

A photograph of a wind farm with several large wind turbines standing on a dry, hilly landscape under a clear blue sky. The turbines are arranged in a line across the horizon. The foreground shows sparse, dry vegetation and a dirt path.

# GWEC | GLOBAL WIND REPORT 2018

APRIL 2019

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## GWEC upcoming events



**April 24 to 25, 2019**



**April 26, 2019**



**May 28 to 30, 2019**



**June 11 to 12, 2019**



**October 8 to 9, 2019**



**October 22 to 25, 2019**

# Word from the Chairman

In 2018, the wind sector once again grew in strength. Wind energy is now one of the cheapest forms of electricity in many markets. Installations of wind capacity overtook new fossil fuel capacity in many mature and emerging markets for the first time. These are strong fundamentals for a now mainstream energy source.

Yet, developments also showed that the wind industry is in transition - for the better. More and more auctioned capacity is coming online, and we see more markets turning merchant. Corporate sourcing and PPAs have grown in volume during 2018 and are underlining the appetite of business to invest in wind energy. Governments are reviewing the design of their energy markets to focus on how to improve the integration of renewables and to capture the most value.

Over the next years, the energy markets will continue to transition. They will challenge business models and require efficiency in what we do and new ways of thinking. I am however very confident that wind energy is well positioned for this transition as we continue to prove that we can bring the needed cost-competitiveness.

Part of this energy transition is the innovation of new solutions. Turbines on land and sea reaching new heights and range, hybrids and co-located projects, new forms of financing and asset ownership, offshore growth and floating wind – are all signals that the industry can reinvent itself. Wind energy is truly well positioned to be part of – and perhaps steer – the energy transition. Thus, we do have a great

opportunity to drive further growth in both mature and developing markets.

This is the 14th annual report on the status of the global wind industry by the Global Wind Energy Council. It provides a comprehensive overview of the global industry at a specific moment in time; an industry now present in more than 90 countries, 30 of which have more than 1,000 MW installed, and 9 with more than 10,000. The information contained in this report, market data, profiles and analysis, have been collected primarily through GWEC's member associations and companies around the world, as well as from governments and independent analysts. We thank all our contributors and look forward to continuing our collaboration in the future.



**Morten Dyrholm**  
Chairman Global Wind Energy Council

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**The energy transition is an opportunity to drive further volume.**

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# Being ready for the energy transition



Adolfo Rebollo  
CEO Ingeteam

The energy transition is here to stay. It can be noticed in the social consciousness globally and in the policies most countries are adopting, when outlining their energy strategies.

Europe and the USA are still ahead of the pack when it comes to renewables integration into the electrical system. Regions like China, APAC and LATAM are closing the gap, creating additional opportunities for those companies that are flexible and global enough.

On the one side, the ability to locate production in emerging markets such as Brazil or India will provide a great advantage for those interested on taking the lead on the opportunities of growing wind energy capacity in those regions. Chinese exports to the USA will continue to be a challenge in 2019, should the current policy of tariffs on imports set by the USA continue, making India an even more attractive option.

On the other side, the need for technological solutions to overcome issues around renewables grid connectivity and potential integration issues will continue to be a priority during 2019. Available technology is allowing the renewables industry to achieve important milestones as more and larger projects are coming online every month. Examples of these are found in various regions, such as India, Middle East or Australia, among others. Having proven technology in wind and solar energy, experience on hybrid plants and energy storage, along with power grid automation and power conversion systems, will be key for those interested in becoming

relevant players. Moreover, being able to offer a full-service solution to such high-tech projects, including not only the best products and systems, but also the most effective O&M, will make a difference in the years to come.

Digitalization in the wind sector is a must. Every player, no matter if big or small, is developing their systems to make it possible, adapting to a fast-changing scenario in which the only clear thing is that secure connectivity and big data are key. During the coming years cybersecurity, as an essential part of the interconnectivity, will be a trending topic, while higher value applications are developed.

The positive outlook for 2019 makes us optimistic. The future of renewables in general, and wind energy in particular is very promising. Whereas onshore has been the leader of new wind installations during the past years, and will continue to be, the growth of offshore will be unstoppable. Solar PV will continue pushing all of us to be more cost effective.

All these are both challenges and opportunities at the same time. Companies like Ingeteam can leverage a high technological background and experience in various sectors and areas, that will be key to facilitate the energy transition. Our commitment is to offer deep knowledge, specialization and flexibility to help our clients in the wind energy sector wherever the opportunity is, contributing to the energy transition, gaining momentum every day.

The wind energy industry as a whole should take pride in the relevant role we have to play in the energy transition. Altogether, acting as a team, we will make a difference, in an optimal, sustainable way, for the sake of a better world today and tomorrow!

**Ingeteam**

# Market transformation points the way to accelerated growth

In 2018 the wind industry continued to grow steadily, with new markets in Latin America, Asia and Africa continuing to join the established giants of China, the US, Europe, India and Brazil. Annual installations were at a lower level than the record year of 2015, but still higher than the years previous to 2015.

But the installation figures do not tell the whole story. Beneath the surface a profound transformation is taking place in both markets and our industry, that will prepare the way for new annual installation records in the early 2020's and – potentially – a period of accelerated growth throughout the next decade.

The main driver of this transformation is wind's emergence as the clear winner on price against fossil fuels and nuclear. Auctions in markets from Brazil to India to Taiwan to Germany continue to throw up ultra-competitive prices, while PPA markets in other geographies

show the same trend – 2019 will be remembered as the year where oil company Exxon-Mobil contracted wind power for its refineries based on price alone. In most areas in the world, we can now confidently argue that wind beats coal and gas on price, and we expect to be able to say the same in those areas where this is still not the case – South-East Asia

continue to rise in all markets and LCOE continues to fall – steadily in the case of onshore wind, and dramatically in the case of offshore wind. Driving this trend are bigger turbines and blades and the impact of digitalisation on turbine performance, predictive O&M and a host of other areas. The major turbine OEMs are now

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**The Global Wind Energy Council intends to play its part and has announced a series of Task forces to help speed up the energy transition and the deployment of wind energy in key areas.**

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is a notable exception – if wind is allowed to compete on a level playing field with other technologies and is able to access markets.

What is allowing this progress is the wind sector's continued ability to innovate and drive efficiency. Capacity factors

unveiling fully modular platforms, changing completely the experience of the customer and further driving efficiency. The other side of the equation is that globalisation of the wind market, intense competition and tight margins are driving another wave of consolidation in the supply chain, meaning pain for



**Ben Backwell**  
CEO Global Wind Energy Council



many actors but a more efficient industry for the future.

Meanwhile, governments are increasingly realising the benefits of wind for their power systems and economies. Ministries and TSO's are increasingly appreciating wind's strengths of providing utility-scale power 24 hours, and in the case of offshore wind, something akin to "base load". This is something which the wind industry itself is helping as its share of generation in the world increases, and it moves to a more sophisticated, "whole system" approach in its interaction with customers and governments. And on a wider level, the renewed sense of urgency around climate, following the publication of the IPCC's landmark 2019 report, will further drive governments to dismantle harmful incumbencies based on fossil fuels in their power systems.

And it's not just governments. The oil majors are starting to make serious strides into the power sector in general, and the wind sector in particular, as the imperatives of carbon reduction and demand from their investors and customers to sensibly manage the energy transition

grows. And on a customer level, the movement of large corporates that aim to contract 100 per cent of their power from renewables continues and spreads to more markets around the world.

These trends will continue to drive growth in wind's heartlands and will lead to breakthroughs and the development of sizeable new markets around the world.

But there is still much to do. In particular, wind power penetration in crucial areas such as South-East Asia and Africa remains virtually insignificant. The wind industry has an enormous task ahead in these regions to illustrate its strengths and the benefits wind can bring, explain how it interacts with other power technologies to build a future energy system, and build coalitions among businesses, political stake holders and the public.

The Global Wind Energy Council intends to play its part and has announced a series of Task forces to help speed up the energy transition and the deployment of wind energy in key areas. We are confident that with the best efforts of all, we can grasp the great opportunity that lies ahead.



# There Is No Alternative

Reducing global CO2 emissions is one of the great challenges of our time. In many parts of the world, however, it appears more than uncertain whether the goals of the Paris Climate Agreement will be achieved. But there is no alternative, and without doubt the wind industry has a prominent part to play in the concert of solution strategies. As a consequence, the continued development of wind power across the globe is an indispensable pillar supporting the energy transition. We, WindEnergy Hamburg and GWEC, are pulling together in support of the industry as it moves forward.

Drawing visitors from more than 100 countries, the world's leading expo for wind energy has demonstrated that it is indeed THE meeting place for experts from the energy industry. In times such as these, with more and more wind markets showing dynamic growth and even well-established ones constantly facing new challenges, this opportunity to share experiences face to face is extremely valuable. GWEC's Global Wind Report provides the necessary country-by-country

development data and forecasts to support educated decisions. For companies wishing to enter the international business or expand their range of activities into additional wind regions, there is no report more comprehensive than this. We, the organisers of WindEnergy Hamburg, the world's leading expo for onshore and offshore wind energy, are proud to support GWEC by being the sponsor of the Global Wind Report and making this fundamental analysis available to the industry.

This is another step towards strengthening our global partnership over the coming years. With more than 1,400 exhibitors from roughly 40 countries, WindEnergy Hamburg is the most important platform for the wind industry as it continues to develop wind power around the world. Apart from offering numerous networking opportunities at the international level and presenting innovative technology developed by the industry, the world's leading expo will again showcase the future of wind energy production, integration and storage from 22 to 25 September 2020. WindEnergy

Hamburg and the global WindEurope Conference, which takes place in parallel, jointly form the Global Wind Summit, the biggest global gathering of the wind industry. Our joint commitment provides significant impetus to help drive the global energy transition towards achieving a CO2-free energy supply for the world.



**Bernd Aufderheide**  
President and CEO  
Hamburg Messe und Congress





# INTRODUCTION



# Good year for wind energy with 51.3 GW new installations

2018 was a good year for the global wind industry with 51.3 GW of new wind energy installed, a slight decrease of 4.0 per cent compared to 2017, but a strong year, nonetheless. Since 2014, annual installations have topped 50 GW each year, despite ups and downs in some markets.

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**GWEC Market Intelligence expects new installations for onshore and offshore of more than 55 GW each year until 2023.**

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## Market status and outlook

The 51.3 GW of new installations brings total cumulative installations up to 591 GW. In the onshore market, 46.8 GW was installed, a decrease of 4.3 per cent compared to 2017. China and USA remained the largest onshore markets with 21.2 GW and 7.6 GW new capacity

respectively. The European onshore market installed 9 GW, a 32 per cent decrease compared to 2017. Growing developing markets in Africa, the Middle East, Latin America and South-East Asia installed a combined 4.8 GW during 2018 (nearly 10 per cent of all new installations), up from eight per cent in 2017 when these markets installed 3.8 GW.

GWEC expects the onshore market to install upwards of 50 GW per year until 2023. Mature markets in Asia, Europe and North America will continue with stable volumes. Growth will come from developing wind energy markets in Africa/ Middle East, Latin America and South-East Asia.

The global offshore market remained stable in 2018 with 4.5 GW of new additions, the same market size as in 2017. The total cumulative installations has now reached 23 GW, representing four per cent of total cumulative installations. GWEC expects increasing offshore installations first in Asia and then in North

America, and annual offshore installations reaching 6 GW or more in the near future.

Market dynamics continued to change in 2018. Many industry players revised their business models and strategies by acquiring new subsidiaries in related fields and/or expanding services offered. The volume of corporate sourcing or corporate PPAs has reached 6.4 GW for wind energy (BloombergNEF), and new solutions such as hybrids and co-located projects are under development, increasing the focus on cost efficiency, ease of integration and supply security. GWEC expects both the short-term and long-term growth of wind energy to be impacted by these three areas – revised business models, corporate sourcing and new solutions.



**Karin Ohlenforst**  
Director of Market Intelligence  
Global Wind Energy Council



# Key growth drivers during the energy transition

## **1. Business models under revision**

The landscape of industry players is changing, not only as corporates procure wind energy and become wind asset owners, but also as increasing opportunities in digitalization bring in new players with new competencies and solutions. Some traditional players are revising their business models expanding their scope and making investments outside their core businesses. This includes investing in charging stations, acquiring a retail distributor or expanding competencies by acquiring an energy trading company. Other players have revised their strategy and now focus solely on renewable solutions.

The main driver behind this development is the search for new or alternative revenue streams while the revenues of core businesses stagnate. For the wind industry, it means intensified competition and new opportunities and, eventually, a more complex industry.

## **2. Corporate sourcing – Strong growth driver in 2018**

According to Bloomberg NEF, 6.4 GW of wind capacity was procured during 2018 as part of corporate sourcing or procurement deals, commonly referred to as corporate PPAs. The concept is not new, but there is a rapid growth in the segment as large corporations in North America and Northern Europe are responsible for the majority of the 6.4 GW of corporate PPAs. The question now is how to take these learnings and experiences to new markets, and how to also include smaller corporates or entities. Corporate sourcing has the potential to drive further demand, in parallel with national targets. To enable this potential further maturity of corporate sourcing models and support from local regulators and authorities is required. 2018 has proven that demand can be driven by corporate PPAs.

## **3. New solutions – Rising focus on value**

A key aspect of the energy transition is the increased focus on value. This assessment focuses on the value an

energy source provides to a system and a market, including the produced energy output, the ease of integration and matching supply and demand. During 2018, the development of hybrid solutions with wind energy continued to offer further opportunities to provide value, for example, more and steadier output and/or an improved match with the demand profile of a market. Key aspects of hybrid solutions are cost efficiency, integration and securing/ timing of supply based on demand profiles. New solutions are not only based on technical innovations and improvements, but also require regulatory adjustments. The development of tools to finance and structure PPAs is necessary. Furthermore, a large enabler is the progress of digitalization in sophisticated management and optimization of energy markets increasingly reliant on larger and larger shares of variable renewable energy such as wind and solar. Maturing hybrid concepts can unlock further capacity on a global level and provide an opportunity for wind energy to prove its value.



An aerial photograph of a vast wind farm. Numerous white wind turbines are scattered across a lush green landscape. A network of orange-brown access roads or paths connects the turbines. The horizon is visible under a sky filled with large, white and grey clouds. The text "MARKET DRIVERS" is overlaid on the left side of the image.

# MARKET DRIVERS



# Introduction to market drivers

This chapter discusses the selected market drivers (1. Business models under revision, 2. Corporate sourcing, and 3. New solutions) in more detail. GWEC Market Intelligence has selected these three drivers based on their global impact on the wind energy market, while there are several other global and especially regional drivers and enablers.

Each driver is explained in more detail and what role the driver has in the global wind energy market. In addition, GWEC Market Intelligence gives an outlook of how each driver might develop and thus represent a growth opportunity for new installations in the wind energy market.

