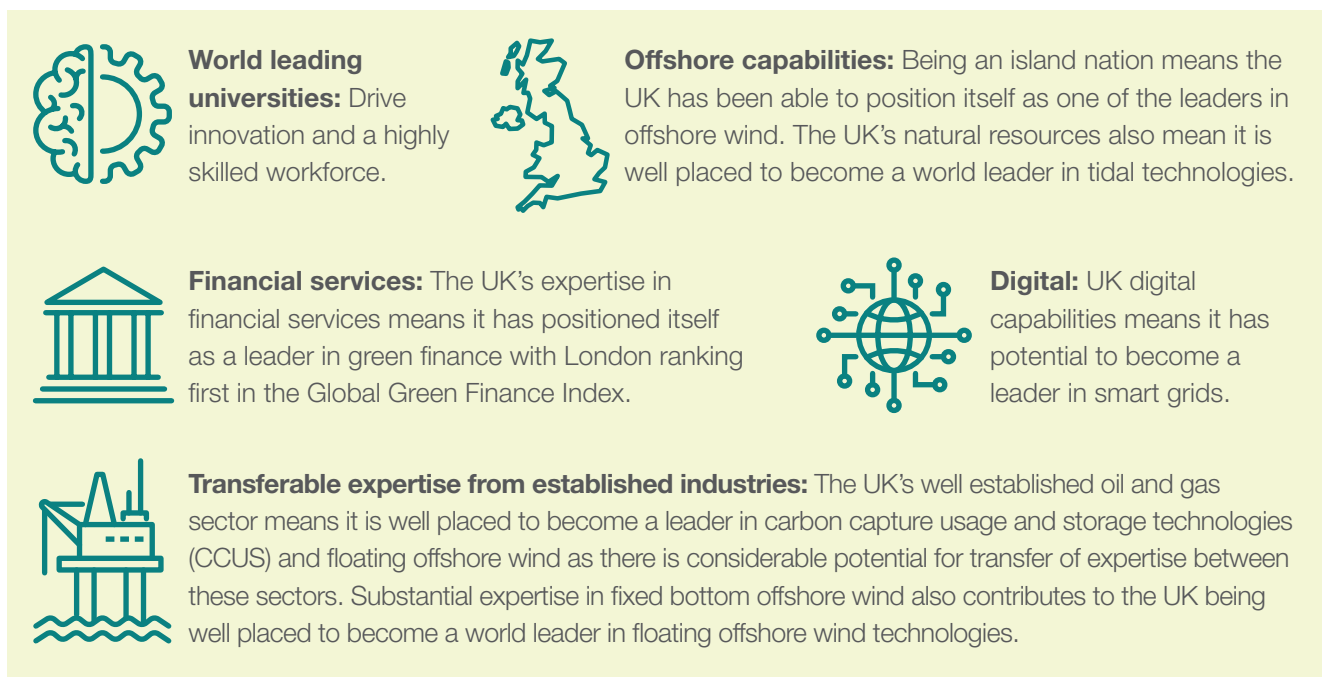


Source: Oxford Economics; Bloomberg NEF

How does the UK compare?

To date, the UK has enjoyed a position of leadership in clean technology, thanks largely to the support of successive governments. However, in an increasingly competitive global environment for business investment in clean technology, alongside an urgent focus on accelerating efforts to enable Net Zero, understanding the strength of the UK's clean technology industry is crucial.

