COP28 Global Offshore Wind Update Report

Sustainability is our business

Glossary

Project Status

IN DEVELOPMENT	Includes projects which have not secured an offtake contract, including those in the early stages of development through to those in planning or consenting stages.
SECURED OR ROUTE TO MARKET SECURED	Includes projects which have secured an offtake contract for power purchase but have not completed commissioning.
OPERATIONAL	Includes projects where all components of the project have been fully commissioned and the project is supplying power at its full capability.

Project Milestones

LEASE AUCTION ANNOUNCED	The date that offshore wind lease auction details are announced, relevant for markets with government led auctions.
LEASE WON	The date a developer or consortium achieve exclusive development rights for a lease area or site.
PLANNING SUBMIT	The date a developer or consortium submits the appropriate planning application for the associated offshore wind site.
CONSENT AWARDED	The date a project is consented and therefore legally approved to begin construction.
FINANCIAL INVESTMENT DECISION (FID)	The date that a project developer or consortium make the final decision on whether to go ahead with the project. Usually depending if the investment in the project would be beneficial or not.
FOUNDATION INSTALLATION START DATE	The date that the first foundation is installed in the water. This milestone represents offshore construction start date. The model uses this date to represent construction start date as it is consistently reported and therefore easy to model.
FIRST POWER PRODUCED	The date the project produces first power to the grid.
COMMERCIAL OPERATIONAL DATE (COD)	The date which the project satisfies the requirements for demonstrating commercial operation.

Glossary

General terms

AMER	Americas region, covering North, Central, South America and the Caribbean.
APAC	Asia-Pacific is the region of the world adjoining the western Pacific Ocean.
CONTRACT FOR DIFFERENCE (CFD)	A Contract for Differences (CFD) is a long-term contract between an electricity generator and off-taker, which compensates the generator the difference between an agreed strike price, and market electricity prices.
DOGGER BANK	Four project areas in the Dogger Bank zone, totalling 4.8 GW were consented in 2015, claiming the title of the largest consented offshore wind zone in the world. Three of the projects, each 1.2 GW, are being developed by SSE, Equinor and Vårgrønn. The first project, Dogger Bank A, reached first generation in October 2023. RWE are developing a fourth project, now at 1.4 GW, which has been renamed Sofia.
EMEA	The EMEA region covers all countries in Europe, the Middle East and Africa.
IRENA	The International Renewable Energy Agency.
ONE-STOP-SHOP	A one-stop-shop is the adoption of a single contact point, combing multiple authority into one single interface.
PORTFOLIO	Total offshore wind capacities (development capacity + route to market secured capacity + operational capacity).
WIND TURBINE GENERATOR (WTG)	A wind turbine generator turns wind energy into electricity using the aerodynamic force from the rotor blades. This includes three major components, the blades, nacelles, and tower.

Contents

Foreword

Accelerating the expansion of renewable energy is vital for achieving net-zero emissions – and the task ahead to triple total renewable generation is significant. The groundwork is in place – proven technology, keen investor interest, a common ambition and desire to transition to clean energy at pace and scale. The International Renewable Energy Agency (IRENA) suggests a threefold increase in total renewable generation by 2030, aiming for over 11,000 GW by 2030 and surpassing 33,000 GW by 2050 to maintain global warming below 1.5 °C. Specifically, offshore wind capacity should grow from today's 64 GW to 494 GW by 2030 and further to 2,465 GW by 2050. Practically, this expansion equates to constructing more than 90 and subsequently over 500 equivalents of the Dogger Bank wind farms by 2030 and 2050, respectively.

The ERM COP28 Global Offshore Wind Update report provides an analysis of the global offshore wind market's status and its evolution since the previous COP27. It forecasts the 2030 market based on current trends and outlines necessary measures to expedite offshore wind development worldwide. These steps are critical to achieve set targets for offshore wind and broader net-zero ambitions.

The report acknowledges the urgent need for more action to meet offshore wind targets. It poses key questions: How much more effort is required, and what strategic moves are essential to hit these targets promptly and effectively, ensuring social and environmental benefits are prioritized?

The time is now for COP28 to help ignite the actions needed to shape a sustainable future for us all.

Tom Reichert
CEO, ERM

Executive summary

Over the last year, there has been a notable increase in policy development aimed at bolstering offshore wind energy, with auctions escalating since COP27. The major inflection point has been China overtaking the birthplace of offshore wind – Europe - in total operational capacity. Despite China's growth, Europe's North Sea regions, including the UK, Germany, the Netherlands, and Denmark, have maintained their growth trajectories, with heightened targets and significant auctions.

Early-stage project development increased 34% from markets all around the world. Emerging frameworks in the Mediterranean and Baltic Seas in Europe, and new markets from Australia to Brazil and the Philippines outside of Europe have shown considerable portfolio growth.

Developers remain keen to continue their long-term growth plans despite the current 40% cost increase from interest rate hikes, inflation, and supply chain issues. Disruption has mostly affected medium term projects due to be constructed before the end of the decade. Examples include in the UK where no capacity in the Annual Allocation Round (AR5) was awarded a route to market, in the US, where multiple offtake contracts are being re-negotiated and terminated, and in Poland, where developers are delaying project FIDs.

Despite projected growth, offshore wind deployment is far behind the capacity calculated to reach net-zero. With the total amount of global operational offshore wind capacity projected to be up to 250 GW by 2030, this is inadequate to meet IRENA's almost 500 GW by 2030 recommendation for net-zero scenarios.

For countries to fulfil these ambitious targets, governments must back industry with robust policy frameworks and support mechanisms that are delivered in a manner that does not result in project delays.

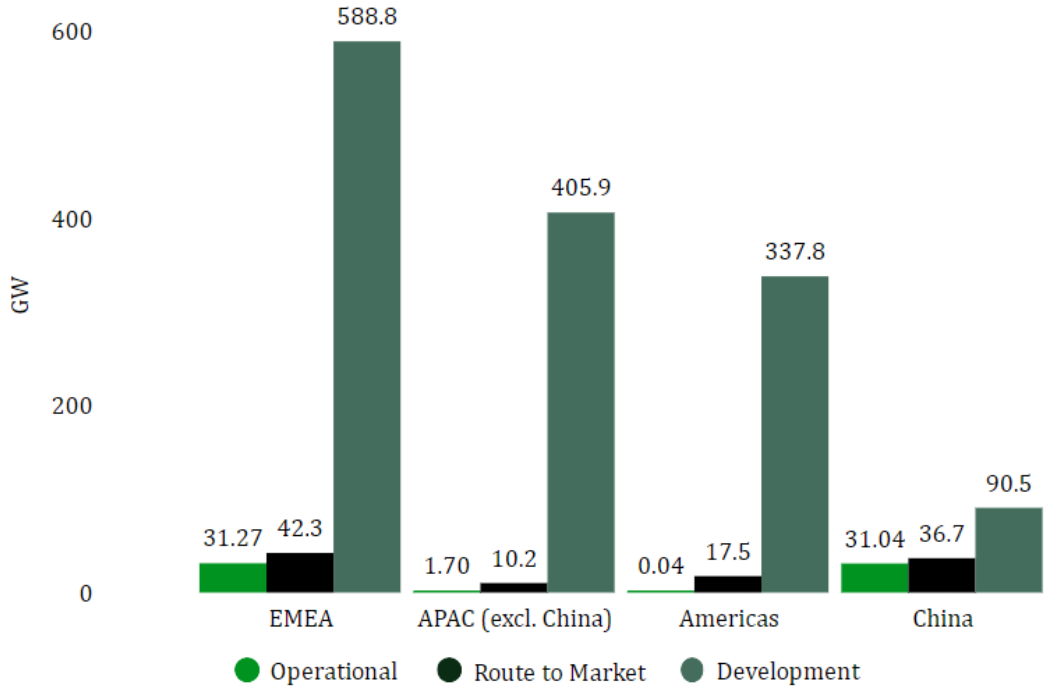
With proven technology, investor interest, and a substantial project pipeline, the foundations for offshore wind expansion are set. Yet, critical challenges persist, such as permitting, grid integration, supply chain issues, and financial support. Tackling these obstacles requires urgent collaborative efforts from governments, industry, and civil society.

There are various policy mechanisms at our disposal today that could mitigate these issues. By adopting best practices from global leaders in offshore wind, we can bridge the gap and ensure that offshore wind plays a pivotal role in combating climate change.

Global operational offshore wind capacity stands at 64 GW

China has the largest operational volume, followed by the UK, Germany and the Netherlands.

