Energy Transitions Commission

Frequently Asked Questions – Offshore Wind Insights Briefing

Contents

Section 1: About the ETC

What is the Energy Transitions Commission and what is its mission?

The Energy Transitions Commission (ETC) is a global coalition of leaders from across the energy landscape committed to achieving net-zero emissions by mid-century in order to limit global warming to well below 2°C and as close as possible to 1.5°C.

Our Commissioners come from a range of organisations – energy producers, energy-intensive industries, technology providers, finance players and environmental NGOs – which operate across developed and developing countries and play different roles in the energy transition. This diversity of viewpoints informs our work: our analyses are developed with a systems perspective through extensive exchanges with experts and practitioners. Our ambition is to inform the decisions of public and private decision-makers and support the leaders at the forefront of climate action to speed up the deployment of low and zero-carbon solutions.

A list of our commissioners can be found here: http://www.energy-transitions.org/who/
Our ambition is set out here: https://www.energy-transitions.org/ambition/

Who funds the ETC?

The ETC is primarily funded by the organisations with which our Commissioners are affiliated. Membership fee levels depend on the size and nature (for-profit or not-for-profit) of the organisation. Commissioners all have equal voice and representation on the Commission regardless of whether their affiliate organisation finances the ETC or not. In addition, some of the ETC's work programmes, in particular in China and India, are funded by philanthropic organisations.

The funding we receive finances the ETC's secretariat, analytical programmes, stakeholder outreach and communications.

Who are the Commissioners and how were they selected?

As of May 2024, the Commission's membership includes over 50 leaders coming from energy companies, energy-intensive industries, technology providers, financial institutions, environmental NGOs and academia. They operate across developed and developing countries and play different roles in the energy transition. Commissioners are selected based on their commitment to working towards a net-zero-emissions economy by mid-century.

We endeavour to diversify the Commission's membership in terms of sector, nationality and gender. The Commission is chaired by Lord Adair Turner who works alongside the ETC's senior leadership team. A list of Commissioners can be found on our website at: http://www.energy-transitions.org/who/

Are the organisations with which your members are affiliated backing this report?

This report was developed in consultation with ETC Members but it should not be taken as members agreeing with every finding or recommendation.

Why is [a given Commissioner] not available for questions?

Some of our Commissioners are unfortunately unavailable for questions due to prior commitments, but several focal reports have now been developed by the Commissioners who not only agree on the importance of reaching net-zero carbon emissions from the energy and industrial systems by mid-century, but also share a broad vision of how the transition can be achieved.

Why have ETC Commissioners not been asked to endorse this report?

This report is part of an ETC Insight series which looks at current issues in the energy transition. ETC members have not been asked to formally endorse the report but have been consulted with and have played an active role in the development of this work.

Does the ETC speak to the challenges of both developed and developing countries?

Achieving massive electrification and early power sector decarbonisation, ahead of economy-wide decarbonisation, must be at the heart of all countries' paths to net zero. This report highlights recent challenges around offshore wind deployment and focusses on UK, European and North American challenges and policies, in contrast to China's successful deployment. The recommendations can be applied globally for countries outside of China with potential to accelerate offshore wind deployment.

In general, the ETC develops global roadmaps while highlighting differences between regional pathways, especially between developed and developing countries. We work with local partners – in Africa, China, India, Indonesia, Europe, U.S., Canada and Australia – who have deep country knowledge and play a key role in strengthening and stress-testing our global analyses by considering regional specificities.

Section 2: About the Insights Briefing and its impact

Who is the paper aimed at? Who is your target audience?

The ETC's Insights Briefing *Overcoming Turbulence in the Offshore Wind Sector,* highlights the need for governments and the offshore wind industry to join forces to restore confidence in the market, drive down costs and accelerate the clean energy transition. It describes the policy action required to attract project development and deliver on capacity targets for offshore wind, which remains a key technology for the global energy transition.

How much of the paper is constituted of new analyses vs. integration of previous publications?

This paper builds on existing ETC analyses including *Making Clean Electrification Possible* (2021) and *Financing the Transition* (2023), and other external analysis from BloombergNEF on offshore wind pipeline and levelised cost of electricity forecasts.