Fig. 7: Key strengths of the UK clean energy industry

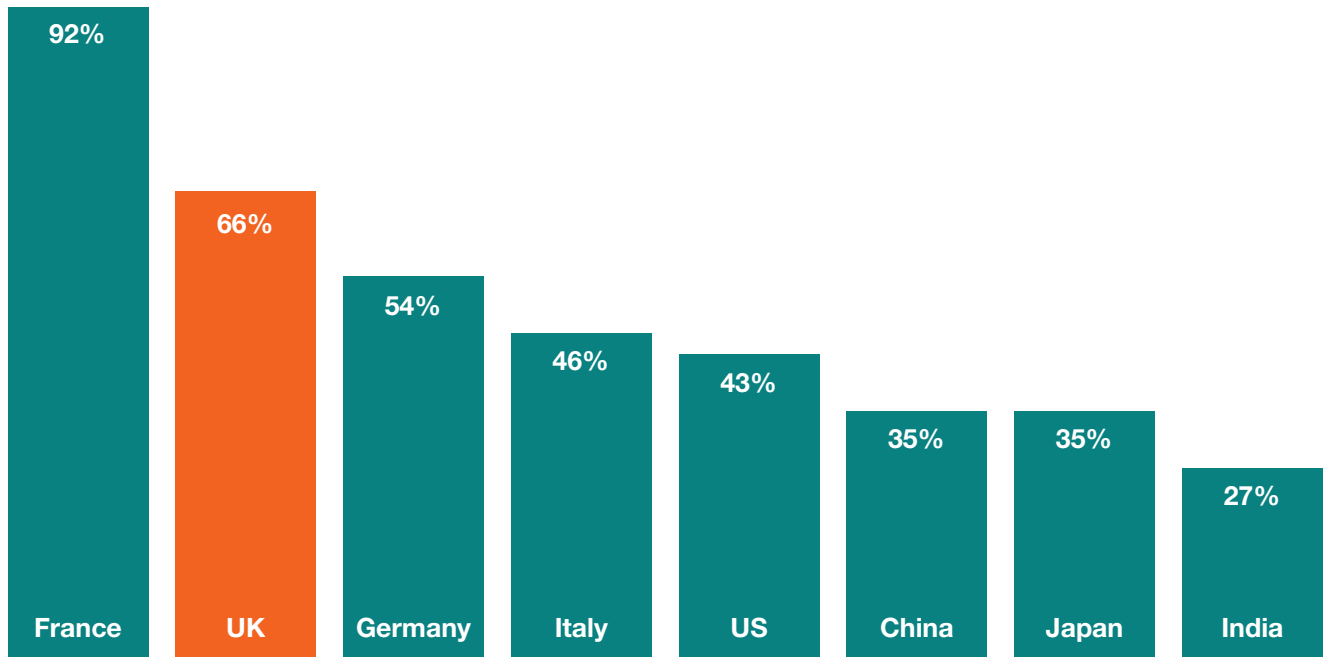


Of the world's largest eight economies, the UK currently produces the second highest share of low carbon electricity output behind France (Fig. 8). In 2023, 66% of British electricity output is forecast to be low carbon.

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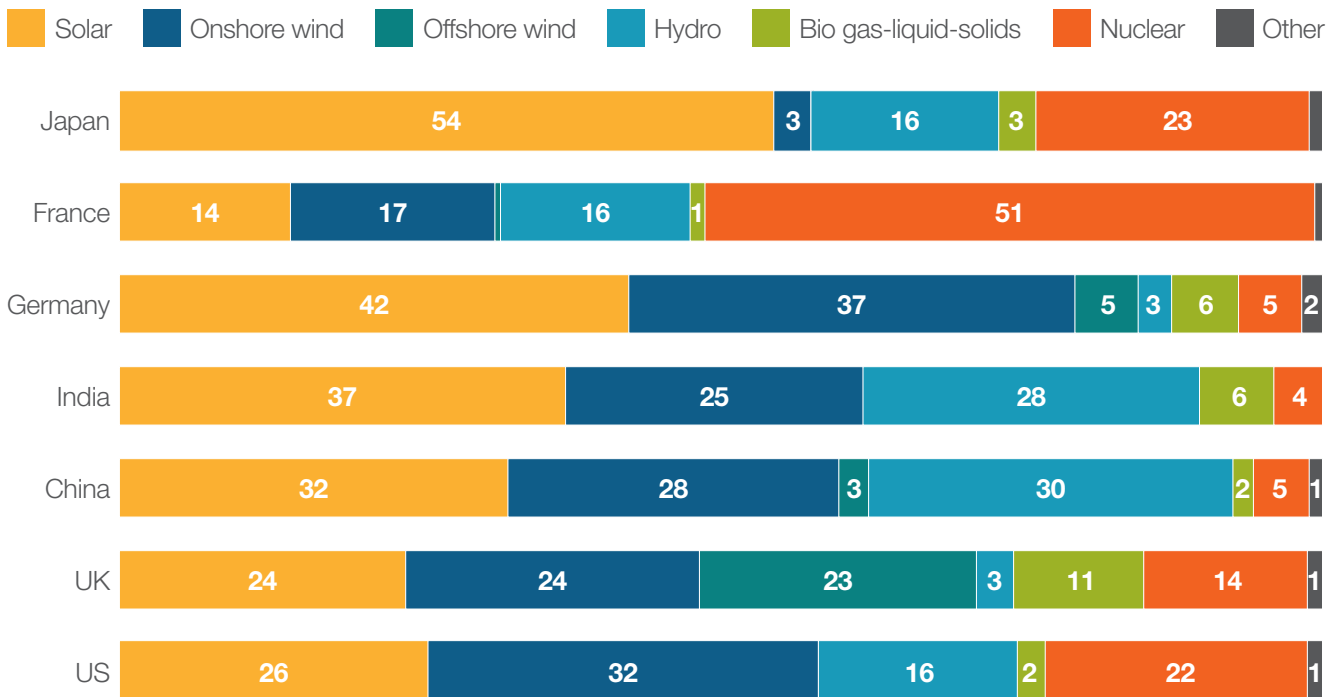
The UK has an expertise in low carbon technologies that is different from the world's other largest economies (Fig. 9). Relative to other countries, the UK has the highest specialisation in both offshore wind and biofuels. In 2022, the UK was home to 22% of the world's total installed offshore wind capacity (Fig. 9). Although the UK is still very much a dominant player in this area, its global share has more than halved since 2012, when the UK had 56% of the world's total installed offshore wind capacity (Fig. 10). This is the result of other countries – not least of all China – rapidly increasing their offshore capacity, illustrating the need for the UK sector to continually strive to not be left behind.