Global operational and secured capacity



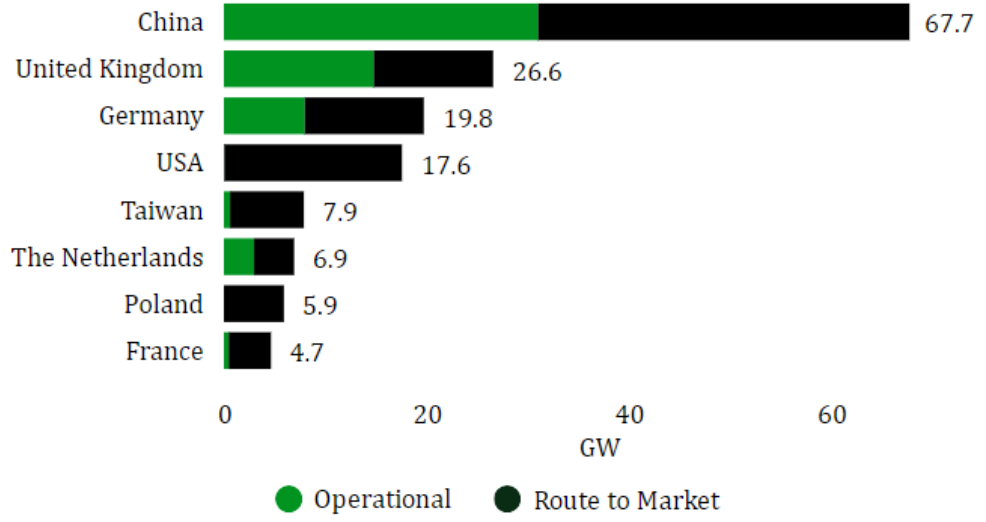
64.1 GW
Operational

106.7 GW
Secured

1,422.9 GW
In Development

1,593.7 GW
Total Portfolio

Leading offshore wind markets



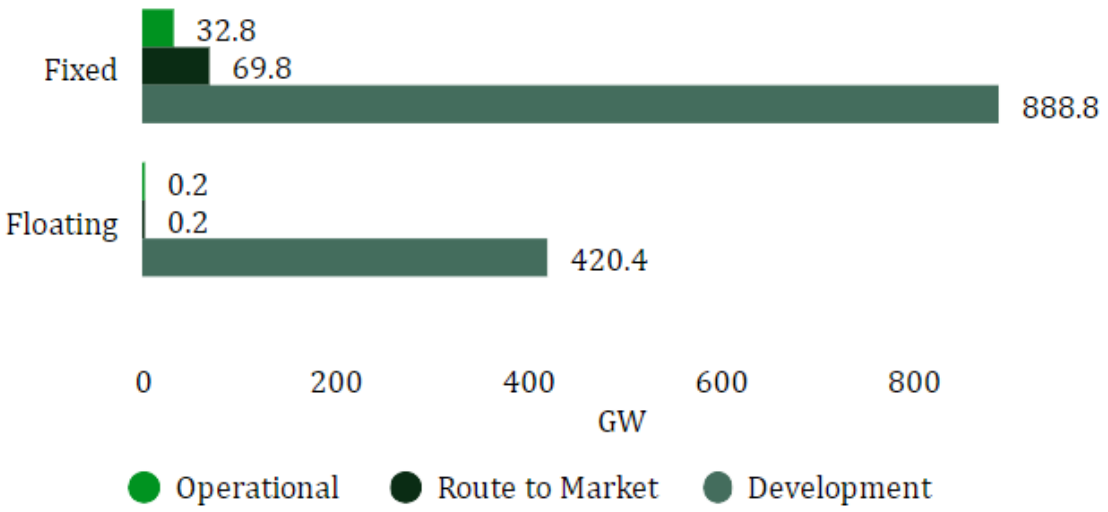
Europe has the largest operational and route to market secured capacity and is home to many mature offshore wind markets. However, global operational capacity only accounts for 13% of the 494 GW of capacity needed to be operational by 2030 to meet IRENA's net-zero target[1]. A large proportion of the development pipeline seen in the chart (left) is overestimated due to overlapping projects and a lack of, or change in, clear regulatory frameworks. This is especially evident in Brazil, Sweden, Ireland and Italy, where frameworks are still being developed.

Current global offshore wind capacity and activity

Floating wind will not advance quick enough to contribute to 2030 goals

At the current rate of maturation, floating wind is not expected to reach commercial scale until the mid-2030s.

Technologies (excl. China)*



*China data excluded due to unavailable data on project technology type.

Floating project and market developments

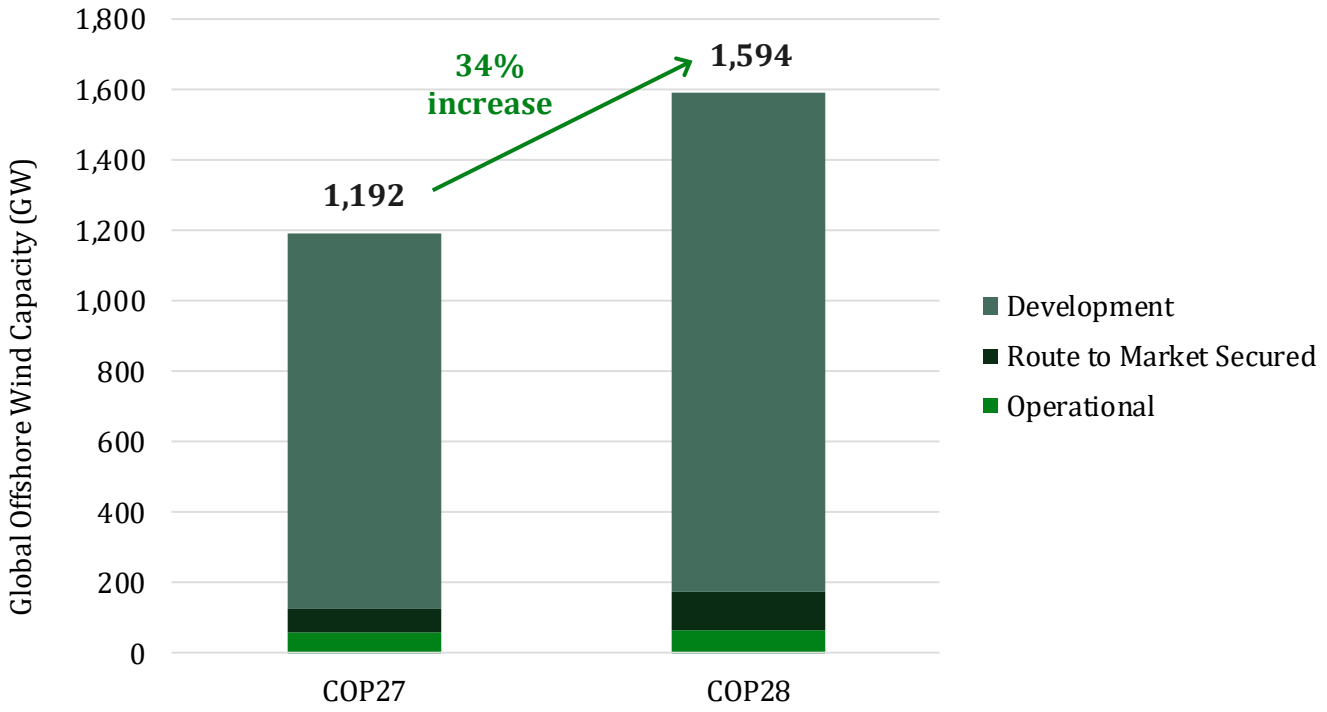
The total global floating offshore wind pipeline is now over 400 GW. Although floating developing capacity is catching up with fixed-bottom capacity, the market is immature, and many barriers are hindering the industrialisation of floating capacity. Only 218 MW of the floating capacity is currently operational and only 158 MW have secured route to market (excluding China). The majority of the floating markets are newly set up and have no route to market mechanisms or regulatory certainty. This imposes a great risk to the project development pipeline and project finance. Most of the announced projects still need to secure seabed exclusivity. Consequently, only a small proportion of floating capacity, around 0.04%, is expected to contribute to 2030 targets.

The floating wind industry is a fast-developing market with large potential. However, costs remain significantly above fixed offshore wind, and policies need to work to support the industrialisation of floating wind to reduce costs ensuring the technology can be quickly deployed at commercial scale post 2030. Clear regulatory frameworks and concessional climate finance will be required to reduce the cost of energy and risks for the first large-scale floating projects.