New ETC analysis, grounded in real-world case studies and discussions with leading offshore wind developers and the supply chain, concludes that offshore wind still remains a crucial technology for the energy transition, with a large potential for future cost decreases. ETC have consulted with members and experts to establish five key recommendations which can relaunch the confidence cycle and bring down costs for the sector.

This paper builds on BloombergNEF offshore wind cost increase analysis to demonstrate that most of the recent cost increases will be temporary, with only limited factors likely to prove permanent.

Who has carried out the underlying analysis?

The ETC secretariat, provided by SYSTEMIQ. The analysis has been tested with relevant experts across member organisations and external stakeholders and with guidance from leading offshore wind developers including Orsted, Iberdrola, Vattenfall, and turbine manufacturers Vestas and Siemens Gamesa.

What are the key regional differences for offshore wind? Which countries face the least barriers? Which countries have the most to gain?

Significant problems were faced by the UK and US (contract cancellations and a lack of bids at auction) in 2023 driven by high inflation and supply chain bottlenecks in the period of post COVID-19 recovery, exacerbated by the effects of the Ukraine war, which drove up offshore wind turbine and installation costs, while increased interest rates resulted in a higher cost of capital.

To some extent all regions of the world outside of China were impacted by these issues, with turbine prices increasing over 20% between 2020 and 2023 in the EMEA and North and South American regions. However, during this same period Chinese wind turbine prices fell by more than 50%, due to the low cost of capital, consistent high demand created by a clear schedule of auctions, a comprehensive supply chain, and a focus on developing larger more efficient turbines within the context of total volume growth sufficiently large to ensure each new design is manufactured on a significant scale.

Whilst prices increased almost everywhere, there was a mixed picture in terms of contracting capacity in other markets, where the impact has been less severe than in the UK and US. In Europe, Germany, the Netherlands and Ireland all managed to contract significant capacity in 2023 of over 3 GW; while in Asia both Japan and South Korea managed to contract around 1.5 GW new capacity.

As China have already experienced large decreases in the cost of deploying offshore wind, all other regions have the most to gain by emulating the success of China, and growing their respective offshore wind markets to be large enough to experience similar economies of scale.

Why was there a perceived crisis in the offshore wind industry?

Until 2022, the offshore wind industry seemed to be flourishing. Annual deployment had increased from less than 1 GW per year installed in the 2000s, to 5 GW per year in 2020. Cumulative installed capacity grew from 12 GW in 2015 to 74 GW by 2023. Prices bid at auctions were on a strong downward path. Estimates of levelised cost of electricity (LCOE) also saw significant decline. BNEF estimated in 2023 that the LCOE for offshore wind in China had fallen from $126/MWh in 2015 to $74/MWh in 2022; while in Germany the estimated decline was from $205/MWh to $112/MWh.

Since 2022, these favourable trends have halted and reversed in some countries, in particular the UK and the US. In the UK, factors such as high inflation, supply chain bottlenecks, and increased interest rates led to higher offshore wind costs. Despite this, the maximum allowable strike price in auctions was only increased by 15%, resulting in project postponements and no bids in the fifth Contracts for Difference round. In the US, inflation, supply chain issues, and higher interest rates led to a 60% increase in estimated costs. Strict local content requirements and the absence of inflation price indexing in contracts further exacerbated the situation, leading to renegotiations, contract cancellations, and bid rejections.

How long do we think it will take offshore wind industry to recover from current difficulties?

Most of the cost increases between 2022-2023 will likely prove temporary with some costs expected to return to 2019-levels (for example, steel), but the real interest effect will likely to prove permanent. This is promising for future offshore wind projects, but does not help companies which bid into auctions in 2021/22 and had to contract supply orders in 2023, particularly those that bid into auctions that are not linked to inflation. A permanent rise in real interest rates could see less money flowing into the sector at a time of growing need.