## 1. Business models under revision during energy transition

During 2018, Shell finalised the acquisition of the British retail distributor First Utility (announced in December 2017). In July 2018, Equinor (former Statoil) announced the acquisition of energy trader Danske Commodities. International utilities such as Enel have a high focus on renewables and business solutions around solutions (Enel formed EnelX, an entity working on distributed energy, energy efficiency, among other topics) These are just a few examples among many others of how industry players adapted their business focus during 2018. Capturing new revenue and growth opportunities is a key driver behind the revision of business models. This development can be directly connected to the dynamics of the energy transition with new

roles, new entrances to the industry, increased focus on extraction of value and many new business opportunities.

Specifically, the combination of falling prices and competitive pressure results in decreasing revenues and the need to seek growth outside traditional business models. To name one example, turbine OEMs have experienced pressured profit margins over the past years. This and similar developments are driving the disruption of the classical business models among all players in the wind industry.

The knowledge and experience of non-traditional players (e.g. oil majors) in the wind energy sector can unlock potential and therefore

drive further volume. This includes the offshore wind market, grid and infrastructure, integration and distribution, it also includes adjacent areas such as increasing electrification and e-mobility.

Underlying is the fact that wind energy is no longer a niche industry and has developed into a mainstream energy solution. GWEC Market Intelligence expects the landscape of industry players to change further and eventually changing relationships and collaboration models.

### GWEC's take on business models under revision

Involving all industry stakeholders is one of GWEC's key goals. GWEC is providing insights and opportunities through its events, round table discussions, GWEC's Task forces and committees.

Revised business models with broadened competencies represent an opportunity for the wind industry to prove its competitiveness and leading role in the energy transition.

## 2. Corporate sourcing – Maturing models and growth driver

Corporate sourcing or corporate PPA have continued to grow during 2018, the model of corporates signing PPAs or sourcing electricity directly from the asset owner has matured. Several sourcing and PPA models were executed (e.g. multi-buyer PPAs, proxy revenue swap, private wire PPAs etc.) and corporates, asset owners, financiers and banks have increased their experience of how to structure such deals. Still, the majority of the corporate sourcing of wind energy has taken place in North America and Northern Europe with large corporates involved. According to BloombergNEF, 60 per cent of wind energy corporate sourcing deals in 2018 were signed in North America where the largest volumes were sourced by AT&T, Walmart and Facebook.

These are examples of how corporate sourcing has become an alternative driver of volume besides national targets and electricity demand. In Sweden, Norsk Hydro signed a corporate

PPA for 235 MW in Sweden for as long as 29 years; the longest duration of a corporate PPA so far.

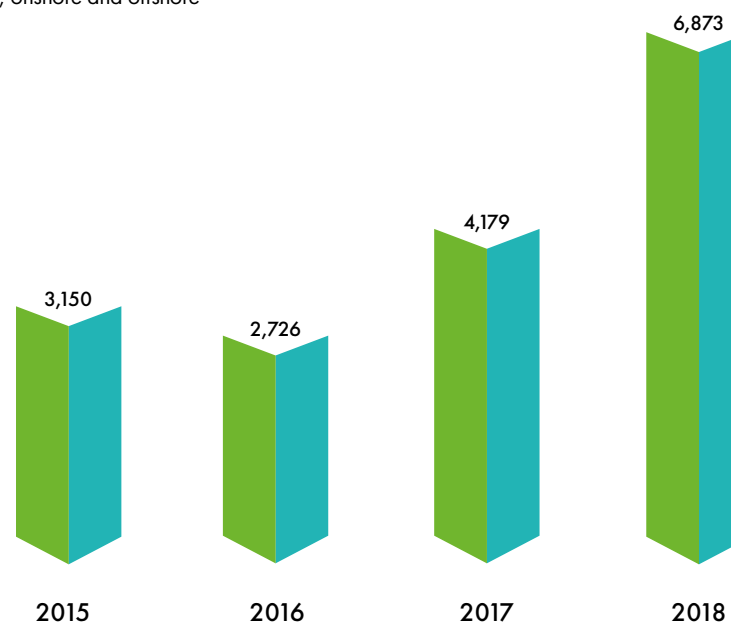
Going forward, two key areas are required for corporate sourcing to become an even stronger and more stable growth driver:

- 1) Establishing corporate sourcing in developing markets (e.g. regulatory changes)
- 2) Smaller/ local corporates to enter corporate sourcing (e.g. through aggregation of a customer base, an approach Vattenfall is working on)

The next few years will show if corporate sourcing can become a growth driver. Otherwise, corporate sourcing will continue to enable volumes but only contained to certain markets and corporates.

### Corporate PPAs for wind energy by signing year

MW, onshore and offshore



Source: BloombergNEF Corporate PPA Database

Assuming a market volume of 50 to 55 GW each year based on order intake activity, installations levels, corporate PPAs made up 12.5 per cent of the market volume during 2018 (7.4 per cent during 2017)

## 2. Corporate sourcing – towards a growth driver for developing markets





### 3. New solutions with increased focus on value as growth opportunity for wind energy

The wind industry has been able to prove its increasing maturity, cost competitiveness and efficiency by relying on one of the most important measures in the energy industry – Levelised Cost of Electricity (LCOE).

LCOE is the common measure of defining cost of wind energy and other energy sources for several years. Industry stakeholders and politicians are using LCOE to assess targets and support levels. The important role of LCOE will not change and will continue to show how wind energy is progressing.

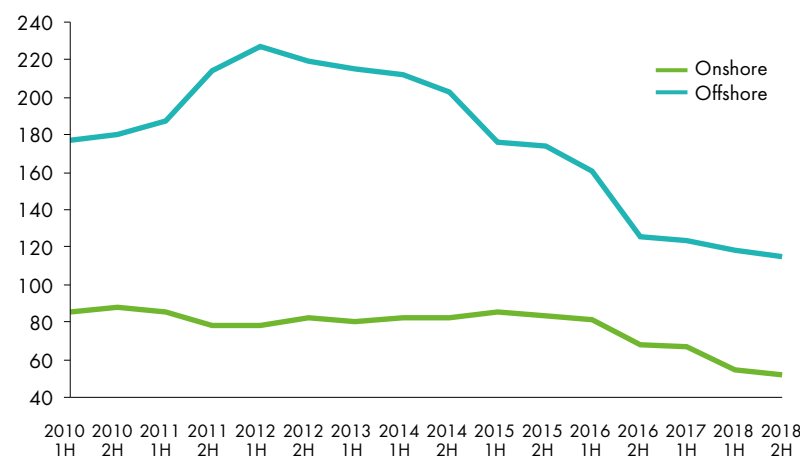
With the help of LCOE, wind energy has proven to be one of the cheapest energy sources. As the energy industry is transitioning the scope is widening, and wind energy is now also proving to provide maximal system value. This increased focus on value includes understanding the efficiency of

an energy source, understanding the means of integrating an energy source, and understanding the timing of supply and demand.

Similar to the development of LCOE, the industry is currently seeking the right formula and indicator to measure value and to allow comparisons (for example, IEA's VALCOE). Agreeing to a common measure is crucial to create deeper understanding of the value provision and to allow unbiased comparisons.

LCOE and cost will not lose relevance. The connection of cost and value is an essential building block of the energy transition. Not only does it allow wind energy to prove its achievements over the past decades to become a leading (renewable) energy source; it also allows the wind energy industry to define solutions that capture and enhance value.

**LCOE - Historic development**  
USD/ MWh



Source: BloombergNEF H2 2018 LCOE Update - Wind

### 3. New solutions (continued) – Challenges during energy transition

GWEC Market Intelligence has selected key examples of how solutions to these three challenges are already being implemented. On the next slide, a short description of each of the selected solutions is provided including examples. On the page that follows this, GWEC Market Intelligence lays out specifics of how the selected solutions are providing answers to each of the challenges.

The development of solutions is a vital part of the energy transition process. Due to its cost competitiveness, ease of deployment and scalability, wind energy plays a leading role in this development. New solutions have the potential to unlock more volume or, taking a more radical perspective, to even revolutionise the way of doing business (e.g. to

develop projects) in the wind industry. A key driver behind this development is the ongoing digitalization. Technological advancement is increasing the annual energy output through better asset management and improved maintenance and therefore allows for better risk management. As a result, increased efficiency means

increased value to the energy system. In connection with other elements (e.g. falling storage cost) further opportunities for integrated wind solutions will develop over the next years.

Most energy markets and asset owners have three key challenges, which could be overcome by new solutions.

#### 1. Cost efficiency

Finding the cheapest and most efficient solutions. This can mean a low LCOE, this can also mean the best revenue solution for the asset owner and the offtaker in order to generate energy efficiently.

#### 2. Renewable integration

Enablers for controlling and dispatching renewable and wind energy based on energy system conditions such as grid rules.

#### 3. Security/Timing of supply

Managing the supply based on timing of demand and to create solutions to compete against fossils like coal energy.

### 3. New solutions (continued) – Models for wind energy-based solutions

Disclaimer – This selection is not exhaustive, there are more solutions being developed or already in existence. Also, the selected examples are by no means intended to exclude other examples, but solely to provide a

“real life” example and to underline how solutions are developing and will eventually overcome challenges of energy markets and asset owners.

New solutions have the potential to unlock more volume or, taking a more radical perspective, to even revolutionise the way of doing business (e.g. to develop projects) in the wind industry.

#### Models for solutions – description and examples

|                                                                                           |                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Co-location, Hybrid solution</b>                                                       | Wind energy plus another energy source and/ or a storage solutions. This can be a fully integrated and combined project, or separate projects sharing a common grid access<br>Example: Kennedy Wind Farm, Australia                             |
| <b>Complementary solution/<br/>virtual power plant</b>                                    | Wind energy projects in different locations or a wind projects and other energy projects in different locations which are virtually managed as complementary solution<br>Example: Luneng Haixi Multi-mixed Energy Demonstration Project , China |
| <b>Financial solution, e.g. Corporate sourcing models, free market mechanism/ trading</b> | Wind energy project is part of a financial solution which can exclude actual physical delivery of electricity. It covers corporate PPAs and risk management tools like revenue swaps<br>Example: Lal Lal wind farm, Australia                   |
| <b>Onsite provision, off grid solutions</b>                                               | Wind energy projects plus storage or other energy sources to supply production plan or to be part of a micro-grid or decentralised energy system<br>Example: Aguni Wind Farm, Japan                                                             |



### 3. New solutions (continued) – Benefits of wind energy-based solutions

Models for solutions – description and examples

| Models for wind energy- based solutions and other energy sources and/ or storage solutions   | Cost-efficiency                                                                                   | Renewable integration                                                                                   | Security/ Timing of supply                                                            |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Co-location, Hybrid solution</b>                                                          | <ul style="list-style-type: none"> <li>• Lower EPC cost</li> <li>• Sharing grid access</li> </ul> | <ul style="list-style-type: none"> <li>• Improvements of grid management</li> </ul>                     | <ul style="list-style-type: none"> <li>• Stable supply guarantee</li> </ul>           |
| <b>Complementary solution/ virtual power plant</b>                                           | <ul style="list-style-type: none"> <li>• Revenue optimization</li> </ul>                          | <ul style="list-style-type: none"> <li>• Virtual integration bypassing grid challenges</li> </ul>       | <ul style="list-style-type: none"> <li>• Flexible response based on demand</li> </ul> |
| <b>Financial solution,</b><br>e.g. Corporate sourcing models, free market mechanism/ trading | <ul style="list-style-type: none"> <li>• Tool to lower risk profile</li> </ul>                    | <ul style="list-style-type: none"> <li>• Incentive to increase share of wind due to low cost</li> </ul> | <ul style="list-style-type: none"> <li>• Not relevant</li> </ul>                      |
| <b>Onsite provision, off grid solutions</b>                                                  | <ul style="list-style-type: none"> <li>• Alternative to wholesale market prices</li> </ul>        | <ul style="list-style-type: none"> <li>• Not relevant</li> </ul>                                        | <ul style="list-style-type: none"> <li>• Supply steered to meet demand</li> </ul>     |

# GWEC Market Intelligence initiative

## Shifting to value

The industry is focusing more and more on the value of the energy source - generation profile, alternative revenue generation models

LCOE remains a key figure to measure efficiency and maturity

Short position paper how the shift to value influences the stakeholders in the wind energy value chain, that is leads to adjustments of business models



May 2019

## Governmental support to energy markets

In several energy systems, coal is perceived as low cost, efficient and reliable solution. The “true cost” of relying on coal are often unclear and overlooked.

Often countries create immense energy dependencies which could lead to high long term costs

Position paper on subsidies received by coal to create an “equal playing field” and learnings from support models (e.g. FIT, auction)



June 2019

## (New) solutions and their enablers

Advancing technology is offering new solutions and business model that go beyond wind energy.

The purpose of governmental support is to create an equal playing field and to enable new, sustainable solutions. This governmental support should not only reside with fossils

Multi-stakeholder study on insights of current and future solutions and their enablers (regulatory, technological etc.)

Pro Bono/Support from technical consultancy



Q3 2019

## GWEC recommendations

Regulators and politicians need to integrate new business models like hybrid/co-location or corporate sourcing into their planning and allocation mechanism

Investments and incentives in more flexible grid and market systems to focus on value of generated energy

Recommendations by GWEC for regulatory support schemes supporting value-focused solutions



Q3 2019

To understand more in depth how the (renewable) energy industry is shifting to value and how value-focused solutions based on wind energy can drive the transition, GWEC is conducting a Market Intelligence study during 2019 based on four elements

- The shift to value and impact along the value chain on business models
- The “equal playing field” for wind and other energy sources, e.g. coal, if looked at the true cost and support
- Value-focused solutions for wind energy and other solutions
- GWEC's perspective on how policies can support value-focused solutions

# MARKET STATUS 2018





# Overview

2018 was a solid year with 51.3 GW installed – a decrease of 4.0 per cent compared to last year, and with total installed capacity of 591 GW (a growth of nine per cent compared to 2017). New installations in the onshore wind market reached 46.8 GW, and the global offshore market installed 4.5 GW, bringing the share in the global market to now eight per cent.