As fixed-bottom remains the only proven commercial scale offshore wind technology, governments should focus on fixed projects for short-term acceleration to meet 2030 targets.

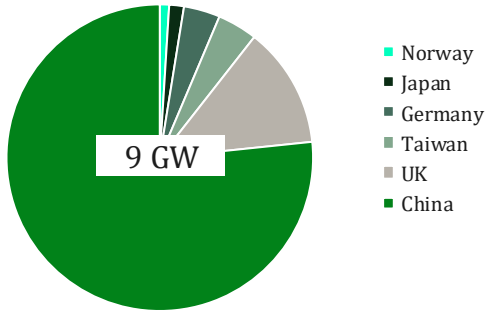
Operational capacity increased by 9 GW since COP27

75% of new operational capacity was built in China. Annual commissioning rates need to increase to an average of 70 GW over the next seven years to meet 2030 targets.

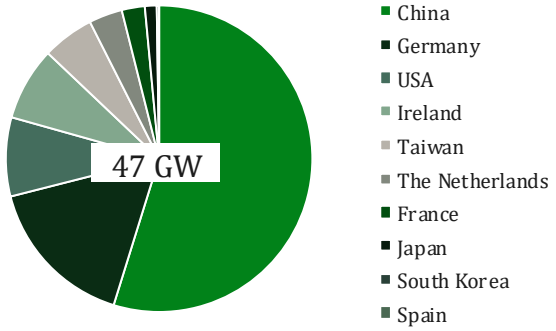


Since COP27, 9 GW of offshore wind capacity entered operations whilst near 50 GW secured a route to market. Over 75% of new operational capacity was built in China. Smaller advances in operational capacity were made across other markets; one offshore wind project became operational in the UK, Norway, Germany and Taiwan.

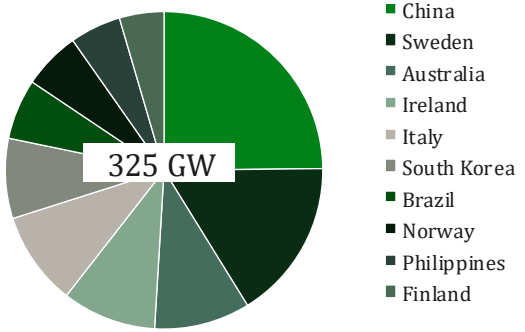
Increases in operational capacity



Increases in route to market secured capacity



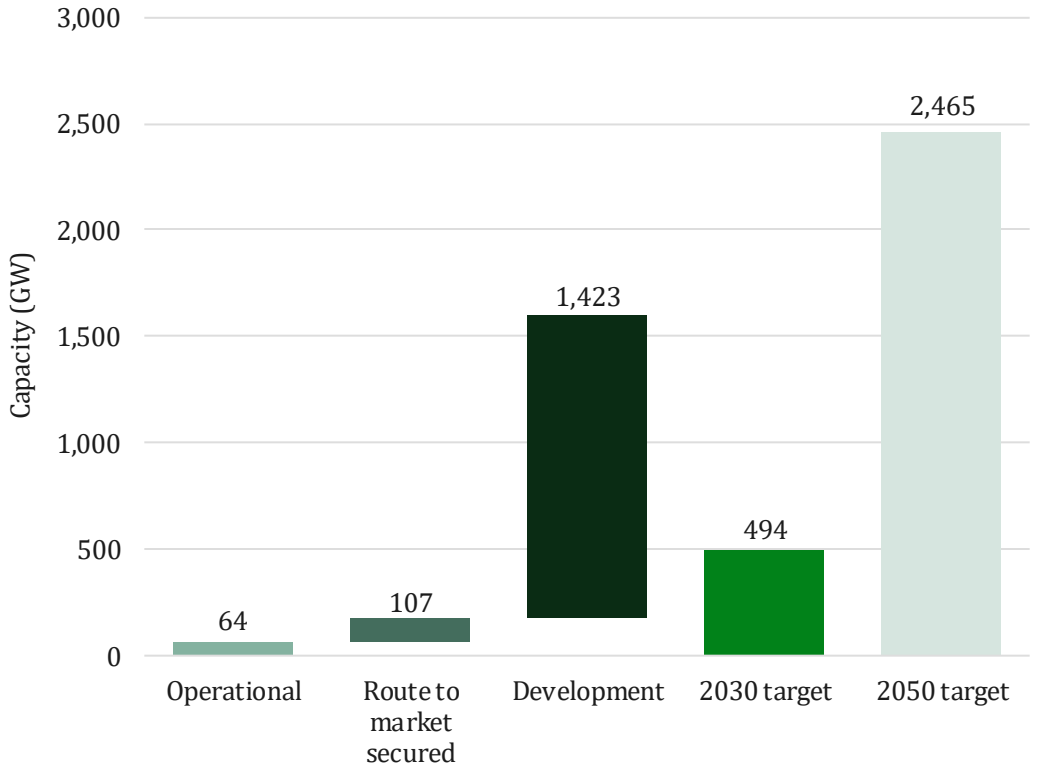
Increases in development capacity (top 10 countries only)*



*402 GW of development capacity added in total

Over 300 GW of capacity currently in development will need to enter operations by 2030 to meet net-zero targets

Global capacities



Key markets, development

Based on IRENA's calculations, operational capacity needs to increase over sevenfold over the next seven years, to keep warming below 1.5°C.

Assuming all 107 GW of current secured capacity will be realised by 2030, an additional 323 GW of capacity currently under development will need to reach operations by 2030 to meet IRENA's target.

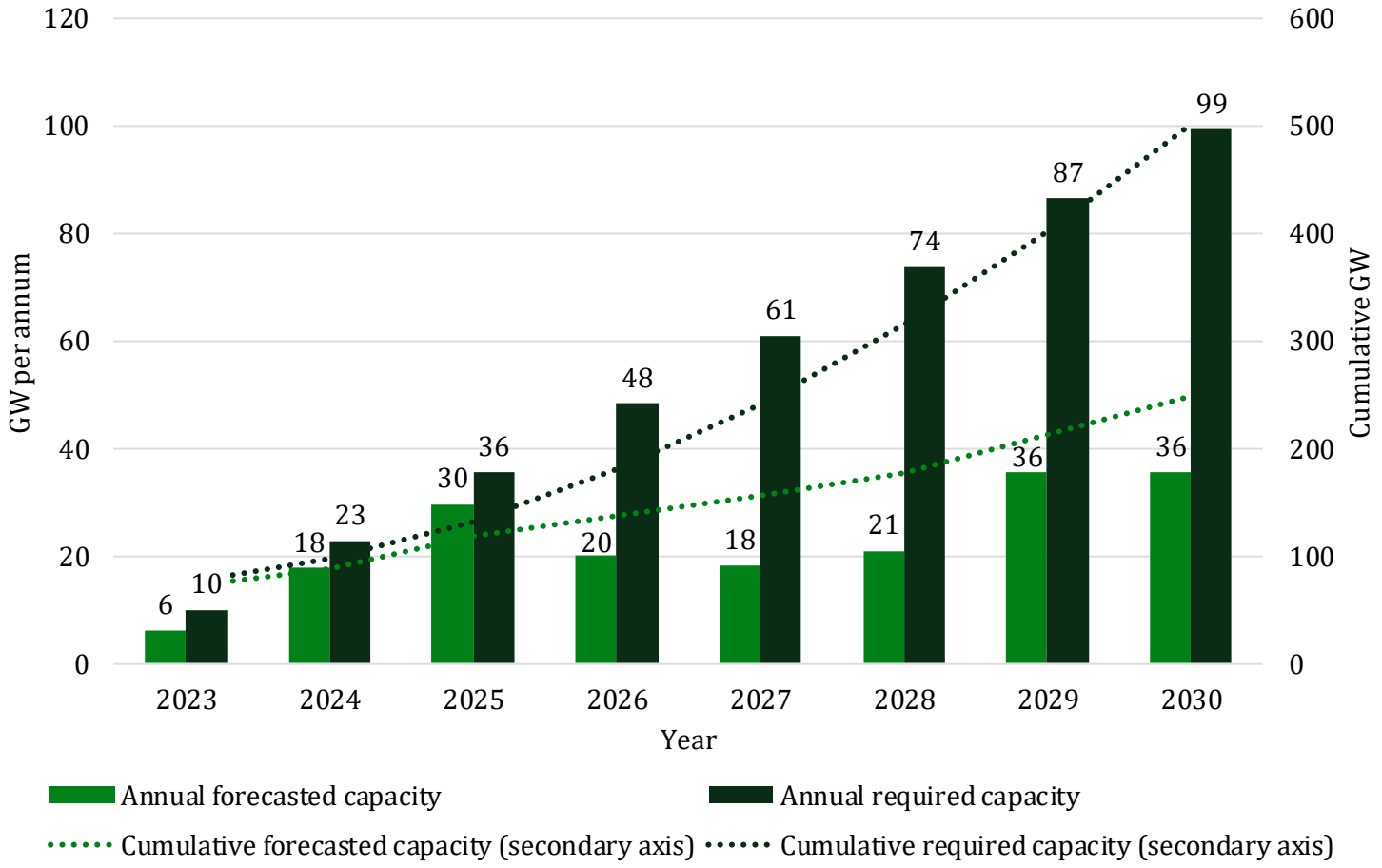
However, this year, the offshore wind industry has seen project delays and cancellations, driven by cost increases from supply chain challenges as well as increasing inflation and interest rates. In the United States, multiple offtake contracts are being re-negotiated and terminated, citing economic headwinds rendering their existing PPAs uneconomic to proceed. In the UK, Vattenfall announced it is halting the development of its Norfolk Boreas project, citing increases in offshore wind costs and supply chain vulnerability, and in Poland, the developers of two projects announced the FID of each will be delayed. In the UK, no capacity in the Annual Allocation Round (AR5) was awarded a route to market.