Fig. 8: Estimated low carbon electricity output, share of total (2023)



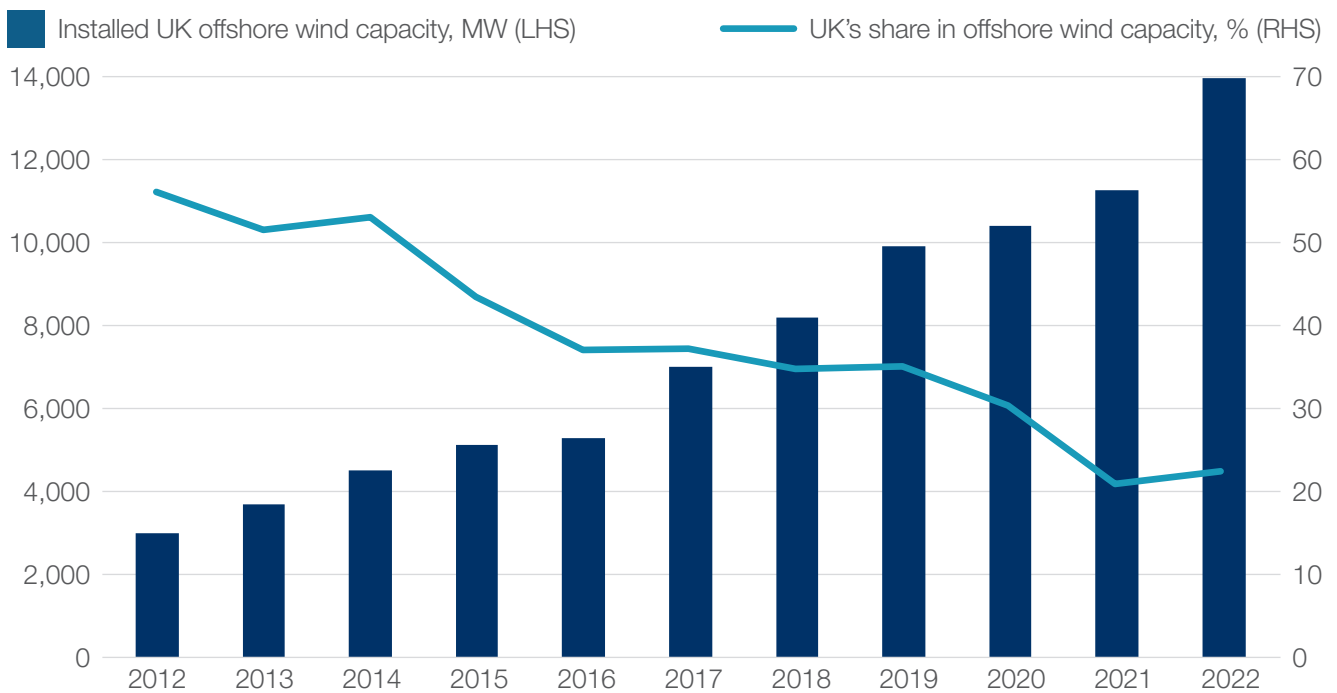
Source: Oxford Economics

Fig. 9: Make up of different countries' installed low carbon energy capacity, 2022 (%)



Source: Oxford Economics

Fig. 10: UK installed offshore wind capacity vs UK's share in world offshore wind capacity