## The onshore market

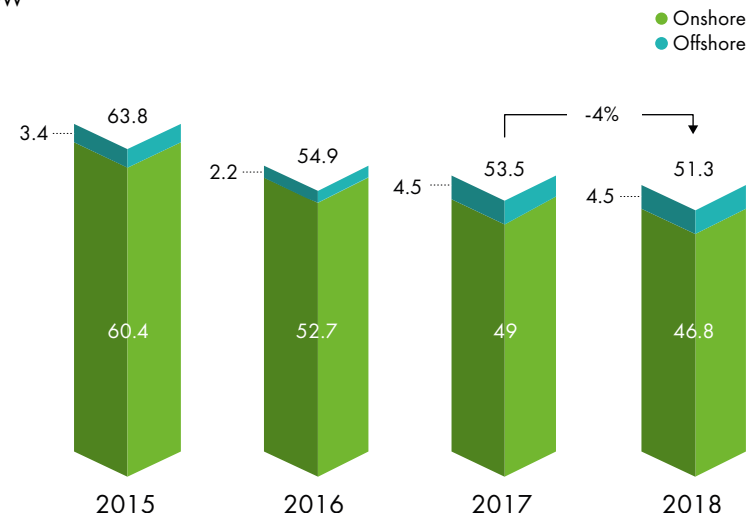
The Chinese onshore market installed 21.2 GW in 2018 and has been the leading market since 2008. China with 206 GW total installations at the end of 2018 is the first market to surpass 200 GW of total installed capacity – reaching its target of 200 GW two years early (based on the Five-Year-Plan 2016-2020). As part of the ongoing reform of the energy market, the Chinese government announced the introduction of auctions in 2018. These auctions focus on competitive pricing, technology and low curtailment risks, while volume is still determined through the central planning process. GWEC expects further progress on market

mechanisms for the integration of renewables and wind energy and moving away from direct subsidies. The full implementation of the Renewable Portfolio Standards (RPS) with quotas for grid companies, local utilities, large corporates and others is one element of the market mechanisms and providing opportunities for wind energy.

The second largest market in 2018 was the US with 7.6 GW of new onshore installations and total onshore installations of 96 GW. Until 2020/ 21, the Production Tax Credit (PTC) will remain the main driver for new installations. Future demand will be linked to RPS and the increasing competitiveness of onshore wind energy. New business models and new financial models are being developed in the US market and will, most likely, further drive volume for new installations.

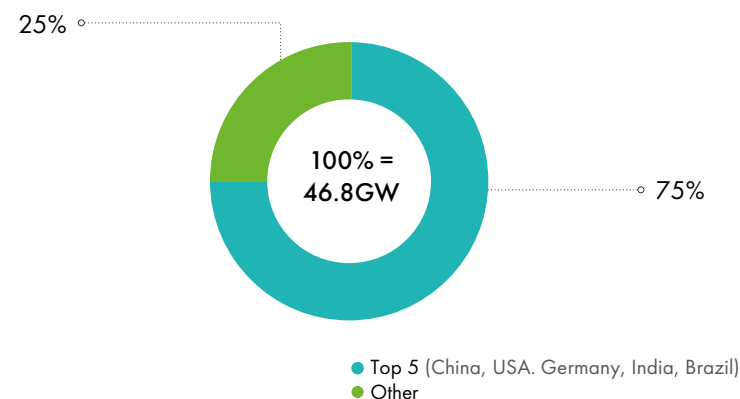
In addition to China and USA, the top five wind markets in 2018 are completed by Germany (2.4 GW), India (2.2 GW) and Brazil (1.9 GW).

## Newly added capacity GW



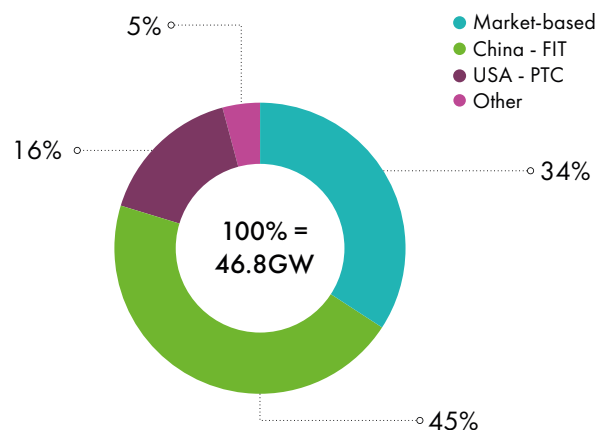
## New capacity 2018 and share of top five onshore markets

Per cent, onshore



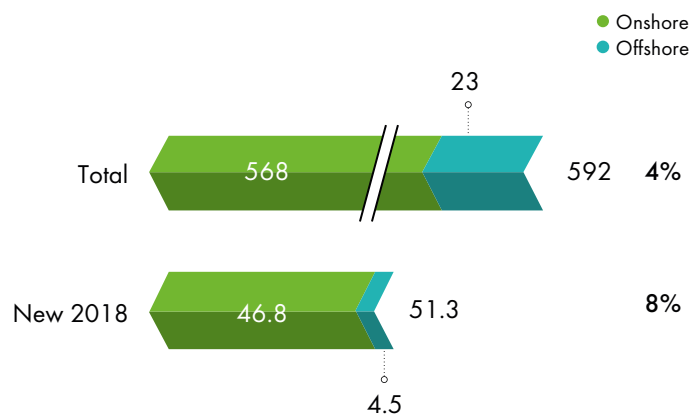
## New capacity 2018 by support mechanism

Per cent, onshore



## Total installations by onshore and offshore

GW, share of total new installations



## Overview (continued)

Excluding the two largest markets, China and USA, market-based mechanisms, such as auctions, tenders, and Green Certificates, were the main drivers behind new installations in 2018: For the onshore market, 16 GW of new installations or 35 per cent of new installations originate from market-based mechanisms. This level can be expected in the future, as 15 GW of onshore wind capacity was auctioned during 2018. The dramatic decreases of bid levels and equipment prices, as seen in 2016 and 2017, have slowed down in 2018, and bid levels will continue to stabilise in 2019. Continuing efforts to increase efficiency and lower cost means that the wind industry will be able to respond to changing market conditions in the future.

With China expecting to implement auctions during 2019, the share of installations originating from market-based mechanisms will rise after 2020, when the first auction-based volume will be installed in China.

Without doubt, auctions and tenders are an important element

for capacity allocation. However, how governments select the support and allocation mechanisms for renewables and wind energy depends on market conditions and the design of the energy market (e.g. integration, pricing mechanism, etc.).

The offshore market – China installed 1.8 GW in 2018, taking the lead for the first time, followed by the United Kingdom (1.3 GW). Globally, the share of offshore installations continues to increase and reached eight per cent for new installations and four per cent of the total installations in 2018.

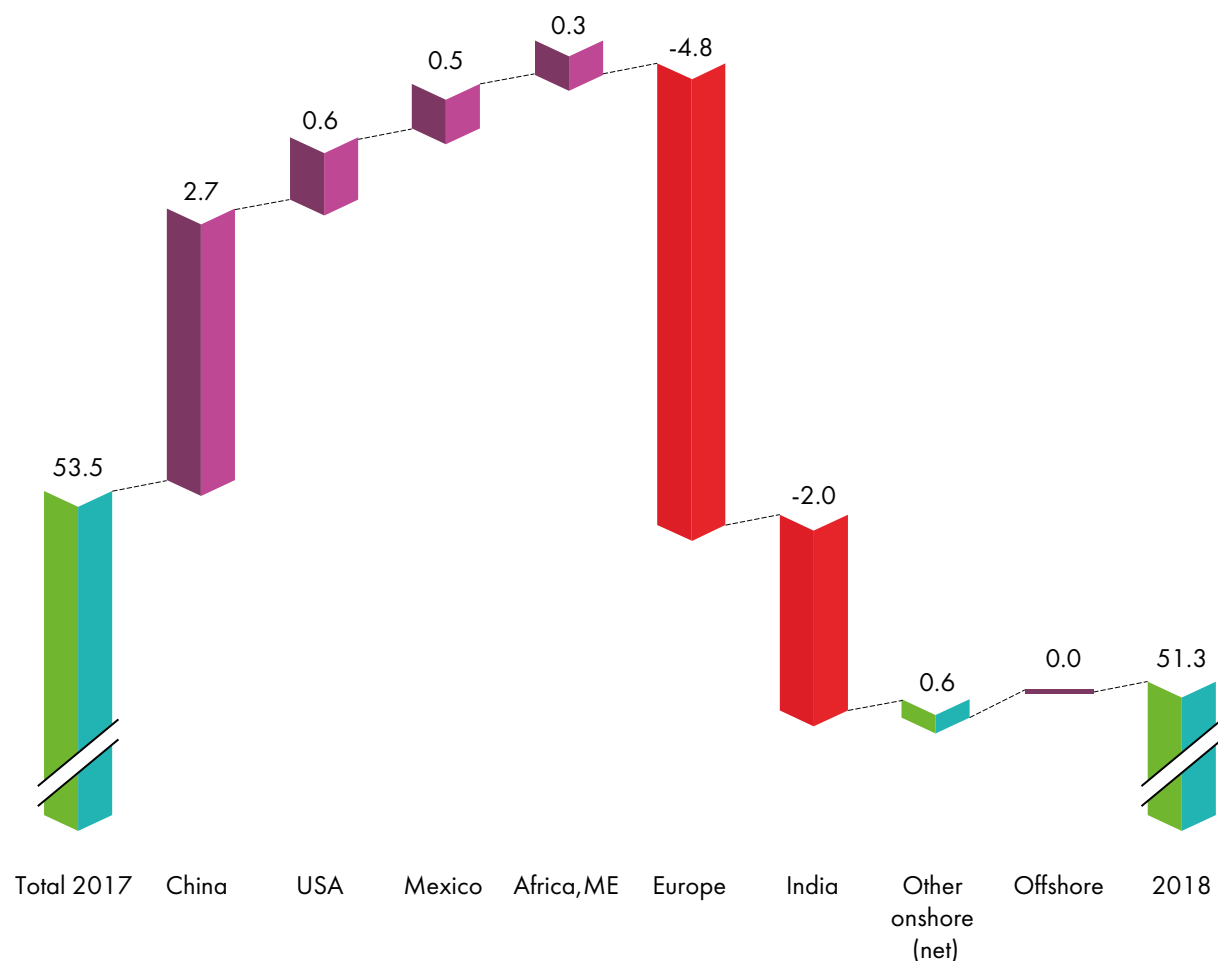
For more details on the offshore market, see the global offshore wind market section.

# China and USA increased new installations, Europe and India saw decreases

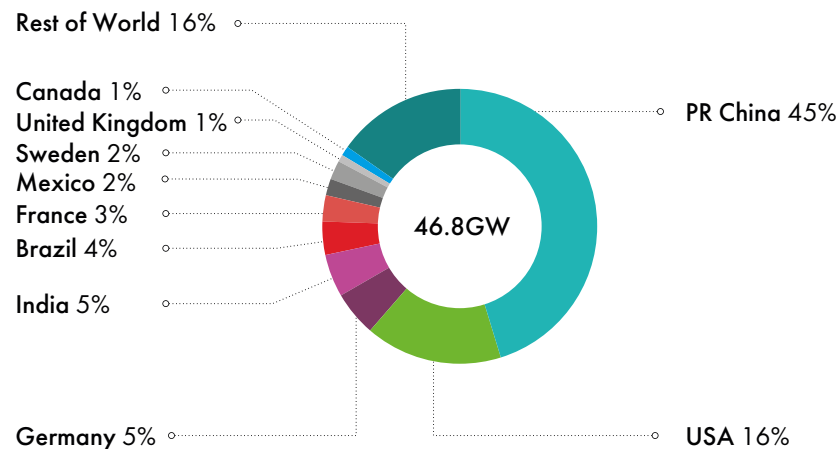
The mature and leading markets in China and North America continued to grow in 2018. Positive developments came from Mexico growing by 500 MW compared to 2017 and reaching 0.9 GW of new installations. Africa/Middle East also grew to 0.9 GW with Egypt and Kenya as leading markets (380 MW and 310 MW of new installations respectively). The decrease in the European onshore market is attributed to lower volumes in Germany and the United Kingdom. In India, new installations slowed compared to 2017 (4 GW in 2017) as execution challenges need to be solved.

## Changes in new installations 2017 to 2018

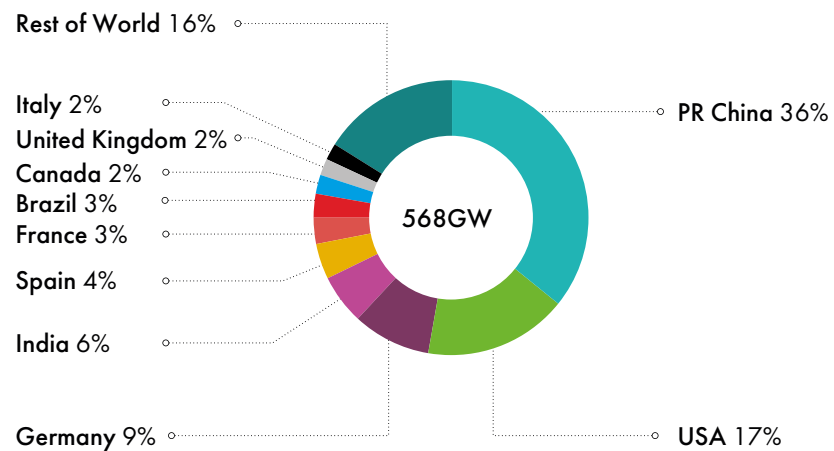
GW, onshore and offshore



### New installations onshore

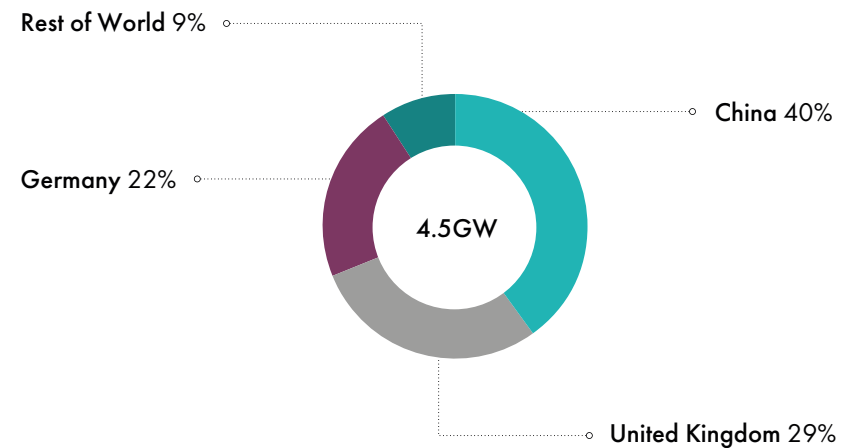


### Total installations onshore

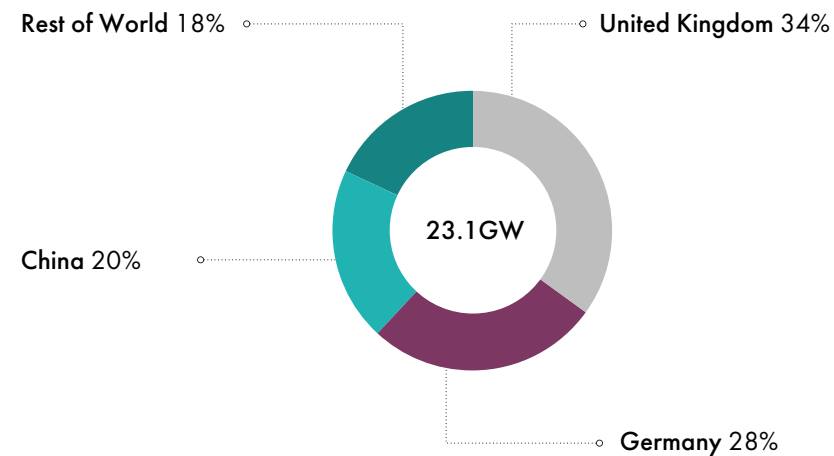


Detailed data sheet available in GWEC's member only area  
For definition of region see Global Wind Report – Methodology and Terminology