At a time where strong tailwinds are needed in the offshore wind industry, uneconomic conditions and uncertainty are causing developers to act cautiously, reducing the amount of offshore wind capacity reaching FID and progressing through the development stages.

Is it too late for 2030?

Global offshore wind predicted to miss IRENA's 2030 target by at least 50%

Based on current project activity, ERM forecasts that up to 175 GW of capacity will be added in the next seven years, bringing operational capacity to 250 GW by 2030.



ERM predicts global operational offshore wind capacity to reach up to 250 GW by 2030. This is much lower than the almost 500 GW of capacity IRENA state is needed to maintain global warming below 1.5 °C.

To reach 494 GW by 2030, an additional 430 GW would need to be installed over the next seven years. Assuming a steady growth of required capacity from now until 2030, the required capacity becomes more out of reach towards the end of the decade. It's predicted that the current capacity that could come online in 2030 represents just 36% of the capacity needed that year.

Of the forecasted capacity, 80 GW has secured a route to market and over 100 GW is still in the development stages. This is not a forecast estimating what actual capacity will be installed in each year since not all projects in advanced stage development will proceed. As the US and UK market have shown recently, with projects with a secured route to market halting development. An actual forecast of the expected total capacity installed will likely be substantially lower than these charts suggest.

Of the total forecasted capacity, Europe accounts for the largest proportion (42%), followed by China (27%), APAC (excl. China) (17%) and the Americas (14%).

2030 ambitions are not sufficient to meet IRENA's 2030 target, and most won't be met

Although targets have played a key role in mobilizing industry, they should not be seen as guaranteeing successful projects. Among the 19 nations with explicit offshore wind goals for 2030, only Poland is on track to achieve its current target of 5.9 GW according to ERM's 2030 projections. Poland is expected to increase its target with an update of the Polish Energy Policy 2040; however, as this has not been officially announced, Poland meeting its target is based on the current 5.9 GW target. In light of recent policy uncertainty, cost increases, and an increasing proportion of projects in the pipeline planning to deliver on merchant pricing, even the most ambitious countries face a challenging path to achieve their targets.

For countries to remain on track and to fulfil these ambitious targets, governments must back them with robust policy frameworks and support mechanisms that are delivered in a manner that does not result in project delays. Evidence suggests a strong link between countries having a well-defined market approach and their success in meeting offshore wind targets. Nations with transparent tender processes, specific criteria, and defined offtake arrangements, like the UK, Denmark, Germany, France, and the Netherlands, stand a better chance of realizing their offshore wind potential within the next decade.

Moreover, countries with an established presence in the offshore wind sector can draw on their extensive experience. Emerging markets are advised to observe these mature markets to identify successful strategies and avoid pitfalls, thereby achieving their ambitious offshore wind goals.

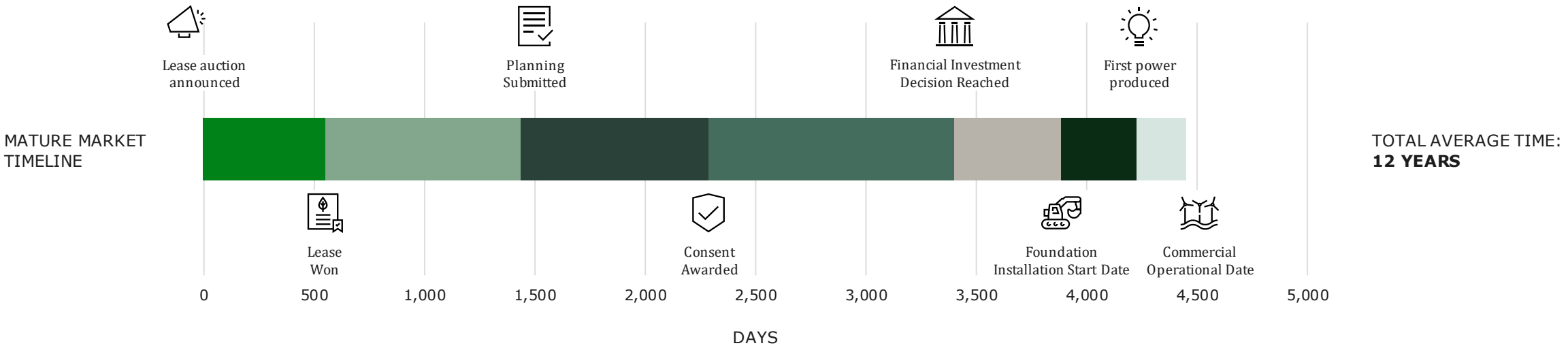
Beyond meeting capacity targets, it's crucial for nations to implement policies that ensure the equitable distribution of benefits from the clean energy system.

Country	Ambition by 2030 (GW)	Operational Capacity (GW)	ERM 2030 Forecast (GW)	Currently on track for 2030 target	% of goal forecasted***
Poland*	5.9	0	6.2	✓	> 100%
South Korea	14.3	0.11	13.2	✗	80 – 90%
USA	30	0.04	25.8	✗	
Japan	5.7	0.20	4.8	✗	
Vietnam	6	0.78	4.9	✗	
Denmark	12.9	2.31	9.9	✗	70 – 80%
Germany	30	8	22.2	✗	
Taiwan	13.1	0.61	9.7	✗	
United Kingdom	50	14.8	35.7	✗	
France**	7	0.48	4.9	✗	
The Netherlands	21	2.99	13.7	✗	49% - 65%
Belgium	5.8	2.26	2.8	✗	
Ireland	5	0.03	3.0	✗	
Italy	0.9	0.03	0.1	✗	< 10%
Spain	3	0.01	0.1	✗	
India	30	0	1.1	✗	
Norway**	11.25	0.09	0.1	✗	
Portugal	2	0.03	0.03	✗	
Greece	2	0	0	✗	

**Poland is expected to increase their target with an update of the Polish Energy Policy 2040 which also assumes investments in grid connections. Assumptions detailed on page 27.*
***Norway's 2040 target and France's 2028 target has been scaled to 2030.*
****Grid availability and supply chain constraints have not been considered as part of the ERM forecast*

Project timelines - Is it too late for 2030?

Can 2030 targets still be met with increased consenting acceleration?



In mature markets, the average time from auction announcement to commercial operation date (COD) for offshore wind projects is 12 years, as per ERM analysis. This duration, however, varies across different markets and projects.

Currently, about 175 GW of capacity is expected to become operational in the next seven years. Reducing the average development time by three years could lead to an additional 150 GW by 2030, totalling 400 GW of global capacity. This would still be 100 GW short of IRENA's target but would significantly narrow the gap.