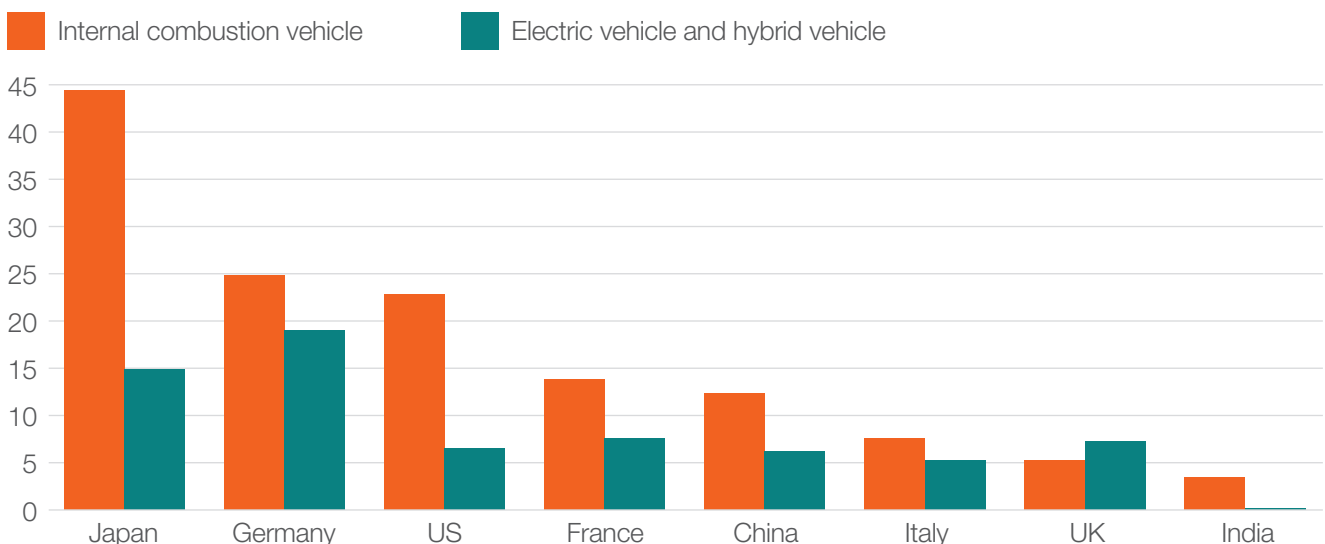


Source: Oxford Economics

The automotive sector is another area where the UK has relative strengths, but these need to be capitalised on to make a success out of the transition. Of the world's largest eight economies, the UK ranked fourth in 2022 for the number of electric and hybrid vehicles it produced per unit of population (Fig. 11). Although these technologies are not necessarily an obvious UK strength, out of these eight economies the UK is the only economy to produce more electric and hybrid vehicles than traditional cars²⁹ (which rely solely on internal combustion engines). Given that the UK has

had a relatively low car manufacturing base in which to switch production, the UK has performed reasonably well in developing its EV and hybrid manufacturing base. As 8 out of 10 cars made in the UK are exported, this industry is an important export market for the UK.³⁰ Moreover, there are some promising future developments in this area for the UK. In July 2023, after securing State aid from the British government, Tata Group announced that it will build a \$4 billion battery factory in the UK to supply Jaguar Land Rover's EVs.³¹

Fig. 11: Internal combustion engine vehicles and electric and hybrid vehicle production 2012–2022, vehicles per 1,000 population