### New installations offshore



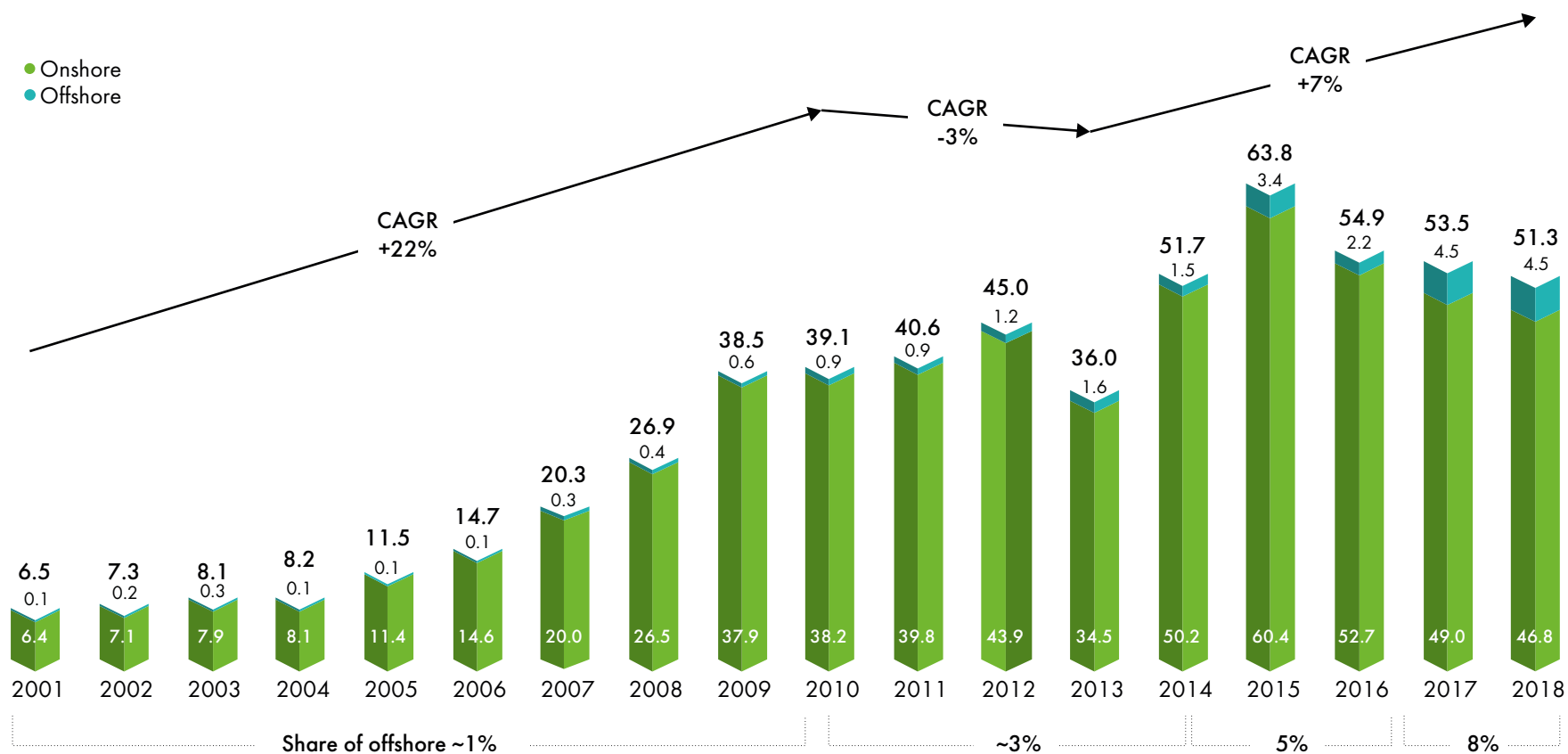
### Total installations offshore





## Historic development of new installations

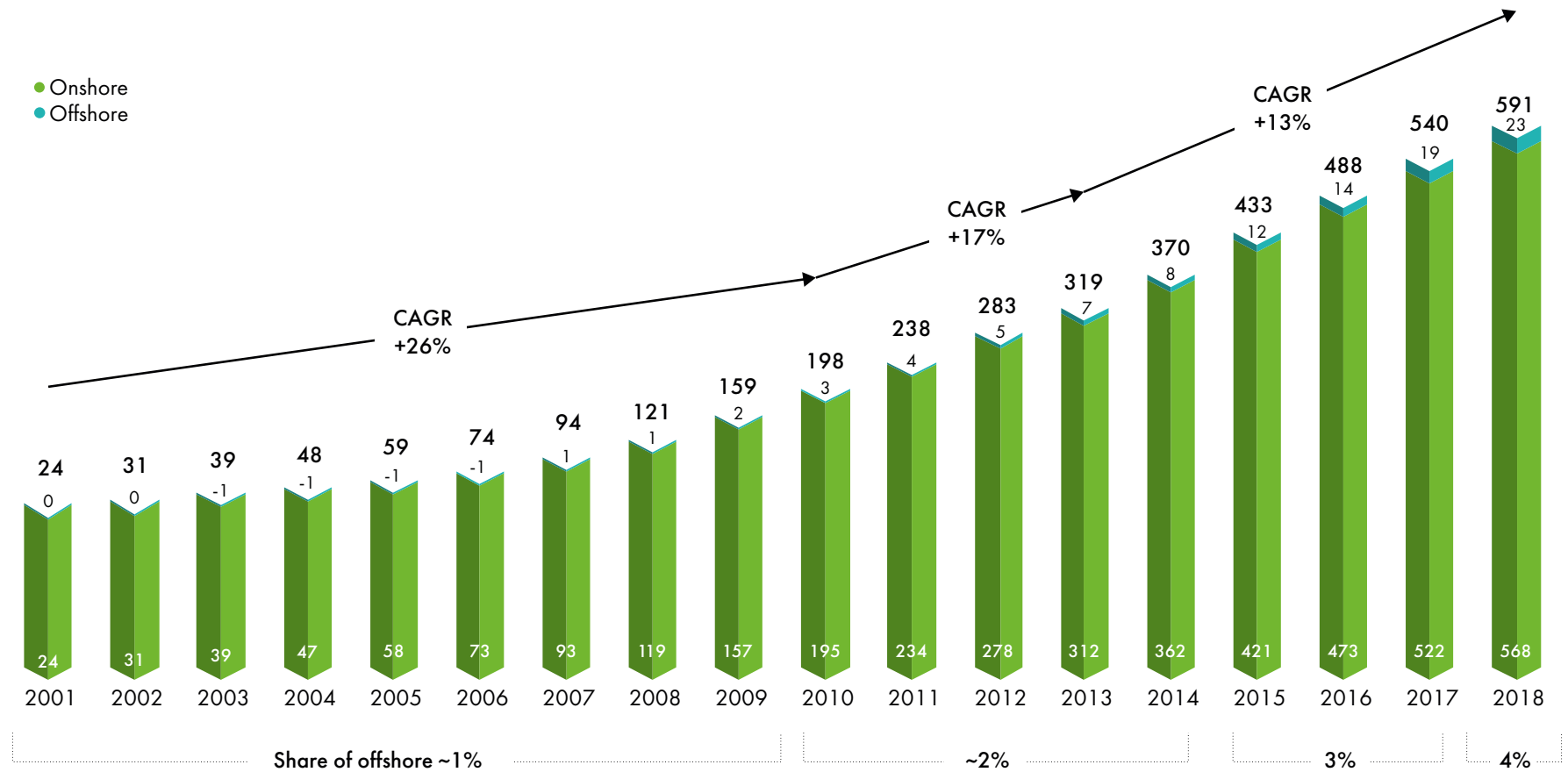
GW



Detailed data sheet available in GWEC's member only area

## Historic development of total installations

GW



Detailed data sheet available in GWEC's member only area

## Historic development of total installations

MW

| MW, onshore                | New installations 2017 | Total installations 2017 | New installations 2018 | Total installations 2018 |
|----------------------------|------------------------|--------------------------|------------------------|--------------------------|
| <b>Total onshore</b>       | <b>48,996</b>          | <b>521,774</b>           | <b>46,820</b>          | <b>568,409</b>           |
| <b>Americas</b>            | <b>10,572</b>          | <b>123,091</b>           | <b>11,940</b>          | <b>135,041</b>           |
| USA                        | 7,017                  | 89,047                   | 7,588                  | 96,635                   |
| Canada                     | 341                    | 12,240                   | 566                    | 12,816                   |
| Brazil                     | 2,027                  | 12,769                   | 1,939                  | 14,707                   |
| Mexico                     | 478                    | 4,006                    | 929                    | 4,935                    |
| Argentina                  | 24                     | 228                      | 494                    | 722                      |
| Chile                      | 269                    | 1,418                    | 204                    | 1,621                    |
| Other Americas             | 416                    | 3,383                    | 220                    | 3,605                    |
| <b>Africa, Middle East</b> | <b>632</b>             | <b>4,758</b>             | <b>962</b>             | <b>5,720</b>             |
| Egypt                      | 0                      | 810                      | 380                    | 1,190                    |
| Kenya                      | 0                      | 26                       | 310                    | 336                      |
| South Africa               | 618                    | 2,085                    | 0                      | 2,085                    |
| Other Africa               | 14                     | 1,837                    | 272                    | 2,109                    |
| <b>Asia-Pacific</b>        | <b>23,927</b>          | <b>231,419</b>           | <b>24,902</b>          | <b>256,320</b>           |
| China                      | 18,499                 | 185,604                  | 21,200                 | 206,804                  |
| India                      | 4,148                  | 32,938                   | 2,191                  | 35,129                   |
| Australia                  | 501                    | 4,813                    | 549                    | 5,362                    |
| Pakistan                   | 199                    | 789                      | 400                    | 1,189                    |
| Japan                      | 170                    | 3,399                    | 262                    | 3,661                    |
| South Korea                | 103                    | 1,102                    | 127                    | 1,229                    |
| Vietnam                    | 38                     | 197                      | 32                     | 228                      |
| Philippines                | 0                      | 427                      | 0                      | 427                      |
| Thailand                   | 218                    | 648                      | 0                      | 648                      |
| Other Asia                 | 51                     | 1,502                    | 141                    | 1,643                    |
| <b>Europe</b>              | <b>13,865</b>          | <b>162,506</b>           | <b>9,016</b>           | <b>171,328</b>           |
| Germany                    | 5,334                  | 50,779                   | 2,402                  | 53,180                   |
| France                     | 1,692                  | 13,757                   | 1,563                  | 15,307                   |
| Sweden                     | 197                    | 6,499                    | 717                    | 7,216                    |
| United Kingdom             | 2,641                  | 12,412                   | 589                    | 13,001                   |
| Turkey                     | 766                    | 6,872                    | 497                    | 7,370                    |
| Other Europe               | 3,235                  | 72,187                   | 3,248                  | 75,435                   |

| MW, offshore          | New installations 2017 | Total installations 2017 | New installations 2018 | Total installations 2018 |
|-----------------------|------------------------|--------------------------|------------------------|--------------------------|
| <b>Total offshore</b> | <b>4,472</b>           | <b>18,658</b>            | <b>4,496</b>           | <b>23,140</b>            |
| <b>Europe</b>         | <b>3,196</b>           | <b>15,630</b>            | <b>2,661</b>           | <b>18,278</b>            |
| United Kingdom        | 1,715                  | 6,651                    | 1,312                  | 7,963                    |
| Germany               | 1,253                  | 5,411                    | 969                    | 6,380                    |
| Belgium               | 165                    | 877                      | 309                    | 1,186                    |
| Denmark               | 0                      | 1,268                    | 61                     | 1,329                    |
| Netherlands           | 0                      | 1,118                    | 0                      | 1,118                    |
| Other Europe          | 63                     | 305                      | 0                      | 302                      |
| <b>Asia-Pacific</b>   | <b>1,276</b>           | <b>2,998</b>             | <b>1,835</b>           | <b>4,832</b>             |
| China                 | 1,161                  | 2,788                    | 1,800                  | 4,588                    |
| South Korea           | 3                      | 38                       | 35                     | 73                       |
| Other Asia            | 112                    | 172                      | 0                      | 171                      |
| <b>Americas</b>       | <b>0</b>               | <b>30</b>                | <b>0</b>               | <b>30</b>                |
| USA                   | 0                      | 30                       | 0                      | 30                       |

Detailed data sheet available in GWEC's member only area



A photograph of four white wind turbines in a field of tall grass at sunset. The sky is a mix of orange, pink, and purple, with some clouds. In the background, there are mountains with some snow. The turbines are arranged in a line, and the grass in the foreground is golden-brown.

# GWEC'S TASK FORCES AND COMMITTEES



# GWEC's focus during 2019

GWEC has initiated a series of task forces and committees to help accelerate growth in key markets and sectors - Latin America, South East Asia, Africa and Global Offshore. These groups bring together leading developers, investors, manufacturers and institutions among GWEC members and other industry stakeholders. Their purpose is to provide governments with guidance on the best regulatory and technical frameworks for attracting investment, carry out public awareness campaigns, and hold best practice workshops and other activities to help different countries and markets to realise the potential of wind energy, and benefit from the social and economic benefits that the wind industry can bring.



GWEC's Global Offshore Wind Task force accelerates the development of offshore wind technology in non-European markets such as Asia and North America. Chaired by Alastair Dutton, the task force is made up of leading developers, investors and manufacturers in the sector, as well as technical experts and inter-governmental organisations



GWEC's South-East Asia Task force, made up of major developers, investors and manufacturers provides the policy, market and technical information needed for the development of new emerging wind markets across the region. South-East Asia has a vast potential for wind technology, with encouraging markets developing in Taiwan, Vietnam and the Philippines.



GWEC Latin America is made up of major developers, investors and manufacturers in the sector to advance the deployment of wind technology in the region. The future prospects as a region are excellent with Argentina, Brazil, Chile and more recently, Colombia all turning to wind technology. GWEC's task force provides expert guidance to enable this advance in the wind industry.