Many expert analysts have assumed that as the total industry scale continues to increase and large numbers of large turbines are manufactured, further significant reductions should be achievable. In 2020, the UK Climate Change Committee suggested that an optimistic but feasible "widespread innovation" scenario could see the UK offshore wind LCOE falling to £25 per MWh in 2050 (2019 prices). However, the rate at which the industry recovers depend on government support in areas that the ETC recommends:

- Set strategic planning, targets, and a constant flow of auctions.
- Contract and auction design to incentivise completion and removal of optionality.
- Streamline planning, permitting, and grid connection processes; and reinforce power grids.
- Encourage harmonisation of turbine components and sizes.
- Address specific supply chain bottlenecks.

Were all markets hit by the price increases of 2023?

To some extent all regions of the world outside of China were impacted by price increases issues, with turbine prices increasing over 20% between 2020 and 2023 in the EMEA and AMER regions. However, during this same period Chinese wind turbine prices fell by more than 50%, due to the low cost of capital, consistent high demand created by a clear schedule of auctions, a comprehensive supply chain, and a focus on developing larger more efficient turbines within the context of total volume growth sufficiently large to ensure each new design is manufactured on a significant scale.

Whilst prices increased almost everywhere, there was a mixed picture in terms of contracting capacity in other markets, where the impact has been less severe than in the UK and US. In Europe, Germany, the Netherlands and Ireland all managed to contract significant capacity in 2023 of over 3 GW (with Ireland contracting capacity for the first time). And in Asia both Japan and South Korea managed to contract around 1.5 GW new capacity.

Why has China been successful in reducing costs whilst they have risen elsewhere?

Despite the challenges faced in the industrialisation of producing ever larger wind turbines whilst keeping costs down, China has proved that this is possible if there is a large enough pipeline and access to low-cost capital. Whilst prices in most markets outside China increased after 2020, Chinese turbine prices fell by more than 50% over this time period.

The key factors which explain this cost reduction are in particular:

- A low cost of capital, driven by financial policies which constrain China's high savings primarily within the country.
- Consistent high demand created by a clear schedule of auctions providing confidence for the supply chain to expand.
- The emergence of a comprehensive supply chain, encompassing turbine components and through to transport infrastructure, including truck, vessel and port capabilities.

- Continued focus on developing very large turbines, but within the context of total volume growth sufficiently large to ensure that each design is manufactured on significant scale

How can other countries follow the success of China?

For other geographies to repeat the success of China, considerations around enabling certainty over deployment volumes and overcoming supply chain bottlenecks will be critical. Policies and processes should be designed to bring confidence to the supply side (component manufacturers, turbine OEMs, transport equipment, ships, and ports) to invest in key facilities and scale output.

Five key recommendations to relaunch the offshore wind confidence cycle and bring down costs are described in this report:

- Set strategic planning, targets, and a constant flow of auctions.
- Contract and auction design to incentivise completion and removal of optionality.
- Streamline planning, permitting, and grid connection processes; and reinforce power grids.
- Encourage harmonisation of turbine components and sizes.
- Address specific supply chain bottlenecks.

Why has offshore wind costs increased while solar costs have decreased in the past year?

Different technologies in the energy transition have experienced varying levels of cost reductions. Solar PV and electric vehicle batteries have seen significant cost reductions of 85-95% over the past 12 years due to mass production and standardized units. On the other hand, CCUS and nuclear costs have not declined significantly, and H2 electrolysers have even increased in cost recently. The divergence in cost reduction is due to the ability to mass-produce standardized units versus technologies that require complex engineering and supply chains. Offshore wind falls in between these categories, as it can benefit from standardized designs and automated factories for production, but still requires some bespoke engineering for installation.

Are further cost declines possible/likely?

Large project pipelines and larger turbines can help achieve economies of scale and improve the economics of offshore wind. A key question is therefore how far can well-designed government policy and industry practice help achieve significant further cost reductions, even if these will never be as rapid as those seen in solar PV. The most simple and effective way to move towards Chinese cost reductions is to grow the market and benefit from economies of scale.

Whilst North and South American and EMEA turbine prices increased over 20% between 2020-2023, Chinese turbine prices decreased over 50% during this period. This suggests that other markets are likely to be able to reduce prices dramatically over the coming decade if they can replicate some of the beneficial features of the Chinese market.

What needs to happen to turbine sizes? Do the benefits outweigh the costs?

On the one hand, larger turbines automatically improve economics since more power can be provided from a single installation, and windspeeds tend to be more constant the higher the hub height and swept area.