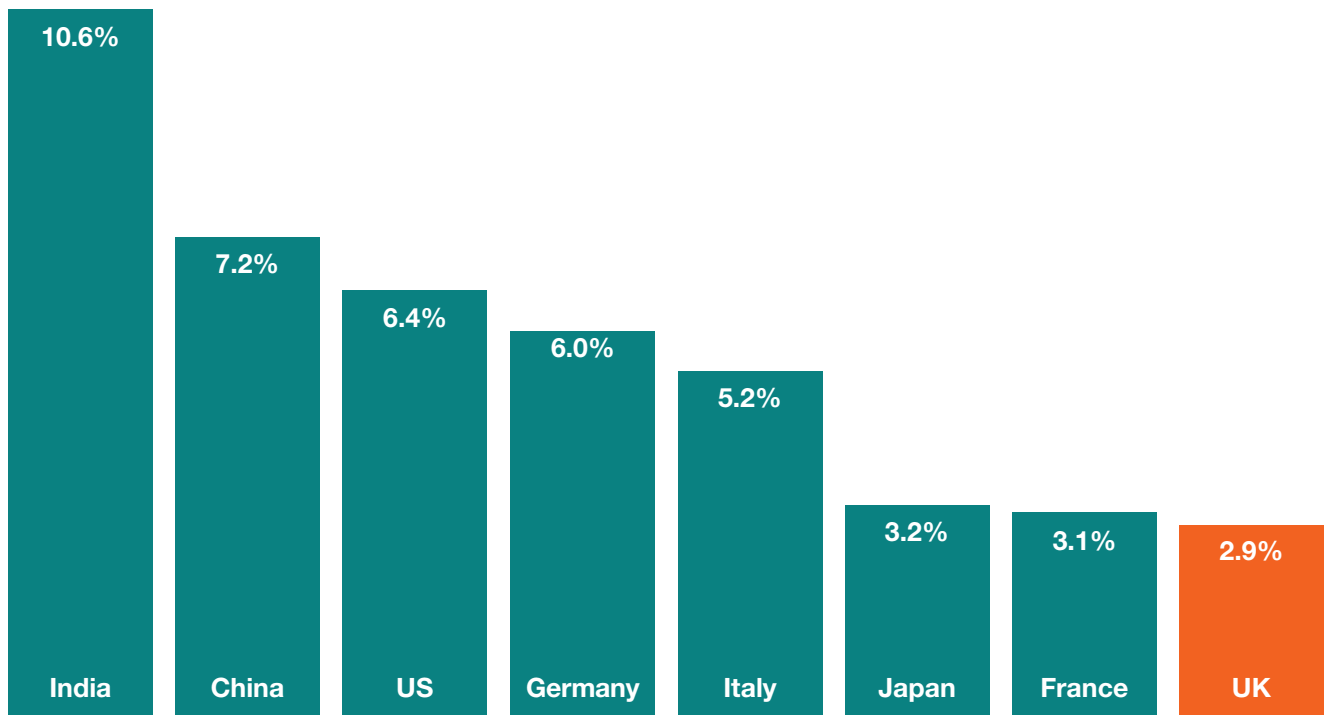


Source: Oxford Economics; LMC Automotive

Although the UK has made a good start on transitioning to a Net Zero economy, it risks falling behind other countries in years to come. Helped by generous incentive schemes, other economies have been increasing their clean technology capacity at a faster rate than the UK. Of the world's largest eight economies, the UK is forecast to have the slowest growth in low carbon electricity generation between now and 2030 (Fig. 12). Low expected levels of investment in the UK are a significant factor behind this downbeat forecast.

Although the UK has made a good start on transitioning to a Net Zero economy, it risks falling behind other countries in years to come.

Fig. 12: Forecasts of average annual growth in low carbon electricity output, 2023–2030



Source: Oxford Economics

What does this mean for the next stage of the energy transition?

As a result of increasing incentives for clean technology investment in other jurisdictions, future investment in UK clean technology is looking increasingly under threat. In contrast to ambitious incentive schemes being provided around the world, the level of UK ambition looks muted. For example, the UK's tax regime means that it does not provide globally competitive capital allowance rates. Excluding temporary full expensing, it ranks 30th out of 38 OECD nations on the average proportion of capital investments businesses are able to recover.³²

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Although the UK has strengths in many low carbon technologies, the lack of incentives for investment means the UK risks falling behind in the global race to decarbonise. A recent illustration of this is that in July of this year, Swedish utility company Vattenfall announced that it would halt the development of its British Norfolk Boreas offshore wind project.

The company warned that Britain could struggle to meet its wind targets without improved incentives for investment.³³ The planned project had a capacity of 1,400MW which is 2.4% of the UK's current installed low carbon operating capacity.

The UK must not rest on its laurels, otherwise more projects like this will either stop during development, or simply never be conceived. We have a great position to start from but must consider the global context in how we compare to other countries, when boardrooms around the world are deciding where to invest.

The rest of the Clean Growth Gap series will consider what the UK can do to attract investment in the face of the stiff global competition outlined in this report, and show how this investment has to be at the heart of the country's future prosperity, supporting jobs, economic activity and communities across Britain.

The Clean Growth Gap



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<https://bit.ly/CleanGrowthGap>

Endnotes

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Our members deliver nearly 80% of the UK's power generation and over 95% of the energy supply for 28 million UK homes as well as businesses.

The sector invests £13 billion annually and delivers nearly £30 billion in gross value - on top of the nearly £100 billion in economic activity through its supply chain and interaction with other sectors. The energy industry is key to delivering growth and plans to invest £100 billion over the course of this decade in new energy sources.

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