Sub-Saharan Africa has abundant renewable energy resources, and has some of the world's fastest growing economies. From strong beginnings in South Africa, Ethiopia and Kenya, the industry has the opportunity to be a major player in powering Africa's growth, creating new jobs and building a local supply chain. The Africa Task Force seeks to build regional cooperation to help African wind reach its full potential.

For more information about GWEC's Task forces and Committees please contact Alyssa Pek [alyssa.pek@gwec.net](mailto:alyssa.pek@gwec.net)

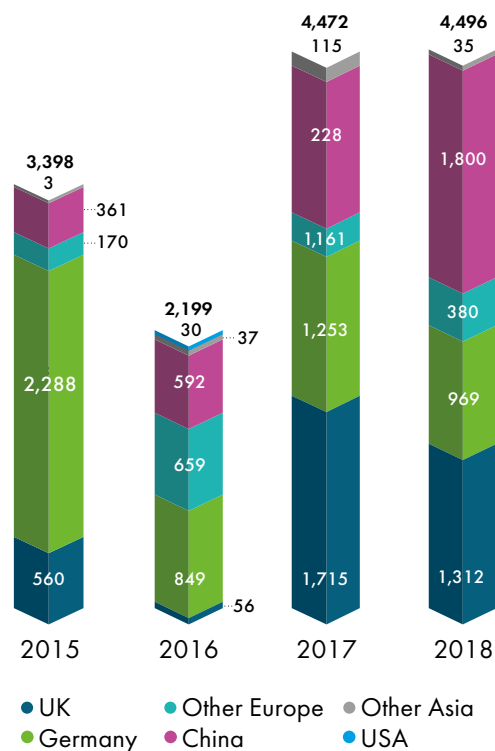
## Offshore Wind Market – Status 2018

2018 was a pivotal year for the offshore wind industry:

- For the first time, China installed and connected more offshore capacity (1.8 GW) than any other country. The United Kingdom took the second place with 1.3 GW and Germany third place with 0.9 GW.

### New offshore installations

MW



- The second tender for offshore wind in Germany included once again a project bidding for 0.0 EUR/MWh support (repeating the zero-priced bids of the first round in 2017 and meaning that the project will only receive the wholesale price of electricity and no further support/payment). This proves how offshore costs have come down. It also proves how the structuring of very capital-intensive offshore projects (e.g. excluding grid connection cost) can advance projects.
- Offshore activities in the US market are increasing. Leasing tenders have been executed (Massachusetts) and industry stakeholders have set up offices (MHI Vestas in Boston). The next

Offshore wind has huge potential in many regions, as the world looks for competitive, zero carbon energy sources that can be deployed at scale and in relatively fast time frames.

stage will be the development of on offshore supply chain and projects advancing towards construction and execution timelines.

- Development in the Asian offshore markets was positive in 2018 – commitments to invest in projects and supply chain have been made. Keeping the momentum requires government commitment and viable levels of support to ensure the growth of the Asian offshore industry.
- India, as an example of an emerging offshore market, held a first Expression of Interest in 2018, and the first offshore tender is expected during 2019. Draft auction rules were released during January 2019.

GWEC Market Intelligence expects the global offshore wind market to continue to grow. Europe will provide stable volume. The Asian market with China will take a leading role, see GWEC Market Intelligence's market outlook for future installations. (For details, see Market Outlook).

GWEC is focusing a large part of its activities in these emerging and developing offshore markets by providing guidance on wind potential and technical development and targeted lobbying activities.

# Offshore wind going global

The current share of the total global offshore installations represents four per cent of the total 591 GW installed. By 2025, the share is expected to exceed 10 per cent and the total installed based could reach 100 GW. While Europe will continue to add 3-4 MW per year based on current targets and planned auctions, Asia could add between 5 to 7 GW of new installations per year if governments stay committed and investments are executed.

Key growing offshore wind markets in Asia are Taiwan, South Korea and Japan. In these markets, investments in projects and supply chains are progressing, and projects are maturing. India and Vietnam are in early stages, but with an offshore wind potential of 27 GW (Vietnam) and 60 GW (India). Vietnam has already installed 99 MW offshore capacity. The administrative processes are still time-consuming, but a stable support system is in place with a FIT of 98 USD/ MWh. India's offshore potential is located off the coast of Gujarat and Tamil Nadu. The government has started to execute auctions for solar PV and

onshore wind since 2017 and has set an offshore wind target of 5 GW by 2022 and 30 GW by 2030.

The Japanese government passed a new Offshore Wind Law, which now gives it a mandate to define a number of areas for offshore wind development, with a view to holding some kind of competitive process for award of 30-year projects by mid-2020. There is a clear need for Japan to turn to offshore wind to meet an expected shortfall in power generation, and increasing dependence on fossil fuel imports, but setting an ambitious plan and whether it is able to establish appropriate frameworks for planning and licensing will be decisive.

In North America, GWEC Market Intelligence expects about 1 GW towards 2023 to 2025, as activity in the north-eastern federal states remains high (e.g. an offshore tender in New York for projects with 200 to 800 MW capacity with a 25-year PPA launched, Massachusetts's auction for offshore zones executed).

The World Bank Group has announced that it is creating a

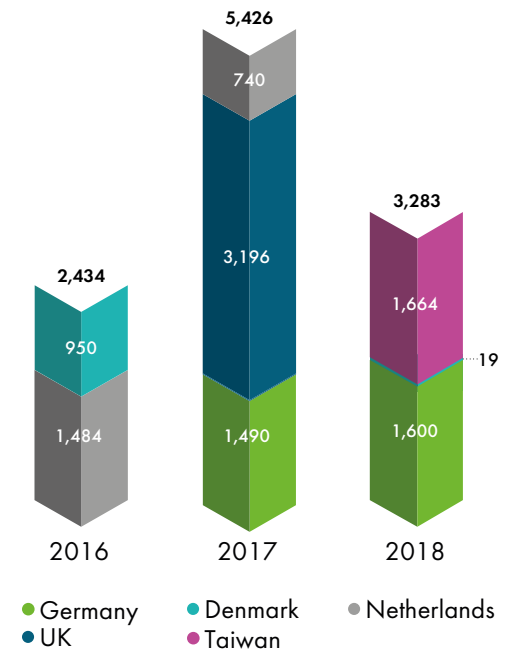
financing stream for offshore wind that could play a vital role in de-risking projects in developing countries and has teamed up with GWEC to help develop the next group of new offshore markets.

## Role of government support

In order for the offshore industry to go global, market conditions need to be in place to support growth. Besides administrative processes for permitting and approval, this includes support from governments for investments in projects and supply chain through FIT or auction mechanisms. There were several examples during 2018 of government support. In Germany, the offshore target is most likely to increase to 20 GW by 2030; France decided to execute an offshore auction in 2019 having settled a discussion about support levels; UK announced in June 2018 to launch further auctions starting from 2019 onwards with the plan to execute auctions every second year; after an intense discussion during 2018, Taiwan announced in January 2019 to limit the reduction of the FIT-system to about six per cent, thus enabling projects to move forward.

## Executed offshore wind auctions

MW





# Offshore wind technology continues to advance

With governments and industry around the world committing to offshore wind, offshore wind technology is advancing to increase efficiency and lower cost. During 2018, the trend for larger

Two offshore auctions were executed in Europe (Germany's 2nd offshore, average winning bid of 46 EUR/MWh and Netherlands' Borselle V, average winning bid of 55 EUR/MWh) including already the new technology. Several LOCE projections see the global and average LCOE for offshore wind to further decrease; emerging and developing offshore markets might start at a higher LCOE-level but utilise experience from more mature markets and the new technology to lower LCOE.

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**There are already  
1.3GW of offshore  
wind auctions planned  
for 2019.**

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offshore turbines continued. GE had already introduced its Haliade X 12MW offshore turbine in 2017, expected to be commercially operational as of 2024/ 25. In 2018 MHI Vestas upgraded its turbine to 10MW to be used for several projects in Netherlands and United Kingdom and the Vineyard project in USA (preferred supplier status). Goldwind introduced an 8MW turbine for projects on the south-east coast of China. Siemens-Gamesa's 10MW turbine is expected to be online by 2022.



# Growth opportunities for onshore wind in South-East Asia

In South-East Asia (including Indonesia, Philippines, Thailand, Vietnam Malaysia, Laos, Myanmar and other smaller markets) the rising demand for energy is driven by economic growth, growth of population and increased urbanization. The fundamentals for wind energy are good to play a leading part. Governments in South-East Asian markets have set

## GWEC sees potential for corporate sourcing to become a driver for future installations in South-East Asia.

targets for wind energy deployment (e.g. Vietnam with 800 MW by 2020, and Philippines with 1.5 GW by 2030). As of December 2018, 1.5 GW of onshore wind capacity was installed in total: and GWEC Market Intelligence expects more than 4 GW new capacity to be installed by 2023 thus contributing to the growth of the Asian wind market.

Aside from these positive fundamentals for wind energy, many governments are still prioritizing coal to provide the largest share in the energy mix of these markets (40 per cent of energy generation according to IEA WEO). The belief is that coal and other fossils secure supply at low cost. However, it is often the design of electricity markets that is giving preference to coal, for example, through energy access rules or caps.

To have more equal opportunities for wind energy in South-East Asia, adjustments to market design and investments in infrastructure and grid are required. This includes dispatch rules and wholesale market pricing. Further, it is important for regulators and state-owned utilities to gain experience to design offtake agreements and integrating wind energy. This also includes also a strong engagement with governmental and local stakeholders to assess the opportunities wind energy provides for them.

Additional opportunities for wind energy will open up through the rise of corporate sourcing and PPAs. For

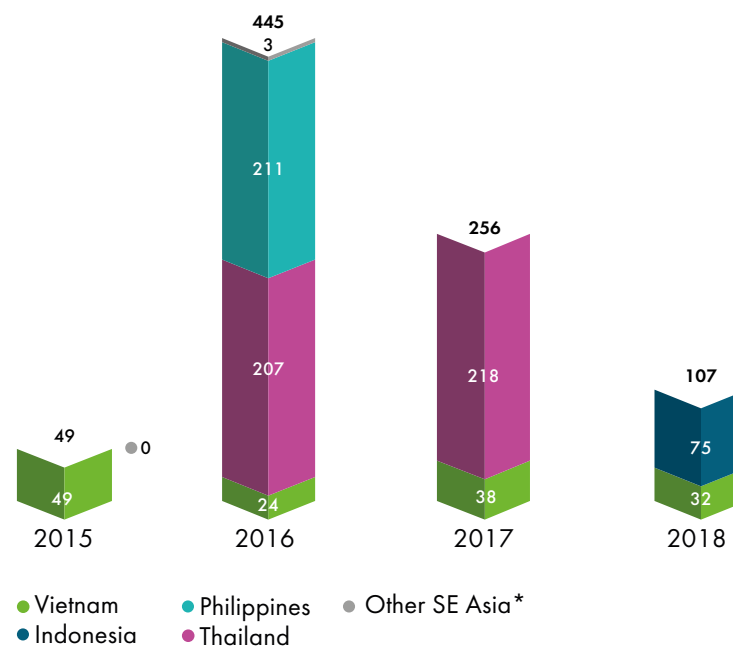
corporates, the benefit is to secure their supply at foreseeable costs. Benefits for governments and regulators are to advance the wind industry in their market, gaining experience and eventually bringing down cost. So far, there have been no corporate PPAs signed with wind

energy in South-East Asia, however, GWEC sees potential for corporate sourcing to become a driver for future installations in South-East Asia.

See market profiles in the Markets to Watch chapter

## New installations in South-East Asia

MW onshore



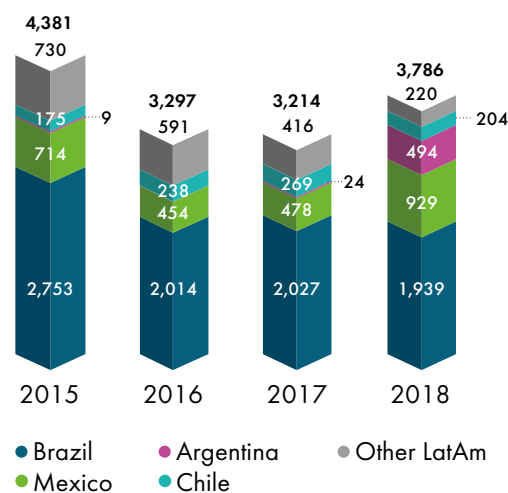
\* Myanmar, Laos, Malaysia and others

# Auctions and bilateral PPAs drive Latin American onshore markets

The majority of governments have implemented and are implementing auction and tender mechanisms focusing on the competitiveness of wind energy.

## New installations in Latin America

MW onshore



The Latin American wind market has grown over the past ten years, accumulating total installations of 25 GW. In the short-term, 3 to 4 GW are expected to be installed each year until 2023. The majority of governments have implemented or are implementing auction and tender mechanisms focusing on the competitiveness of wind energy compared to other energy sources. Brazil and Mexico conducted joint capacity auctions for onshore wind and solar. Chile auctioned GWh based on estimated demand and Colombia is using a similar approach.

In Brazil, the two auctions executed during 2018 (A-4 in April 2018 and A-6 in September 2018) captured 1 GW for onshore wind in total. The lowest average winning bid, 67.6 BRL/MWh for onshore wind, made wind once again the most competitive technology in Brazilian auctions in 2018. The continuation of the auction programme in Brazil ensures a steady market development and utilization of the supply chain, and two more auctions (A-4 in June 2019 and A-6 in September 2019) have already been announced.

Mexico had a record year in 2018 with 929 MW of new installed capacity reaching a total of almost 5 GW. The auction in November 2017 produced one of the lowest bids for onshore wind, with 17.8USD/MWh setting a benchmark for the industry. Also, bilateral agreements with corporations continue to be a strong driver in the market. The outlook for Mexico is, in the short term, overshadowed by the cancellation of the November 2018 renewable energy auction, as well as by the cancellation of the tenders for grid infrastructure. Still, GWEC expects Mexico to reach its target of generating 35 per cent of its power through renewables by 2024.

During 2018, Argentina has executed projects from previous auctions and has a solid pipeline of 3,7 GW under construction and awarded (this includes Renovar 1, 1.5, 2 and Mater, plus the reapproved Resolution 202 projects). Round 3 of RenovAr for small scale projects is under way and another auction is expected for 2019. The private PPA market (Mater) is also increasing for wind power projects. Both Vestas and Nordex will open factories in

Argentina during 2019, creating another local production hub in Latin America besides Brazil. The government is addressing challenges regarding grid expansion for further developments (2021 and beyond) with new rules to be enacted during 2019.

Chile is executing and installing capacity from the 2016er auction and awaits another tech-neutral auction for onshore wind and solar PV during 2019.