But continued progress to ever larger turbine sizes has also created technical and volume/business case risk; it has reduced the number of identical turbines being produced and brings with it significant transportation and installation complexity, requiring specialised vessels and equipment which are in short supply, which must grow alongside turbines or risk creating further bottlenecks. China has shown, however, that focus on enlarging turbine sizes can payoff with sufficient production volumes.

There are ongoing discussions within industry and the supply chain as to whether regulatory harmonisation to slow the speed of turbine height growth is desirable or even possible; however, engagement between governments, regulators, and industry to increase the visibility of future turbine heights would be useful to allow the supply chain to plan for the future and mitigate further bottlenecks.

What does the recent cancellation of GE Vernova's 18 MW turbine mean for turbine sizes going forward?

In October 2023, GE Vernova were contracted to deliver new 18 MW turbines, which had not been successfully rolled out at scale, to three New York projects totalling 4 GW of capacity. These plans were changed in April 2024, With GE scraping the plans for the larger variant and focusing on 15.5 MW "workhorse" turbines instead, resulting in the New York projects being cancelled.

In this instance the efficiency benefits from moving towards a larger turbine were outweighed by the complexities of having to manufacture and install the larger product. Of the three largest Western turbine manufacturers, both Vestas and GE Vernova are now focusing on delivering 15 MW turbines at scale, whilst Siemens Gamesa is still pushing on to develop and deliver larger turbines at scale. This could suggest a natural slowing in the race towards larger turbines in Western markets, however this does not appear to be the case in China, where 18 MW turbines have been installed at scale since 2023, with larger turbines on the horizon.

Section 3: Geo-politics and macro-economics and the energy transition

What is the role of clean electrification in the energy transition?
Clean electrification will be at the heart of the energy transition, enabled by the rapidly falling costs of renewable energy, with a complementary role for clean hydrogen technology in sectors that are difficult or impossible to electrify.

The ETC report ***Making Clean Electrification Possible: 30 years to electrify the global economy*** sets out why it is essential but also feasible and affordable to multiply the size of the global power system by 5, while shifting to renewable-based electricity provision. The parallel report ***Making the Hydrogen Economy Possible: Accelerating clean hydrogen in an electrified economy*** set out the complementary role for clean hydrogen and how a combination of private-sector collaboration and policy support can drive the initial ramp-up of clean hydrogen production and use to reach 50 million tonnes by 2030.

How has the current macroeconomic situation impacted the energy transition?

The high energy prices, resurgent inflation, and higher interest rates which have arisen in the recovery from COVID and as a result of Russia's invasion of Ukraine have created a new context at least for a transitional period. This has an ambivalent impact on the pace of the energy transition:

- On the one hand, higher fossil fuel prices, and greater awareness of their inherent volatility, have created incentives to accelerate the energy transition – both in terms of investing in clean electricity generation and energy efficiency improvements - to build energy security and reduce future consumer costs, as well as delivering near-term financial benefits to renewable generators that have low marginal costs. In addition, renewables are already the cheapest source of new bulk power generation in countries comprising two-thirds of the world's population and nine-tenths of global electricity generation.[1]
- On the other, inflation in key supply chains has produced a temporary increase in the cost of some inputs, and high-interest rates have increased the nominal cost of capital which is a key determinant of the relative cost of renewable versus fossil fuel investments. Fiscal stresses in developed and developing countries may also reduce the potential to support the transition via government expenditure.

What are some of the ongoing policy developments around clean energy supply chains?

The US Inflation Reduction Act was passed in 2022. In early 2023, the EU put forward its Green Deal Industrial Plan and the associated Net Zero Industry Act and Critical Raw Materials Act. These measures have been put in place in response to long-standing state support for manufacturing and deployment of clean energy technologies in China.

The EU Commission also launched an inquiry in April 2024 into Chinese suppliers of wind turbines under the new 'Foreign Subsidies Regulation' policy. This follows the announcement of an inquiry into subsidised electric vehicles coming from China in October 2023.

What are the key benefits and trade-offs of developing local supply chains?