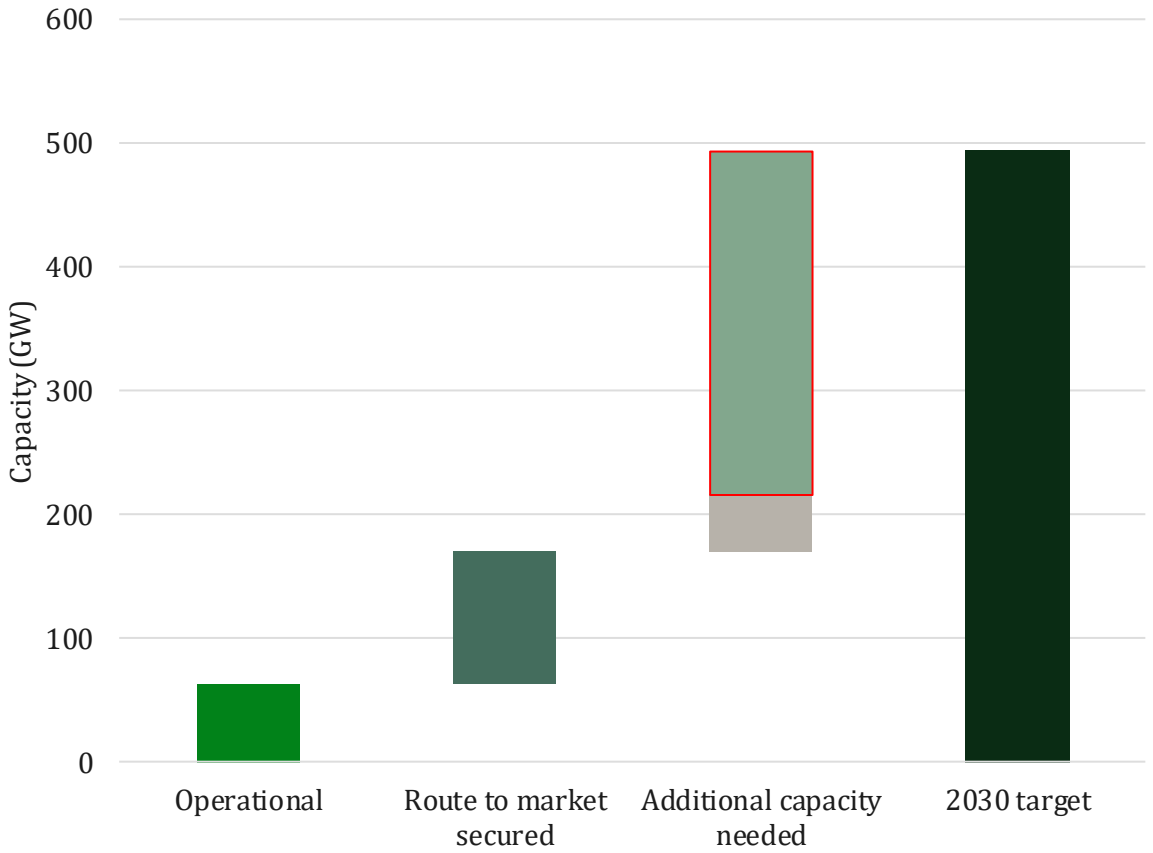
The consent approval phase, often taking 2-3 years, is a major time-consuming step in the development process. This phase can be delayed due to bureaucratic delays (often caused by understaffed departments), unclear permitting procedures, and community opposition. Inadequate grid infrastructure presents another challenge, necessitating timely upgrades for effective integration of new generation capacity and alleviation of grid bottlenecks. Potential delays in projects also undermines supply chain confidence, delaying investment in manufacturing capacity, installation vessels and ports and harbour infrastructure.

To expedite offshore wind deployment, regulators must coordinate multiple intertwined processes ensuring growth occurs in a clear and transparent method. Fortunately, they have several policy levers to streamline development to help this process, including simplifying permitting with a “one-stop shop” approach, engaging in stakeholder consultations, and enforcing mandated lead times. Addressing these barriers and bottlenecks is crucial for achieving the accelerated deployment of offshore wind capacity by 2030.

Route to market - More offshore wind offtake auctions needed to de-risk the project business case

The current pipeline of offshore wind auctions is not sufficient to support the build-out of capacity to reach net-zero targets.

Auctions currently scheduled



Key challenges

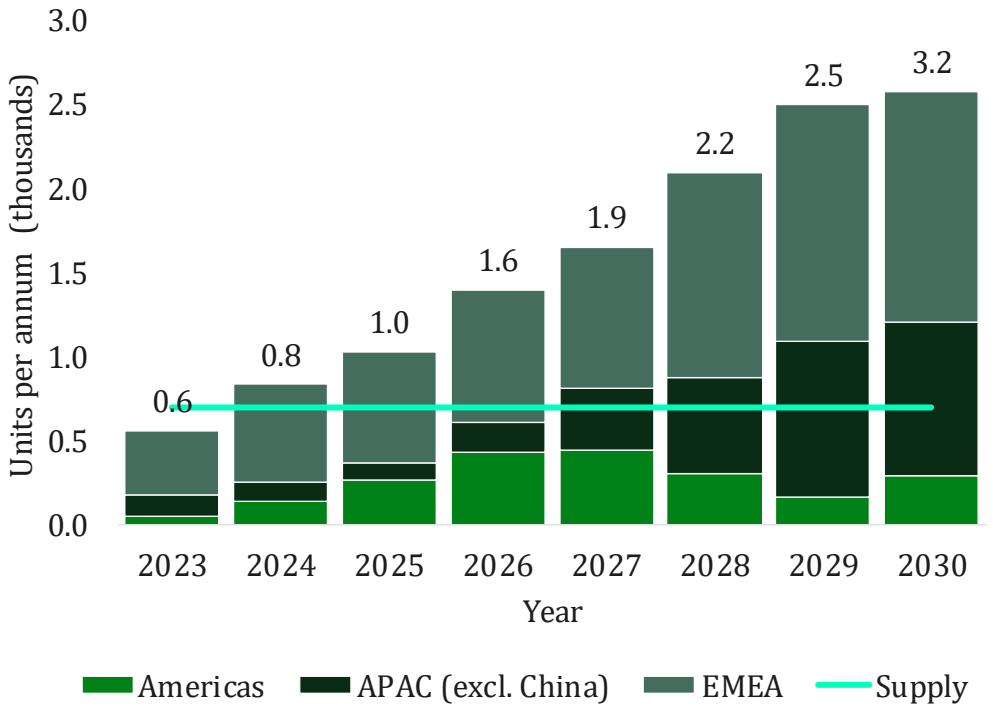
The current offshore wind capacity allocation through auctions is projected to be nearly 50 GW between 2023 and 2026, with expectations of further auctions as policies evolve. To meet IRENA's 2030 target, alongside the 107 GW of secured capacity, an additional 323 GW under development must become operational. Governments are urged to provide long-term auction schedules, enhancing developers' confidence and fostering a stable project pipeline.

It's crucial to recognize that auction results are not definitive indicators of capacity realization, as demonstrated by recent events in the where no capacity in the Annual Allocation Round (AR5) was awarded a route to market, in the US, where multiple offtake contracts are being re-negotiated and terminated, and in Poland, where developers are delaying project FIDs. Governments must also consider rising costs and supply chain pressures, ensuring that subsidy mechanisms like CfDs align with the strategic importance of offshore wind development.

Supply chain - Shortages are expected from 2024 – 2030

Projects in development also need to take into account the impact of supply chain constraints on project development timelines.

Supply & demand forecast of WTGs*



Assumptions detailed in Data and Assumptions, page 27

Key challenges

Offshore wind projects demand significant capital and equipment, relying on a stable supply chain. The procurement of wind turbine generators (WTGs), foundations, cables, and installation vessels is vital. Manufacturing lead times for these components often exceed a year, not accounting for the additional time needed for engineering and design. Additionally, establishing new factories to support global expansion also involves lengthy lead times.

As annual installations are projected to increase sevenfold by the end of the decade, supply chain demands will rise, particularly post-2026. This increase will escalate competition for resources from Original Equipment Manufacturers (OEMs), with Chinese OEMs likely extending their reach beyond China, especially in the Asia-Pacific region.