During 2018, Colombia prepared for the first renewable auction and results will be announced by June 2019. The execution of the auction will prove the government's intention to drive renewables and onshore wind forward.

Auction and tenders drive the majority of installations in the Latin American markets. Bilateral agreements/private PPAs and opportunities to commission capacity before the mandatory auction-defined deadline are additional drivers for future installations and supply chain utilization in Latin America.

# Government commitment crucial for Africa/ Middle East onshore markets

The onshore markets in Africa and Middle East are expected to install 1 GW or more each year, adding over 6 GW of new capacity by 2023. The majority of the volume is expected to be driven by Egypt, Kenya, Morocco and South Africa.

During 2018, several governments in this region re-confirmed their renewable and wind-specific targets. Kenya, for example, announced a target of 100 per cent renewable electricity by 2020, and market activity in general gained momentum. South Africa recovered from its stand-still and is expected to hold the fifth procurement round during 2019. Tunisia successfully executed a 130- MW tender and this capacity is expected to be installed by 2021. Kenya's Lake Turkana project was fully commissioned and reported a 80 per cent capacity factor during February 2019. The regional market leader in 2018 was Egypt, with 380 MW.

To drive further growth in these markets, governments need to

remain committed to their targets and follow-up on the execution of announced and planned tenders and procurement programmes. Continuous investment in the general infrastructure, especially grid, is required to secure planning and pipeline execution.

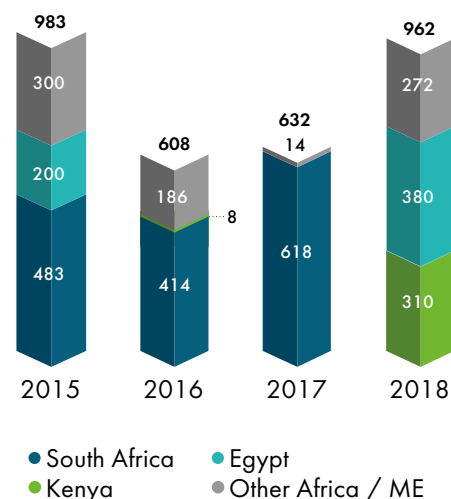
**Government commitment and executing policies remain key for growth in the African wind market.**

Securing PPAs is not a new challenge in African markets. This challenge is linked to lengthy administrative permitting processes, the slow inauguration of governmental schemes and guidelines for the set-up and execution of PPAs and the financial strength of available offtakers.

The positive short-term outlook for the region proves the willingness and ability to execute and install. Overcoming challenges (e.g. and structuring bankable PPAs) will impact how targets and ambitions will be reached and how international and local players will continue their commitment to the region.

## New installations in Africa/Middle East

MW onshore





A man wearing a light-colored shirt, dark pants, and a cap is kneeling in a field of young green plants, likely a vineyard or orchard, working the soil. In the background, several large wind turbines are visible on a hill under a clear sky. The scene is illuminated by warm, golden light, suggesting late afternoon or early morning.

# MARKETS TO WATCH



# Vietnam onshore market

## Current and future role on onshore wind in the energy system

GWEC continues to view Vietnam as a market with huge potential for both onshore and offshore wind, due to a confluence of geographic, economic and political factors. Endowed with more than 3,000 km of coastline, it has promising wind speeds in the favourable southwest and Central Highlands regions. Recent droughts in the Mekong

rapid urbanisation, a growing population and annual GDP growth above 6 per cent since 2010 – are being compounded by Vietnam's narrowing access to concessional international development funds, as it sails comfortably into middle-income status.

In order to deliver the capacity to sustain Vietnam's industrial development and escalating power consumption – energy load has

2016), which targets 10.7 per cent of electricity production to be supplied by renewables by 2030. It aims to have 800 MW in installed wind power capacity by 2020; by 2030, it targets 6 GW in wind.

Activity needs to be scaled up in order to reach the first milestone of 800 MW by 2020. Current onshore installed capacity is only 228 MW, although up to 80 further wind projects are registered with the Ministry of Industry and Trade (MOIT), reflective of the rush to market as developers seek to benefit from the increased FITs for projects operational by 2021. Large-scale offshore projects are also advancing, although not as quickly – outside of those already in advanced permitting stages, offshore projects face a narrow margin of time to get commissioned ahead of the 2021 deadline.

## Unlocking potential in the wind market

2018 was marked by positive indicators for the wind sector in Vietnam. The increase of FITs, issued via Decision 39 in September 2018, applies to wind

## Activity needs to be scaled up in order to reach the first milestone of 800 MW by 2020.

Delta have also raised anxieties about hydropower, which generates more than one-third of Vietnam's electricity.

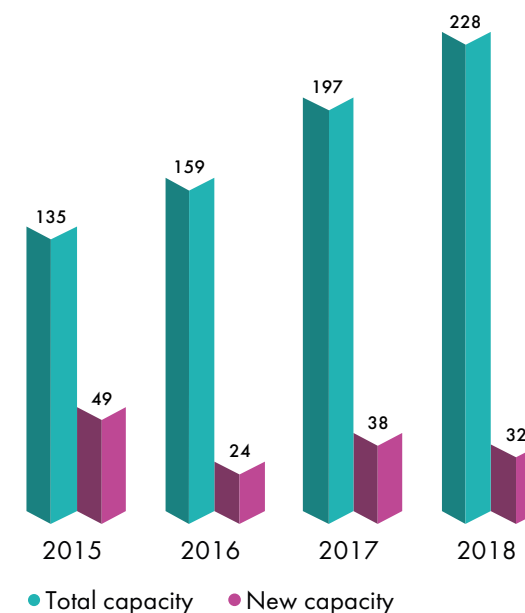
Meanwhile, macroeconomic constraints and energy security concerns are encouraging officials to reconsider the country's reliance on imported coal (coal provides more than one-third of power generation). A troika of pressures on energy security –

grown at an average rate of 10 per cent over the last five years, a pace forecast to continue through 2020 and slow slightly to eight per cent to 2030 – renewable energy and wind energy are increasingly seen as a solution.

The Vietnamese government has publicly committed to a diversified energy mix, outlined in the National Power Development Plan VII (PDP7, released in 2011 and revised in

## Total and new installations

MW onshore



\* Including offshore wind

projects that commence operations by November 2021 with a lifetime of 20 years. An incremental plan is in place to upgrade the transmission grid, and a four-year project between MOIT and the German government to develop the wind power sector concluded in December 2018, with dividends in capacity-building and recommendations for existing legal and regulatory frameworks.

Still, a number of financial, regulatory and legal barriers are obstructing investment in wind. Permitting is complicated, and a common sticking point is the standardised wind PPA, which must be agreed with Vietnam Electricity Corporation (EVN), the state-owned company which holds a monopoly on transmission and distribution. These PPAs are generally viewed as non-negotiable and falling short of international best practices. Pricing schemes post-2021 are unclear, though a forthcoming solar auction scheme could influence the regulatory development of wind projects.

Amid the convergence of Vietnam's macroeconomic and energy security concerns, it is critical that the government

addresses the current impediments to the development of the wind sector. There is great opportunity to bring private-sector funding, technical expertise and a streamlined supply chain to Vietnam's shores, but officials must first address the bankability

- **PPA/Financing:** De-risking the standardised PPA for wind, particularly vis-à-vis curtailment, termination, state guarantee and dispute resolution, is vital. Local financing schemes for renewables projects are weak, therefore wind IPPs require

## Permitting is complicated, and a common sticking point is the standardised wind PPA.

obstacles, regulatory opacity and pricing issues inhibiting investment.

substantial equity investment and expertise in inflation and convertibility risks.

### Current Challenges:

- **Permitting:** The approvals process for utility-scale projects is complex, requiring engagement with several stakeholders, including MOIT, EVN and relevant provincial People's Committees.

- **Capacity-building:** While Vietnam presently lacks strong technical expertise in wind, this presents opportunities for job growth and developing a skilled domestic EPC workforce.

Sources: GWEC Market Intelligence; World Bank; IRENA; EVN, press; expert interviews.

### Tipping Point

A planned pilot auction for the solar power sector could impact pricing schemes for wind energy projects. If it drives bids and cost levels down and is applied to the wind sector, investors may balk at the unappetising prospect of a low-bid auction scheme combined with an unbankable PPA. However, if the MOIT makes the necessary amendments to the PPA, the impact will be moderated.

# Thailand onshore market

## Current and future role of onshore wind in the energy system

From its first small-scale pilot programme of 150 KW wind generation in Phuket Island in the early 1980s, Thailand has since expanded to more than 648 MW of installed capacity, with most growth concentrated in the last seven years. The upscaling of the sector followed the economy's transition from agriculture-based to primarily industrial and commercial. While not growing as quickly as its lower-income neighbours – Vietnam and Philippines – Thailand's current rate of >3 per cent annual GDP growth is expected to continue through the medium term. As incomes rise alongside quality of life for Thais, so does their energy consumption – forecast to increase by 78 per cent by 2036.

Energy demand is growing as a result of expanding urbanisation, a rapidly growing economy, new infrastructure demands like mass rapid transit systems and campaigns for the thriving automobile sector to invest in electric vehicles. Meanwhile, consumption at the current rate

would deplete proven domestic reserves of natural gas and oil within five years. Facing high energy dependence ratios and exposure to commodity market price volatility, Thailand is turning to alternative and indigenous energy sources. This pivot is hardened by the growing unpopularity of coal-fired plants, with notable public opposition to coal projects in the south.

Installed capacity for renewables has doubled in the last decade, largely driven by hydropower and biomass. Thai officials sparked wind investment in the region with the 2007 Adder Programme, a feed-in premium scheme for small power producers – the first such scheme in South-East Asia. In 2014, uncertainties around tariffs prompted a shift to FITs, and by 2017, more than 30 wind projects were registered with the Energy Regulatory Commission.

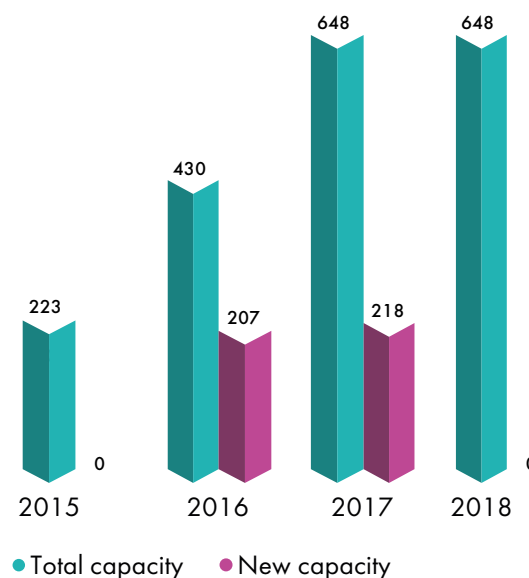
As of 2018, renewable energy supplied 15 per cent of total consumed power in Thailand, but installed wind capacity is still one-fifth of the 3,002 MW targeted by 2036 in the government's Alternative Energy Development

Plan (AEDP), one of five plans comprising the Thailand Integrated Energy Blueprint.

With the formulation of procurement schemes in the near future left unclear, many local wind investors are now deploying their capital to other wind energy markets in the region.

## Total and new installations

MW onshore



### Unlocking potential in the wind market

The long-term prospects are promising in Thailand, which has a technical onshore wind capacity of up to 13 GW, with the highest potential in the northeast, western and southern areas. The implementation of the AEDP's capacity targets – a long way from the current installations – will require dedication from government to sustain a welcoming environment for private-sector power producers.

Some uncertainties remain for new developers over land use rights: A legal dispute over a wind farm's land lease in Phetchaburi in early 2017 has been resolved, but serves as a reminder of the importance of engagement with partners and stakeholders, such as local residents and provincial committees of the Agricultural Land Reform Office.

Growth of the renewable energy sector may not be swift enough to relieve Thailand of its reliance on natural gas, but as officials continue to refine the energy system – undertaking smart grid studies, targeted investment incentives and competitive bidding PPA schemes in the renewable sector – Thailand has the potential to emerge as a

The long-term prospects are promising in Thailand, which has a technical onshore wind capacity of up to 13 GW.

leading wind energy market in the region. To deliver on this, supportive policy and pricing schemes are needed to facilitate further private investment in wind.

#### Current Challenges:

- **Permitting:** While the licensing process is clearly defined, delays can be encountered, such as around building construction certificates. Given the 2017 land lease dispute (left), close management of land acquisition permits, understanding of the Land Code and engagement with stakeholders such as local residents and Agricultural Land

Reform Office provincial committees is recommended.

- **Investment:** Local commercial banks are acclimating to the long-tenor financing required for wind projects.
- **Policy:** Interagency coordination can be a challenge, as the Thailand Integrated Energy Blueprint acts as an industry steering guide instead of a single national energy plan.

Sources: GWEC Market Intelligence; World Bank; IRENA; MOE; EGAT; DEDE; NEPC; press; expert interviews.

#### Tipping Point

The National Energy Policy Council approved revisions to Thailand's Power Development Plan (2018-2037) on 24 January 2019. Capacity targets were revised upward for non-hydro renewables to 18 per cent by 2037, with natural gas comprising 53 per cent and coal 12 per cent. While the revised version increases the share of natural gas in the energy mix, it also invites greater gradual private participation in the energy industry.



# Philippines onshore market

## Current and future role of onshore wind in the energy system

Fuelled by high GDP growth (averaging 6.6 per cent over the last six years) and a transition to a services-based economy, the Philippines is turning a critical eye to its long-term energy security. Its more than 7,000 islands are vulnerable to severe tropical weather and connection challenges; and additionally, the archipelago's

increase energy security and reduce dependence on imported coal and other fossil fuels. With excellent wind conditions on the northern and central Luzon and Palawan islands and total potential wind capacity of more than 76 GW across the archipelago, the potential is enormous for investments in wind. But positive signals and stronger policy-steering is needed to activate the wind sector.

The 2.35 GW target by 2030 is remarkably low compared to the country's 76 GW potential wind capacity.

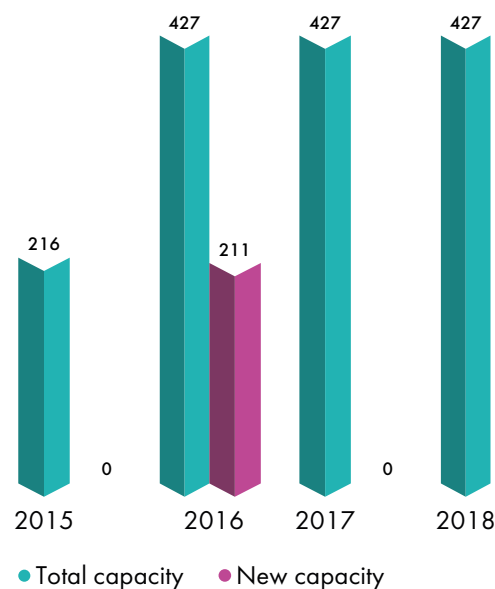
location means it may not be able to rely on interconnections with the planned ASEAN Power Grid. On the supply side, nearly half of Philippines' energy supply comes from imported fossil fuels, leaving it exposed to price fluctuations.