Near-shoring production can help diversify sources of supply for key materials and/or components, reducing risks from exogenous shocks (e.g., pandemics, droughts) or political and trade instability. There is a legitimate desire in the US and across Europe to develop local supply chains rather than relying heavily on imports, driven by policies such as local content requirements; these however can increase costs. Such policies should ideally be designed in ways which enable turbine prices to continue their historic decline, replicating the favourable features of the Chinese supply chain where possible in other countries, rather than simply increasing costs via tariffs. The most simple and effective way to move towards Chinese cost reductions is to grow the market and benefit from economies of scale.

Long-term manufacturing investments require a stable pipeline in the country/region in order to be paid off. Large and stable project pipelines at the country/regional level can help overcome market fragmentation issues, whilst local content requirements must be carefully balanced against the need to achieve economies of scale at a multiple-country/regional level.

How will 2024 global elections impact climate commitments?

The impact of the 2024 global elections on climate commitments will largely depend on the policies and priorities of the leaders and parties elected during that time. The outcomes of global elections this year may create significant regional differences in climate strategy with some governments pushing for more climate ambition and some for less.

[1] BNEF (2022), *Cost of New Renewables Temporarily Rises as Inflation Starts to Bite.*

The global elections may impact medium-term policy decisions and the amount of investment flowing to renewable energy deployment, but in the short-term, there is less risk of a global shock from election results given the time required for policy changes to occur.

No matter the outcome of the 2024 global elections, the cost of generation from wind and solar will still be on a strong downward trajectory, whilst the benefits of clean energy are felt throughout the whole population. Potential new leaders of countries should realise this, and continue to back the increased deployment of clean energy technologies or be at risk of getting left behind.

What kind of financial support is required to unlock offshore wind capacity?

Offshore wind subsidy systems and auctions have played a crucial role in promoting the development of projects and historical cost reductions in the technology. Contract mechanisms have been iterated on in recent years and countries have adopted varying types:

1) Fixed Price Mechanisms – designated price per unit output

Early renewable deployments tended to be supported by Feed-in-Tariffs (FiTs) which gave renewables developers a certain fixed price for electricity delivered, with the price determined by government.

2) Explicit subsidies relative to floating electricity price

Such as delivered via the UK Renewables Obligation (RO) scheme in place in the UK between 2002 to 2017. The RO was a green certificate scheme which obligated energy suppliers (i.e. the companies selling electricity to end consumers) to source a certain percentage of their electricity from renewable sources.

3) Contracts for Difference Auctions (CfD) – competitive process to agree price per unit output

CfDs were first introduced in the UK in 2014, and are usually competitively allocated via an auction. In this process, developers submit bids that specify the price they require for the electricity generated by their projects. The government then awards contracts to projects with the lowest bid prices. CfDs should be and usually are "two-sided". This means that if the market price is below the strike price, the government pays the generator the difference between the strike price and the market reference price, but if the wholesale price is above the strike price, the generator pays the difference to a counterparty who returns money to consumers.

"Two-sided" CfDs are the preferred financing mechanism for financing offshore wind projects, as developers can lock in a guaranteed price for their output, and then contract with the supply chain and install the infrastructure with this price in mind. Best practice is for these contracts to have an inflation-adjustment mechanism, so if costs increase between contract award and signing of supply chain contracts, this would be reflected in final revenues received by the developer.

4) Auctions of rights-to-deliver (leading to "negative bidding"):

In some countries offshore wind markets have become so competitive that neither explicit subsidies nor guaranteed prices are required to entice interest. Indeed, if offshore wind is expected to be cheaper than fossil fuel based electricity, developers may be willing to pay governments for the right to develop and deliver. Some governments (recently Germany and the Netherlands) have tried to extract this value through so called "negative bidding" auctions, where developers submit bids outlining what they are willing to pay to the government for a "right-to-deliver" offshore wind in a specified seabed. After securing this, the developer then has to secure off takers, who will buy the power, either through a Power Purchase Agreement (PPA), or selling their power on the merchant market.

Whilst auctions are a critical route to market, offshore wind developers may choose instead to depend on corporate PPAs, or selling into the merchant market – or a combination of all of these. Auction structures should in general be designed to enable flexible combinations of these revenue streams.