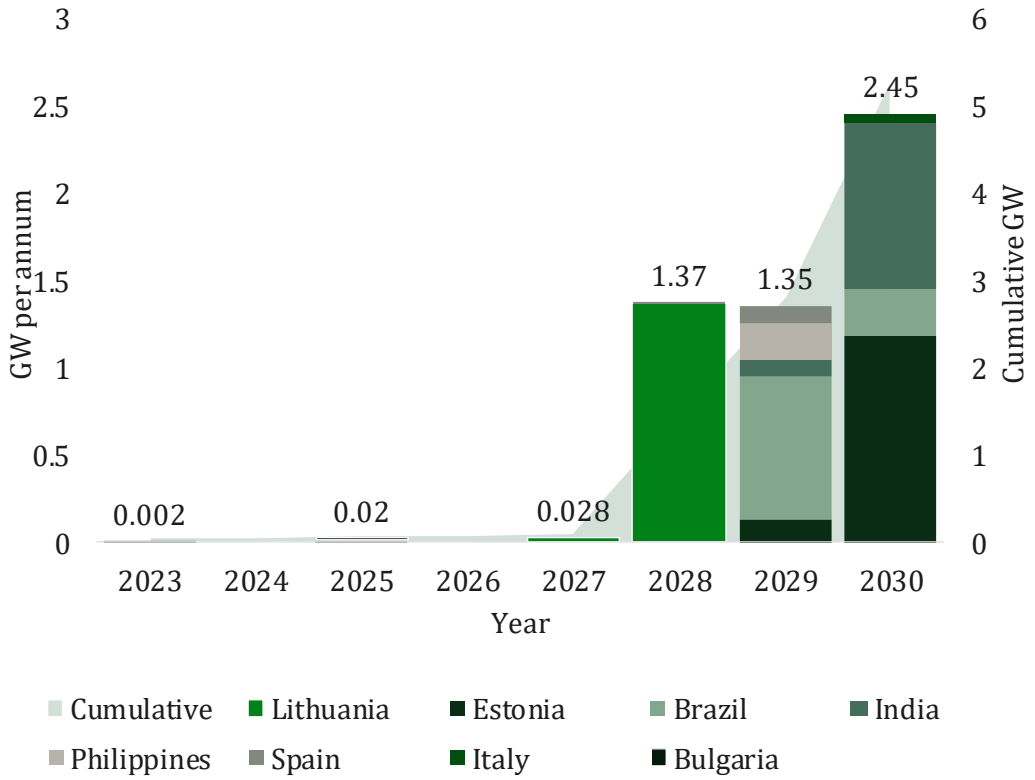
To support growth, the offshore wind sector requires dependable project pipelines and strong investor confidence. Long-term planning is critical for suppliers to invest in expanding their facilities and capabilities. Regulators need to provide the necessary certainty, fostering early investment in manufacturing capacity through clear, long-term project pipelines and well-defined local content requirements. Given the impracticality of a single country or region supporting the full supply chain, either in fixed or floating wind, cross-regional collaboration on industrialization is essential to avoid erratic growth patterns.

For floating wind, industrialization poses unique challenges, particularly in developing infrastructure for large-scale foundation manufacturing. Currently, there is no established methodology for commercial scale foundation production. Finding a solution within the next three years is imperative for advancing commercial scale projects planned for the end of the decade. This highlights the need for innovation and investment in new manufacturing techniques and infrastructure to meet the increasing demand and complexity of offshore wind projects.

The need for acceleration in emerging markets

Capacity in emerging markets accounts for less than 3% of the total capacity forecast to come online between 2023 and 2030.

Capacity forecast to come online in emerging markets



Summary

In this scenario, emerging markets are defined as markets with offshore wind activity but less than 50 MW operational capacity and less than 5 GW of route to market secured capacity:

- Australia
- Brazil
- Bulgaria
- Canada
- Colombia
- Egypt
- Estonia
- Greece
- India
- Italy
- Latvia
- Lithuania
- New Zealand
- Philippines
- Portugal
- Romania
- Spain

Of these 17 markets, only eight are expected to commission capacity between 2023 and 2030, when a total of 5.2 GW of capacity is due to come online.

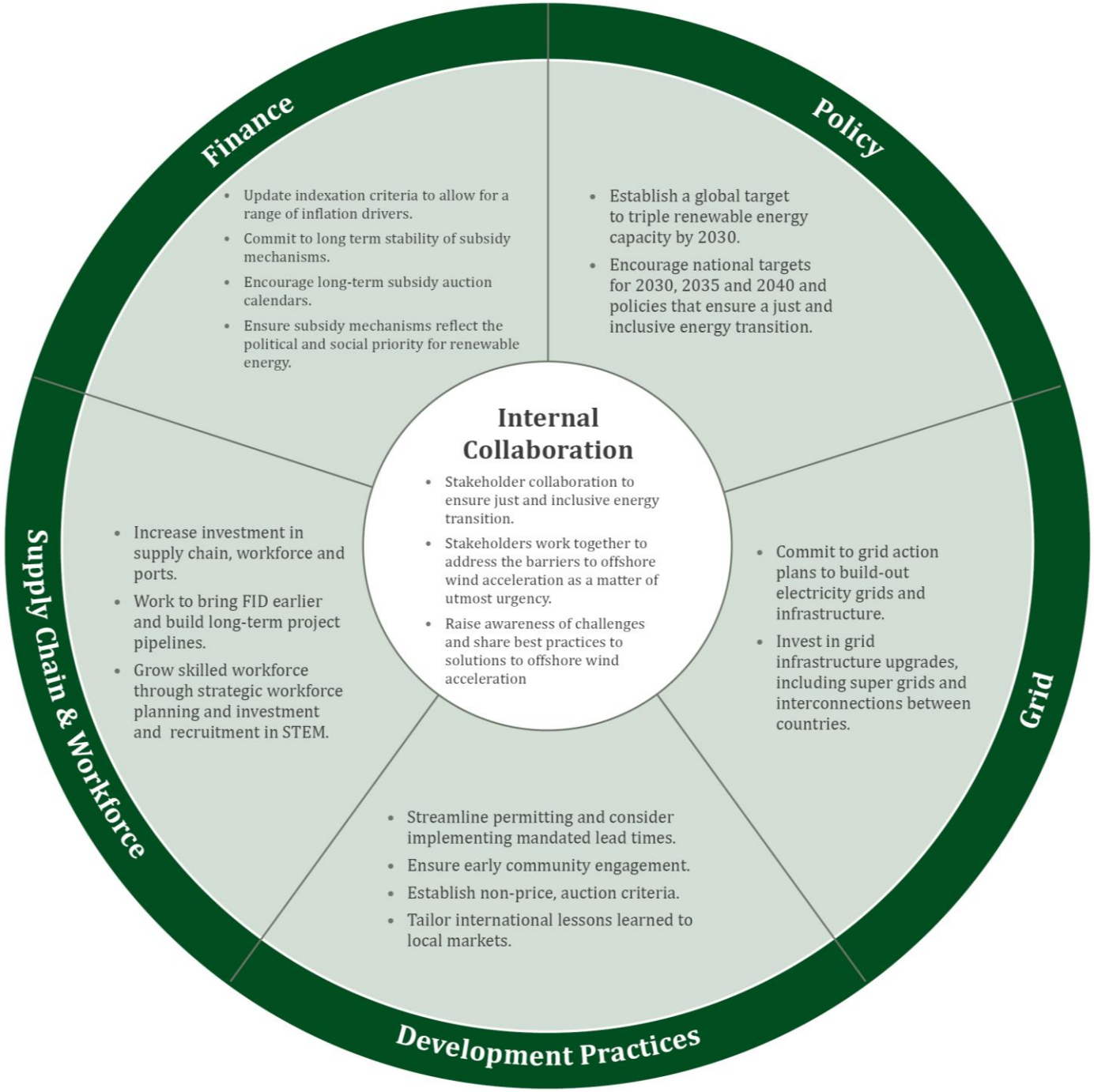
It is critical that emerging markets continue establishing the strategic fit for offshore wind in country and translate this vision through policy and regulatory frameworks to deliver the infrastructure and bring the projects to operation.

The first projects in any new market will have higher costs, uncertainties and risks presenting barriers for initial development. A coordinated approach is needed to mitigate the impacts of the highly priced first projects. Concessional finance is needed to reduce the initial cost premium and enable emerging markets to accelerate offshore wind deployment[6].

Recommendations to accelerate offshore wind build-out

Recommendations to support the global acceleration of offshore wind

Action is needed across five key areas. International collaboration is central to the progress of the global offshore wind industry and must feed into each action where possible.