These realities are pushing officials towards alternative and indigenous energy sources, in order to

The Renewable Energy Act in 2008 and its blueprint, the National Renewable Energy Plan (NREP) in 2011, set the goal of tripling renewable energy capacity from its 2010 level to 15,304 MW by 2030, of which 2,345 MW is allocated for wind. While the 2.35 GW target by 2030 is remarkably low compared to the country's 76 GW potential wind capacity,

## Total and new installations

MW onshore





officials have expressed commitment to attaining wind grid parity by 2025, and for the Philippines to become the top wind energy producer in South-East Asia over the next decade.

Following the issuance of FITs for wind in 2012, enthusiastic developers piled in and the initial 200 MW allocation was oversubscribed within three years. Installed wind capacity swelled from 33 MW in 2012 to 426.9 MW, as of June 2018 – a stand-out figure in the region. Yet, with more than 50 wind projects currently registered with the Department of Energy (DOE), installations have lagged behind official targets due to a challenging pro-coal policy environment.

#### Unlocking potential in the wind market

While the coal train pushes on in the Philippines (coal generation is set to increase five-fold by 2030), so does forecast energy demand. A strong framework to develop wind energy is needed to upscale the deployment of wind projects. Promising initiatives include the formulation of the formulation of an RPS scheme – while rather low, these mandate a minimum percentage of renewable generation in on-grid and

off-grid supply – and a proposed Green Energy Option for end-users to purchase renewable energy in an open-access market.

The government has formally committed to a technology-neutral approach and fair playing field in its energy system. However, it needs to reconsider the available incentives to renewable energy investors, and possibly resync targets with its enormous endowment of potential wind capacity.

#### Current Challenges:

- **Permitting:** While efforts have been made to streamline regulatory procedures for energy projects, bottlenecks and red tape in the approvals process remain an issue.
- **Investment:** Foreign ownership of renewable energy projects is currently limited to 40 per cent. Domestic commercial banks are open to lending, although loan terms tend to be conservative as

renewable energy projects are still perceived to be high-risk.

- **Tax incentives:** Proposal HB 4774 (2017) amends the zero-rated VAT status of renewable energy sales to VAT-exempt, which might raise production costs if passed – a space to watch.
- **Policy:** Institutional capacity is a challenge, with the DOE's Renewable Energy Management Bureau considered overstretched. As public sentiment can significantly impact official policy positions, partnership dynamics are important.
- **Infrastructure:** Grid instability is a medium-term risk – the surge in volume and variability of renewables is showing signs of impacting grid operations in northern Luzon. The government is assessing its smart grid and storage policies.

Sources: GWEC Market Intelligence; World Bank; IRENA; DOE, USAID; press; expert interviews.

#### Tipping Point:

The DOE is currently undertaking a review of the NREP parameters and targets, and is expected to shortly release a revised version, with a potential greater allocation for wind. Legislative elections in May 2019 may also impact the political commitment to renewable energy.

# Indonesia onshore market

## Current and future role of onshore wind in the energy system

Indonesia is the largest energy consumer among ASEAN nations, comprising 38 per cent of the region's total energy use. Rapid urbanisation, steady economic growth and an expanding fleet of automobiles and motorcycles on its road are driving energy demand, which surged by 65 per

cent from 2000 to 2014. Demand for electricity is set to triple over the next decade, as the country's population grows and its mining and manufacturing industries march on.

domestic natural gas and oil reserves has declined in recent years, it has been replaced by increased oil imports. But with concerns rising among Indonesia's 264 million residents over air quality and the adverse environmental impacts of fossil fuels production, Indonesia has joined its neighbours in committing to a clean energy shift.

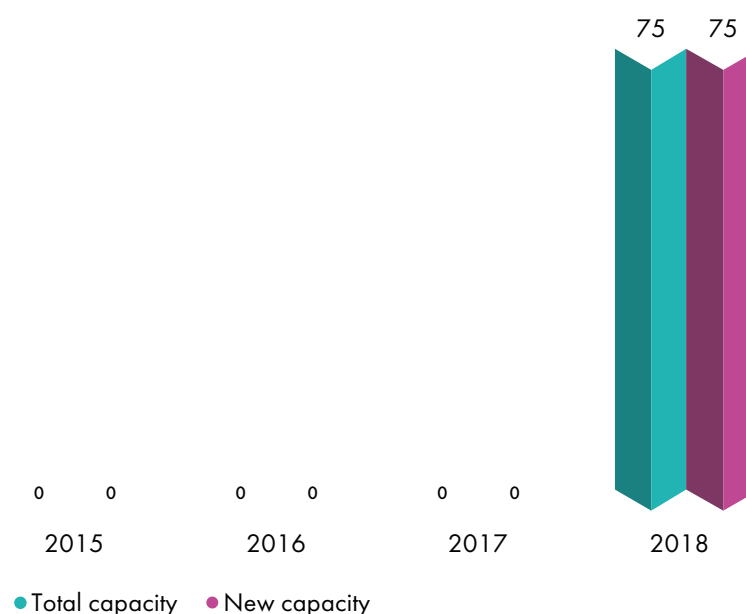
Potential onshore wind capacity across Indonesia's more than 17,500 islands is 9.29 GW.

To a large extent, this demand will be met by Indonesia's own reserves – coal supplies nearly one-third of the country's energy, with enough proven domestic reserves to last another seven decades at current consumption levels. While exploitation of

MEMR issued tariff guidelines for renewable energy in 2017, a year in which it signed 70 PPAs with renewable energy (wind, biomass, biogas, solar) generators. Wind and other renewable energy projects are seen as particularly important in filling-in the existing electrification gaps in remote/rural areas and small islands. In July 2018, President Joko Widodo inaugurated the country's first wind power project in South Sulawesi, the 75-MW Sidrap Wind Farm, with a second farm nearing completion in Jeneponto.

## Total and new capacity

MW onshore



## Next tipping point or main event to influence the onshore wind market

General election scheduled for April 2019 to revisit Indonesia's energy priorities (e.g. drive electrification through the support of onshore wind)

The Ministry of Energy and Mineral Resources (MEMR) has targeted 23 per cent of primary supply to be generated by renewables by 2025, and 31 per cent by 2050. Of the 45 GW targeted for renewable energy capacity by 2025, it is aiming for 1.8 GW of installed wind capacity.

project financing and government commitments. The latest electricity plan (RUPTL 2018-2027) released by Indonesia's sole off-taker, Perusahaan Listrik Negara (PLN) – an SOE which controls system transmission, distribution and more than two-thirds of power generation

development roadmap is littered with potential stranded assets.

Wind is an increasingly cost-effective energy option, particularly for a country facing rapidly growing power demand and distribution challenges. Despite declining technology costs and an attractive value proposition for wind energy, bureaucratic challenges and uncertainties around regulation and pricing have hindered investor interest. Officials need to send stronger market signals of a commitment to a more diversified, transparent and flexible energy system.

capped at 85 per cent of the regional production cost, if it is higher than the national cost. If the regional cost is lower, tariffs are negotiated directly with PLN.

- **Policy:** Electricity prices are subsidised and some of the highest in the region. Pricing reform has stalled in the pre-election period, but may be revisited after the general election in April 2019.

## Wind is an increasingly cost-effective energy option, particularly for a country facing rapidly growing power demand and distribution challenges.

Potential onshore wind capacity across Indonesia's more than 17,500 islands is 9.29 GW, according to the MEMR, with the most promising resources on Java-Bali, Sulawesi and Nusa Tenggara. Given the concentration of residents and energy demand on Java, most development in the next few years will be in this region.

But statements by MEMR officials in late 2018 revised its 23 per cent TPES renewables target by 2025 downward, amid a stalling of

assets in the country – in March 2018 doubles down on a coal-dependent energy system and adopts a more conservative approach to adoption of renewables.

### Unlocking potential in the wind market

Indonesia's subsidised electricity and reliance on its coal wealth form a crutch which will not last – PLN is already overleveraged, and while it has advised that no new coal plants will be developed beyond those already in planning, its

### Current Challenges:

- **Permitting:** A regulation in 2016 sought to reduce the licensing requirements from 52 licenses in 923 days to 22 licenses in 256 days. While online systems have reduced processing times, the permitting process can be lengthy.
- **Local content:** IPPs must meet local content requirements – the country's first utility-scale wind farm, in Sidrap, used 40% local materials.
- **Investment:** There is no set FIT for wind power – prices are

Sources: GWEC Market Intelligence; World Bank; IRENA; MEMR; PLN; press; expert interviews.



# Argentina onshore market

## Potential for steady growth but grid issues must be resolved

Argentina has some of the best wind resources in the world, with high, steady wind speeds in Buenos Aires Province and Patagonia in the south and in the central and north-western provinces of the country. Combined with its low costs of land acquisition and the current administration's commitment to liberalising the energy market, Argentina is well positioned to become a sizeable wind market with enormous, as-yet untapped potential.

Just in time – the country of 44.3 million residents is on track to see electricity demand rise by 26% from 2015 to 2025. Chronic blackouts (due to a grid that operates at near-capacity and expensive wholesale power prices have encouraged Argentina's pivot to a diversified energy mix. The country holds abundant gas reserves, and is primarily dependant on natural gas and hydropower, which comprise around one-half and one-third of installed capacity, respectively. But its fossil fuel-fed thermal power plants are nearing obsolescence, and there has been a sharp

increase of smaller plants run on imported diesel – threatening Argentina's security of supply and damaging its economic prospects.

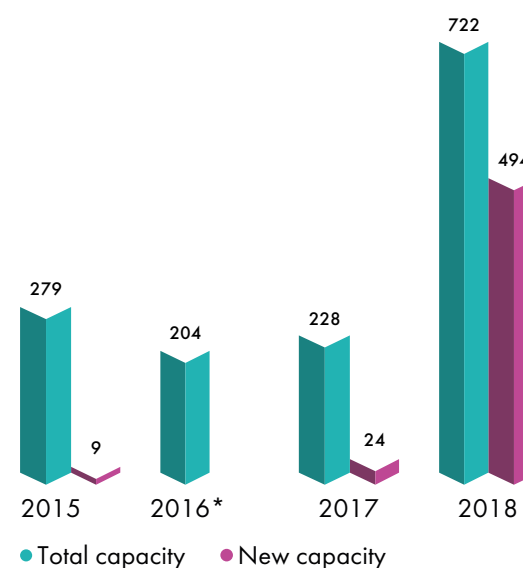
While Argentina tried to kick start its wind sector through the GENREN programme initiated in 2010, economic instability and inadequate regulatory frameworks made most projects awarded unviable and wind project development lay dormant for another decade. Since President Mauricio Macri swept into office in 2015, he has slashed energy subsidies and introduced a battery of legislation and market initiatives designed to boost private participation in renewables.

Law 27.191 in 2015 declared renewable energy a national interest, mandating that 8% of total electricity consumption would be generated from renewable energy by 2018, and 20% by 2025. That year, the government formulated a World Bank-backed renewable energy fund (FODER) and fiscal incentives to attract foreign capital.

The first round of Argentina's renewable energy tender

## Total and new installations

MW onshore



\* Re-adjustment of capacity

## Tipping point

General elections in October 2019 will likely see President Mauricio Macri defend his position against a “moderate” candidate from the opposition Peronist party. However there is a chance that the former President Cristina Fernández de Kirchner will still be the opposition candidate. The election will largely be decided on economic issues, and a worsening of the already volatile macroeconomic situation could further harm President Macri's chances. On the other hand, wind power is increasingly seen as a bright spot in Argentina's economic panorama, and enjoys strong cross-party support.

programme, RenovAr, took place in 2016, with 708 MW in wind capacity contracted out of a total 1,109 MW. The wind allocation was oversubscribed nearly six-fold, prompting the government to hold RenovAr 1.5 later that year, with wind prevailing to contract 765 MW of the 1.3 GW awarded.

Following RenovAr 2.0 in 2017 for 1.8 GW of capacity, Argentina had awarded 3,738 MW of capacity to 63 wind power projects, concentrated in southern Buenos Aires Province Region, Puerto Madryn and Santa Cruz/Chubut.

Part of this capacity has come from contracts signed in Argentina's promising corporate PPA market known as MATER, as large power users seek to avoid market risk and achieve lower wholesale price by meeting their mandated renewable power obligations directly from wind power and other renewable energy producers. As of late 2018, some 827MW of wind generation capacity had been contracted through MATER, so large scale corporates such as Aluar, Fravega, Toyota and other companies.



However the major challenge now for continued growth of the wind sector once the current pipeline has been built is the lack of available grid connection capacity. Government plans to carry out large scale tenders for new grid through a private-public participation (PPP) model have so far failed to take place, and the government is now studying the possibility of carrying out further tenders which will allow generators to propose and carry out grid extensions as part of their bids.

Meanwhile, the government is carrying out the RenovAr MiniRen 3.0, which foresees projects of less than 10MW in size which will connect to local distribution networks. The government recently extended its application period for MiniRen to May 2019.

### Unlocking potential in the wind market

Argentina's government has thus made huge positive strides, with a well-designed regulatory framework creating transparency and open competition, PPA's denominated in USD to reduce current risk, and multiple guarantees to mitigate the risk of payment delay or default through

the FODER scheme and accords with the World Bank which provides operators with a put-option.

However, continued macro-economic volatility continues to make for a difficult investment climate, with the bulk of financing for wind projects coming from balance sheet, export credit agencies or multilaterals, rather than international project finance.

Market administrator and clearing house CAMMESA, is overleveraged and enmeshed in a complex of legacy cross-subsidy arrangement with the state, with provincial governments, distributors, and generators including large debts owed to it and by it. CAMMESA's short term lack of solvency has reportedly led to the FODER guarantee scheme being used for payments for the first time.

Adding to uncertainty around the investment climate are the upcoming elections in October 2019 (see below), which could put further pressure on key macroeconomic indicators such as the Peso/USD exchange rate and inflation.

Still, for the mid-term, a strong framework of ambitious national targets, technology-specific

auctions, a growing corporate PPA and strong public support indicate great promise. Looking ahead, large regulated market tenders with grid are needed to allow continued Argentina's wind energy market and meet its renewables target of 20% by 2025.