Challenges and recommendations for accelerating global offshore wind build-out

Challenge	Enabler	Recommendations
Offshore wind deployment is far behind the capacity calculated to reach net-zero.	Policy	• Governments should set national targets to cumulatively align with IRENA's target of 500 GW by 2030. • Each appropriate offshore wind market should set clean, long-term offshore wind policy ambitions, including 2030, 2035 and 2040 targets. • Regulators should also adopt policies which ensure that gains from the clean energy system are equitably distributed, and that offshore wind acceleration is in line with a just and inclusive energy transition.
The ability to connect offshore wind farms to the grid is becoming increasingly constrained[4]. Power curtailment in projects is becoming more common, as to not overwhelm transmission systems. Transmission systems aren't developed enough to take energy to areas of high demand and low supply. As grid build-out often requires a longer lead time than construction of renewable projects themselves, the lack of available grid connections and transmission poses a significant bottleneck to the acceleration of offshore wind[1].	Grid	• Regulators should urgently invest in grid action plans which rapidly build-out electricity grids and infrastructure. • Timely grid infrastructure upgrades are needed to allow additional generation to integrate into the grid system and decrease bottlenecks. • The need for super grids and interconnections between countries should be addressed.
Developing and constructing an offshore wind project is a lengthy process. It can take an average of 12 years from the lease auction announce date to the Commercial Operational Date (COD).	Development Practices	• To streamline permitting, governments should consider implementing a "one-stop shop" model for permitting authorities to create a single point of contact and consequently, a more simplified permitting process. • Governments should consider implementing mandated lead times for completing the permitting process of offshore wind project development. • Governments should ensure that community engagement is enacted early in the development process to secure local support for renewables projects. • Governments should use international lessons learned and tailor them to the local environment. • Non-price criteria should be included in auction criteria to integrate deployment plans and targets with wider environmental and biodiversity strategies on land and in the sea, maximising the potential for an environmentally friendly transition with net-positive biodiversity impacts.

Challenges and recommendations for accelerating global offshore wind build-out

Challenge	Enabler	Recommendations
The current state of offshore wind capacity highlights a significant challenge in balancing the rapidly growing demand with the existing supply chain capabilities: **Rapid Growth in Offshore Wind Capacity**: The offshore wind sector is experiencing a surge in demand. This is driven by the global push for renewable energy sources and the technological advancements making offshore wind a more viable option. **Low-Profit Margins and Investment**: Due to the competitive nature of auctions and the rush to secure contracts, profit margins for suppliers are thin. This low profitability can deter investment in expanding capacity, leading to a reluctance to scale up operations. Without sufficient confidence in the long-term viability and profitability of the offshore wind pipeline, companies may be hesitant to commit the substantial required resources to expanding their capacity, particularly in new markets.	Supply Chain & workforce	• Governments need to work collaboratively to build strong and diverse supply chains. Governments should encourage national and regional collaboration to support a global offshore wind development strategy, putting adequate capacity in the supply chain. • Governments need to increase investment into the offshore wind supply chain, including into ports (fixed and floating) and the workforce. • Governments should work to bring financial decision earlier and commit to offshore wind development plans to increase confidence in long-term project pipeline, allowing suppliers to effectively plan for efficient supply chain development. • Strategic workforce planning is required at national and regional levels to focus on education, training and upskilling. A collaborative effort is needed between industry and government to grow a sustainable level of recruitment and enrolment in STEM subjects to build a skilled and diverse offshore wind workforce.
Offshore wind faces serious cost inflation due to raw materials shortages and price increases. Also, interest rate hikes increase the cost of debt. Offshore wind remains competitive but increasing capital costs might undermine net-zero goals. Supply chain costs are expected to have increased by 40% over the past year, yet the prices agreed for the power generated by offshore wind farms have not. The development of projects without increased government support across the UK and US have been deemed uneconomical.	Finance	• Update indexation criteria to allow for a range of inflation drivers including commodities as well as interest rates. • Ensure stability of the subsidy mechanism. • Governments should set out long-term subsidy auction calendars to build a steady pipeline of projects and ensure confidence in market. Announcing auctions 2 -3 years ahead enables developers to plan ahead and invest in offshore wind developments with further confidence, unlocking investment. • Subsidy mechanisms for offshore wind should reflect the political and social priority for renewable energy.

Challenges and recommendations for accelerating global offshore wind build-out

Challenge	Enabler	Recommendations
There is the need for more collaboration between governments and regions, with increased levels of 'know-how' shared between stakeholders.	International Collaboration	• All stakeholders need to collaborate to ensure offshore wind acceleration is in line with a just and inclusive energy transition. • Governments, industry and civil society must work together to address the barriers to offshore wind acceleration as a matter of utmost urgency, from permitting to grids, supply chain bottlenecks, and finance. • Awareness needs to be raised around the challenges to offshore wind acceleration to mobilise the extent of the support and action required.

Additional information

Snap-shot of key updates in offshore wind activity since COP27

PROJECT DEVELOPMENT

In March 2023, the 342 MW Kaskasi offshore wind farm in **Germany** was announced fully operational.

In **Scotland**, the Seagreen offshore wind farm became fully operational in October 2023. The project is Scotland's biggest wind farm, with 114 Vestas turbines.

In August 2023, Hywind Tampen was officially commissioned off the coast of **Norway**, becoming the World's largest floating offshore wind farm at 88 MW.

In July 2023, Vattenfall announced it is halting the development of its 1,400 MW Norfolk Boreas project in the **UK**, citing increases in offshore wind costs and supply chain vulnerability.

Japan's first commercial scale offshore wind farm, the 84 MW Noshiro Port, achieved COD in December 2022.

The first commercial scale projects to be built in the **US** are well underway with all the foundations completed at Orsted's 128 MW South Fork, and just under half of foundations (estimated) at the 804 MW Vineyard Wind 1.

In a first for the **US** market, three large projects together totalling 3,234 MW have announced or finalized the termination of their previously awarded PPAs, citing economic headwinds rendering their existing PPAs uneconomic to proceed.

FLOATING PROJECT PIPELINE

In August 2023, Hywind Tampen was officially commissioned off the coast of **Norway**, becoming the World's largest floating offshore wind farm at 88 MW.

In April 2023, 20 new areas were identified for offshore wind development in **Norway**, 14 of which will utilise floating technology.

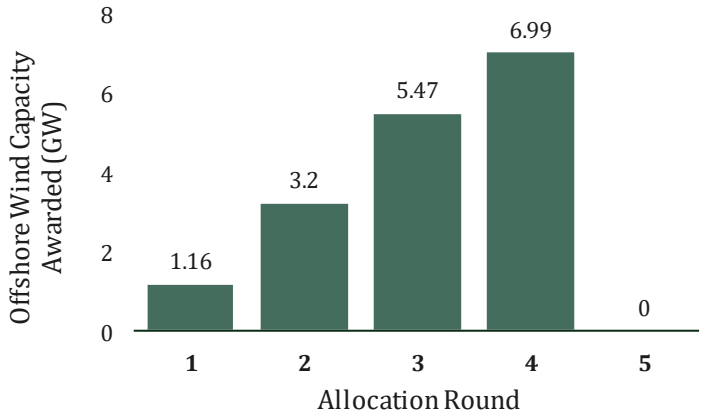
In **France**, the final specifications for the South Brittany floating tender were published in June 2023. Additionally, the government progressed plans for the AO6 tender, which will allocate two 250 MW floating sites, each with a 500 MW extension.

Floating capacity in **APAC** exceeded 85 GW. Multiple large-scale projects were announced across the Philippines and Australia.

TOPIC HIGHLIGHT: AR5 results, UK

In the **UK**, no offshore wind projects were allocated a subsidy through AR5. The subsidy provided through the scheme was unlikely to allow projects to be built economically given 40% cost increases and tough macroeconomic conditions. For reference, the auction price cap was 44 GBP/MWh, which reflected the prices in previous AR, but did not increase to manage increases in supply chain costs and interest rates. Additionally, the CfD mechanism offers a largely fixed revenue level, so cost uncertainty would be uneconomical.

In November 2023, the UK government raised the maximum price offshore wind and other renewables projects can receive in the next Contracts for Difference (CfD) auction, set to take place in 2024. The maximum strike price has been increased by 66% for offshore wind projects, from £44/MWh to £73/MWh, and by 52% for floating offshore wind projects, from £116/MWh to £176/MWh[2].



AUCTION ACTIVITY

Ireland's long awaited first offshore wind auction ORESS1 awarded a route to market for over 3 GW of capacity.

In 2023, the **Polish** Ministry of Infrastructure awarded Offshore Location Licenses (OLL's) to a total of 10 sites totalling 8.3 GW of capacity.

Lithuania and **Estonia** launched offshore wind auctions for the first time.

In **Finland,** Metsähallitus announced a tender programme for over 6 GW of offshore wind capacity.

In **the Netherlands**, while the tenders for IJmuiden Ver sites III and IV were pulled forward by 2 years, to 2023, later delayed to early 2024.

In **Australia**, the state of Victoria will hold the first offtake auction for offshore wind projects in 2025. The government proposed to use CfD as the major support mechanism.

4 GW of capacity was awarded through **US** auctions.

Germany awarded 1.8 GW through sites not-centrally pre-examined and 7 GW through sites centrally pre examined. TotalEnergies and bp secured two sites each in the auction for not-centrally pre examined sites, paying a total of €12.6 billion for site exclusivity.

Round 3-1 Administrative Contracts were signed in **Taiwan.** Five Round 3-1 projects comprise 2285 MW were signed. Another two winning bidders, NPI and Skyborn, abandoned their allocation for 665 MW.

EMERGING MARKETS

First offshore wind projects announced in **Egypt.**

Early-stage offshore wind policies emerged in younger European markets such as **Azerbaijan, Cyprus, Malta, Sri Lanka,** and **Romania.**

Vietnam's PDP8 was approved in May 2023, after a two-year waiting period. The PDP outlines plans to install 6 GW of offshore wind by 2030.

In **Colombia,** details of the first seabed tender round were announced, with the intention to launch the auction in December.

TOPIC HIGHLIGHT: INDIA PROPOSED A TENDER FOR OVER 7.2 GW OF CAPACITY.

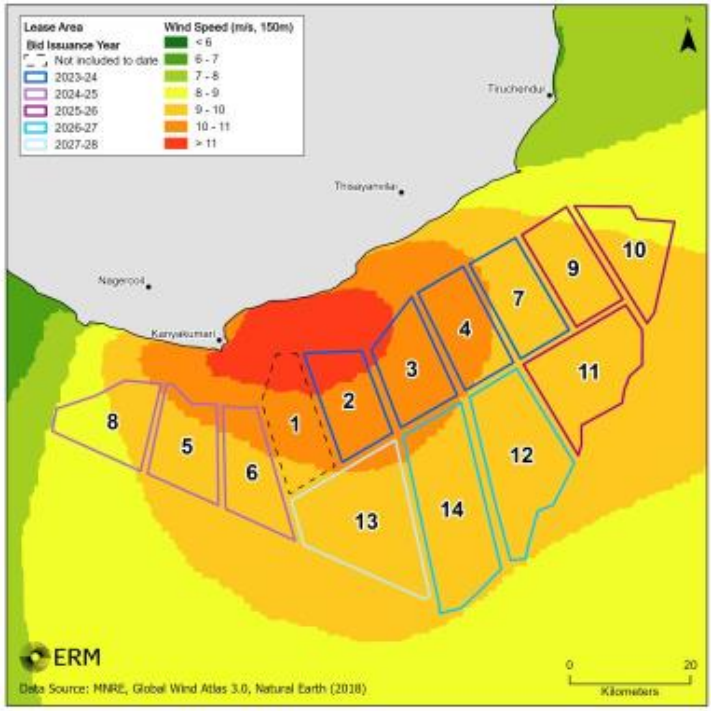
India's Ministry of New & Renewable Energy (MNRE) published a public notice to propose a tender for the allocation of seven offshore wind power sites off the coast of Tamil Nadu, totalling over 7.2 GW in capacity. The tender for the first four sites is to be issued on 1st February 2024, followed by three more sites in FY 2024-25.

No Central Financial Assistance (CFA) will be available, for example in the form of Viability Gap Funding (VGF), and thus developers will be required to secure offtake through either the open access mechanism, bilateral PPAs or sale through power exchanges.

The first four sites, labelled as 2, 3, 4 and 7 (see right), are primarily located in waters approximately 15 to 50 metres in depth and roughly 10 to 30 kilometres from shore. Mean wind speeds at 150 metres for the sites range from 9 m/s to over 11 m/s.

The three sites to be tendered in FY 2024-25 (5, 6 and 8) are located to the west of the first four sites and are predominantly situated within slightly lower mean wind speed areas of 8 to 10+ m/s. Sites for subsequent auctions, as indicated in the revised strategy paper, are located in sea areas either further from shore or lower in mean wind speed.

The bidding will be conducted in a single stage two-envelope (techno-commercial and financial) process. The winning developer will be granted a five-year lease (potentially extendable for a further year) to carry out detailed surveys and studies and by the end of this period, the developer must have commissioned the project. Once commissioned, the seabed lease will be extended for the operational and decommissioning of the offshore wind project.



Endnotes

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[3] IRENA and GWEC 2023, Enabling frameworks for offshore wind scaleup: Innovations in permitting, International Renewable Energy Agency, Abu Dhabi.

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Data and Assumptions

Data in charts relevant up to 10th November 2023.

Assumptions from supply chain model on page 14:

Grid availability and supply chain constraints have not been considered as part of the ERM 2030 forecast.

Poland reaching 5.9 GW of capacity coming from offshore wind will likely happen according to the plan. It became possible after several projects secured CfD during the first round that took place in 2021. Among those projects, one has already reached FID, Baltic Power. B&C-wind owner, Ocean Winds, has recently confirmed that their project will also reach FID by the end of 2024.

Assumptions from supply chain model on page 22:

The turbine rating is modelled for future projects using GRIP. Based on the capacity demand provided in the first section, and the turbine rating model, the annual number of wind turbine generators are forecasted.

ERM estimated the supply capacity of the 3 major OEMs: Siemens Gamesa, Vestas, and GE. Public information is used to estimate the supply capacity. The combined total supply capacity is estimated at around 700 units/year. However, it is commercially sensitive information and therefore the actual supply capacity can be higher.

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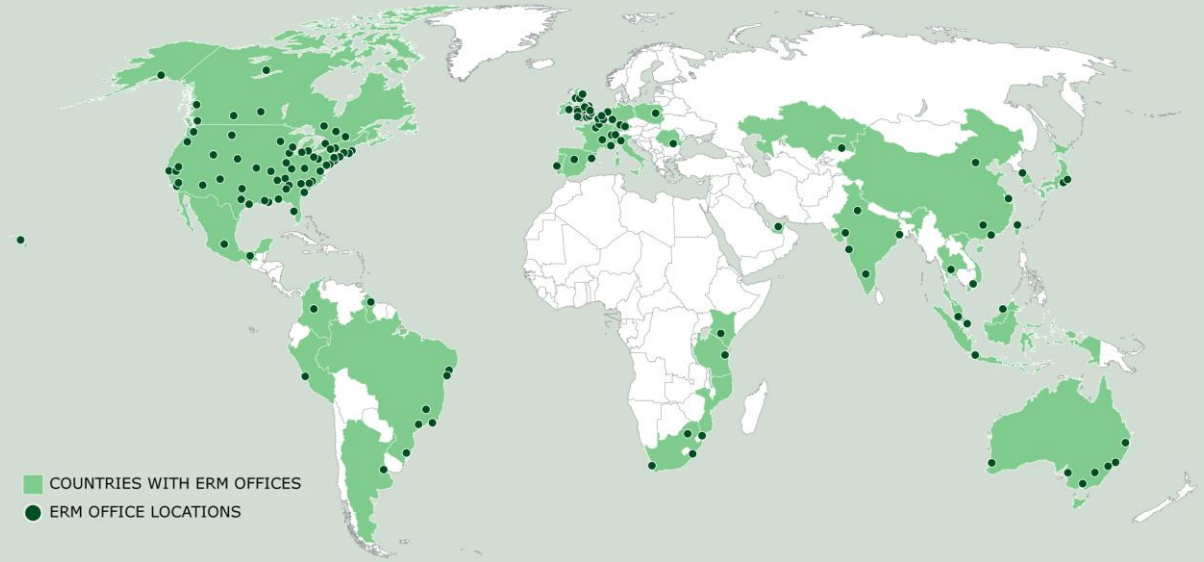
ERM OVERVIEW

8000+ Professionals	40 Countries & territories	**Climate change consulting Leader** Verdantix Green Quadrant 2023
150+ Offices	50+ Years of experience	#1 Sustainability service provider – HFS 2022



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We provide a range of data, forecasting, modelling and research tools. At the heart of its service is our Global Renewable Infrastructure Project (GRIP) digital data hub.

GRIP: The authoritative source for essential offshore wind industry information.

- We successfully produced data extracts, analysis, and forecasts for a wide range of clients, from project developers, investors, manufacturers, supply chain players, and NGOs.
- GRIP 2.0 is our latest iteration of the product, with improved functionality, speed, and ease-of-use.

GRIP
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GRIP stores publicly available information relating to 2,000+ existing and planned offshore wind projects, with worldwide coverage.

The global market intelligence system is available via personal computer, tablet and smartphone and can be accessed through any internet connection via our online data portal, at the following URL:

grip.thinkrcg.com

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Scalable functionality
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Fast and frequent
Instant access to verified data, updated daily

Built by experts
Proprietary models – with expert support and analysis

Thank you

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