### Current challenges:

- **Investment:** Project financing continues to a challenge due to Argentina's risk profile. Offtaker risk with CAMMESA, continues to be a worry, despite the different guarantee schemes.
- **Infrastructure:** Grid transmission and distribution constraints are slowing down the deployment of wind energy projects, and government has taken too long to carry out tenders for expansions
- **Policy:** As each province has its own Provincial Electricity Regulator (ENRESP) and one or more primary distribution entity, local stakeholder management is key. The future of the RenovAr programme will depend on the incumbent/incoming administration's support following general elections in October 2019.

Sources: GWEC Market Intelligence; World Bank; IRENA; ME&M; CAMMESA; press; expert interviews.

# Columbia onshore market

## Current and future role of wind:

Colombia has 16.8 GW of installed capacity, of which two-thirds is supplied by hydropower, 28 per cent by thermal power and 6 per cent from other renewable sources, as of 2017. While the country has potential wind capacity of 18 GW, its reliance on its abundant hydro resources has limited the incentives for investment in wind energy.

Its sole operational wind project is a 19.5 MW farm in La Guajira, a desert province in the country's northern tip which is home to strong, constant winds and the majority of potential wind capacity. But while geography provides Colombia with favourable wind conditions, it also threatens its energy system: The intensifying impacts of El Niño and attendant challenges of droughts, landslides and flooding destabilise security of supply and trigger electricity pricing spikes.

With demand for electricity among Colombia's 49 million residents set to surge 52 per cent from 2016 to 2030, according to the National Mining and Energy Planning Unit (UPME), officials have initiated

procurement schemes to lock in an energy matrix that includes wind.

An encouraging tone was set by the first dedicated auction for long-term PPAs awarded to wind, solar and biomass projects, launched in mid-2018. However, the tender was postponed to January 2019, and then voided, with Ministry of Mines and Energy (MME) officials citing antitrust concerns and the 22 pre-qualified bidders' failure to meet competition criteria. After the disappointing initial effort, the auction is scheduled to be replayed in Q2 2019, still offering 1.2 GW in renewable energy under 12-year PPAs.

The Reliability Charge auction scheme, introduced in 2006 and open to all energy sources, is designed to ensure a sufficient energy supply during droughts. In March 2019, this auction added wind and solar energy to the reliability matrix for the first time. Combined, wind and solar won 35 per cent, or 1,398 MW, of capacity – this includes 1,160 MW capacity across 20-year PPAs awarded to six wind projects in La Guajira.

Despite the postponement of the first renewable auction, development activity remains high. 1.7 GW of wind and solar projects have connection agreements with the National Mining and Energy Planning Unit (UPME), which has approved a further 55 wind projects for more than 7.5 GW through 2027. This is in line with the UPME's goal to increase the share of renewable energy to 10 per cent of installed capacity by 2028. What is missing is the execution of the first renewable auction to sign PPAs.

## Unlocking potential in the market

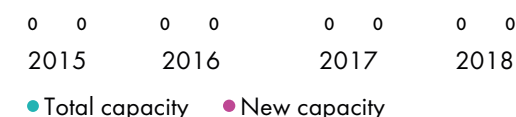
While auctions to date have wedged the door open for wind energy, a plan for technology-specific and long-term procurement is needed to capture the country's wind potential. Although the initial renewable energy auction was voided, it demonstrated the appetite of foreign investors and large generators to commit to wind energy in Colombia.

When President Iván Duque entered office in 2018, he set the ambition to install 1.5 GW of wind

## Total and new installations

MW onshore

No large-scale installations







and solar capacity by the end of his term in 2022. In order to reach this goal, it will be crucial to establish a comprehensive and consistent auction process with a reliable timeline.

To build on the promising pipeline of bids and planned projects, energy authorities need to open up more renewable energy participation in both auction schemes – this will create momentum for the sector to take off at competitive prices and in compliance with the competitiveness index. A more coherent national clean energy policy and procurement scheme will allow Colombia to capitalise on the interest from the private sector, and enable its energy system to become more resilient.

#### **Current challenges:**

- **Investment:** PPAs are in Colombian pesos, requiring understanding of volatility risks.

- **Permitting:** Construction requires sensitive engagement with local communities, of which some are in former conflict zones unaccustomed to state presence. In 2016, the wind farm in La Guajira temporarily suspended operations over a land rights clash with indigenous groups.

- **Infrastructure:** Investments in the transmission structure will be vital to connect wind farms in the north to the National Interconnected System (SIN). A USD 174 million transmission line in La Guajira has been contracted and is scheduled for completion in 2022.

- **Policy:** Colombia lacks a ratified and unified framework of renewable targets, leaving foreign investors uncertain of long-term planning.

#### **Tipping point**

Results from the Reliability Charge auction were announced in March 2019, allocating 1,398 MW of capacity to wind and solar energy projects via auction for the first time. The first large-scale renewable energy auction scheme, excluding hydropower, will run in Q2 2019, possibly June 2019.



# Peru onshore market

## Current and future role on onshore wind in the energy system

Peru has a substantial endowment of wind, particularly along its northern coastline in Piura, Ancash and Cajamarca, around the Andean Mountains, as well as in Ica, south of the capital Lima. Yet with a technically feasible capacity of 20.5 GW, according to the Ministry of Energy and Mines (MINEM), less than two per cent of the country's wind resources has been exploited to date.

**Less than two per cent of the country's wind resources has been exploited to date.**

Electricity demand on Peru's grid, the National Electric Interconnected System (SEIN), is projected to rise at an average rate of 6.4% each year from 2019 to 2024. Meanwhile, the adverse warming effects of El Niño threaten the reliability of hydropower, which accounts for more than half of

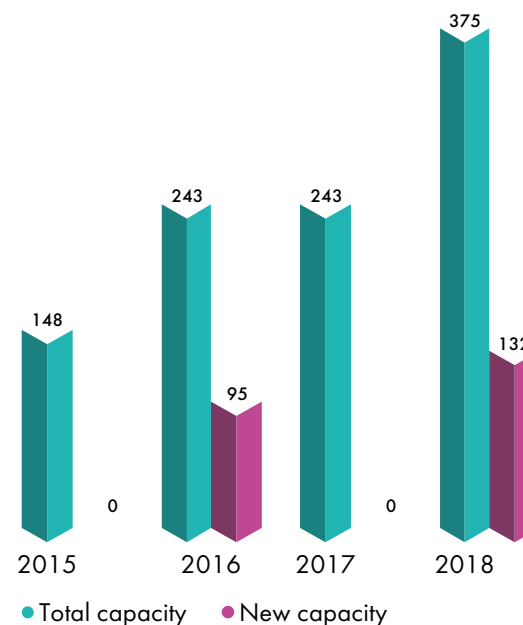
generation, and place Peru's 32.2 million residents at risk of flooding and droughts.

This hastens the need for a diversified energy matrix. MINEM's National Energy Plan (2014-2025) targets 60 per cent of power generation to be sourced from renewable energy by 2025; however, only five per cent is allocated for non-hydro resources. The 5-per cent benchmark reiterates a previous target set in 2008, and is regrettably low considering Peru's vast, undeployed wind energy potential. By mid-2018, wind and solar projects generated four per cent of the country's electricity, of which three per cent came from wind.

Renewable Energy Resource-specific auctions (RERs refer to wind, solar, biomass, geothermal, tidal and small <20 MW hydro) have been the primary vehicle for project concessions. The scheme was introduced in 2008 by a law mandating that auctions for 20-year PPAs to supply on-grid renewable energy be held every two years, resulting in the country's first renewable auction in 2009.

## Total and new installations

MW onshore



Sources: Expert interviews, press releases, WorldBank

## Tipping point

As wind power is defined as having zero firm capacity in Peru's grid, PPAs cannot be signed directly with grid-connected power consumers. A revision which recognises wind as having firm capacity has not been approved by MINEM yet, but could open up utility-scale wind projects to corporate PPAs.

Following three more RER auctions in 2011, 2013 and 2016, the government commissioned a total of 71 clean energy projects and 1.34 GW of total renewable capacity.

Contracts picked up in the last auction in 2016 saw a dramatic pricing adjustment for wind projects down to USD 38/MWh, among the lowest subsidy-free tariffs on the continent at the time.

#### Unlocking potential in the wind market

That most RER investment has gone into onshore wind and small hydro projects is a promising sign of foreign investors' readiness to back wind energy in Peru. A planned fifth auction for 2017 was postponed to the end of 2018, but never materialised, with MINEM officials citing the slow realisation of auctioned projects. Oversupply of generation and reserve margins that exceed the country's present energy needs have also prevented projects from moving ahead.

Going forward, GWEC expects further procurement rounds. But Peru's oversupply is due to taper off by 2021 – and as wind becomes increasingly cost-competitive for consumers (natural

gas, subsidised by the government, retains the lowest tariffs), it is expected to play a larger role in diversifying the energy mix.

Off-grid generation is on the horizon, due to the demands for cheap power from Peru's mining and industrial operations. Officials are also aiming to boost wind

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### GWEC expects further procurement rounds.

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deployment in the south, where many mining companies are concentrated, in support of the rural electrification programme. But meaningful plans need to be laid now to capture this potential, and build the capacity needed to meet Peru's future energy demands.

#### Current challenges:

- **Investment:** PPAs are in USD, but the 20-year lifetime of the agreements makes foreign exchange risk a factor.
- **Policy:** Peru has not published a national framework or plan for

renewable energy with long-term, mandated targets. As a result, the auction scheme has been run according to a flexible timeline and shorter-term forecasts; officials cite the country's oversupply of generation as the reason for the postponement of the fifth RER auction. Graft in the public sector is also an issue, with corruption scandals tainting a number of former heads of state and senior officials.

- **Infrastructure:** Transmission capacity needs to be built in order to deploy wind and renewable energy in certain areas, such as in the Andes regions.



A photograph of two large wind turbines standing on a grassy hill. The hill is covered in tall, white, feathery grasses. A dirt road leads towards the turbines, and a small, open-sided vehicle is driving away from the viewer on the road. The sky is blue with scattered white clouds.

# MARKET OUTLOOK 2019 TO 2023

# Global wind energy market to grow on average by 2.7 per cent each year

The market outlook for the global wind industry is positive. Over the next five years, GWEC Market Intelligence expects that over 300 GW of new capacity will be added. That is more than 55 GW of new installations each year until 2023.

## Supportive policies are key to enabling faster market growth.

Near-term, governmental support (auction/ tender programmes and renewable targets) are still a main driver for installations. The opportunities for wind energy to operate on a commercial basis are increasing though as wind is proving its cost-competitiveness and bilateral agreements (e.g., in the form of corporate PPAs) will grow.

It is difficult to predict the installations driven by commercial

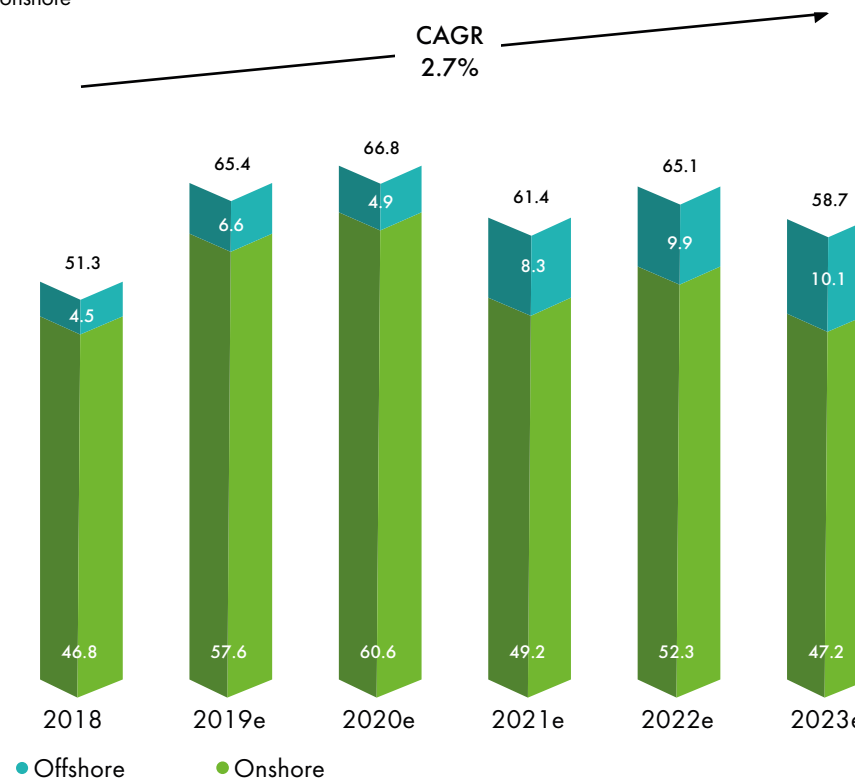
opportunities rather than government support. However, several markets like USA, Mexico, Brazil and others already get considerable volumes through these drivers.

The investment climate for wind energy and renewable energy has stayed positive during 2018, and despite, certain outlooks on the global economy, the activity level in the wind market will remain high.

Many markets are reassessing their energy demand and their market design. Wind energy as a flexible and easily-scalable capacity will be part of the solutions for the reassessment. The pressure decreasing prices pushed the wind energy industry over the past years to accelerate technical developments and efficiency improvements. For the near-term, the price pressure will not be as severe, but will continue to exist as a key element to mature the wind industry.

## New installations outlook

GW onshore



GWEC's Market Outlook represents the industry perspective for the expected installations of new capacity for the next five years. The outlook is based on input from regional wind associations, governmental targets, available project information and input from industry experts and GWEC members.

An update will be released during Q3 2019.  
Detailed data sheet available in GWEC's member only area



# Developing markets and offshore to take larger share in global market

## Offshore wind

The offshore market will become a truly global market over the next five years. Capacity will grow, especially in Asia. The first large-scale offshore installations are expected in North America towards 2022 or 2023. Currently, eight per cent of the new installations are offshore, by 2023, this share is expected to increase to 22 per cent by 2023.

## Africa/ Middle East

Steady volume is expected from Africa/Middle East based on the expectation that African governments stay true to their ambitions for wind and renewable energy – and project execution progresses. For South Africa, the largest market in Africa so far, the next auction/ procurement round is expected in H1 2019 and will re-install confidence in the market.

## Asia excl. China

India will drive the volume of new installations with the execution of the scheduled auctions. In South-East Asia, unless governments stop prioritizing coal, wind energy will remain at a moderate level – despite better economics.

## Pacific

Australia and New Zealand challenge wind energy to drive down cost and, at the same time, to provide opportunities for new and advanced business models like hybrid and co-located models.

## Europe

As a mature market, the European onshore market is expected to remain stable as governments execute their auctions and tenders. For 2019, installations increase as auctioned volume in Spain will be installed and a large project pipeline in Sweden will be executed.

## Americas

In Latin America, governments' commitment to large-scale auction is driving the volume. Maintaining the commitment is crucial for positive development in Latin America. For the next two years, the PTC will drive the US market, good economics and state-level RPS will ensure future market activity.

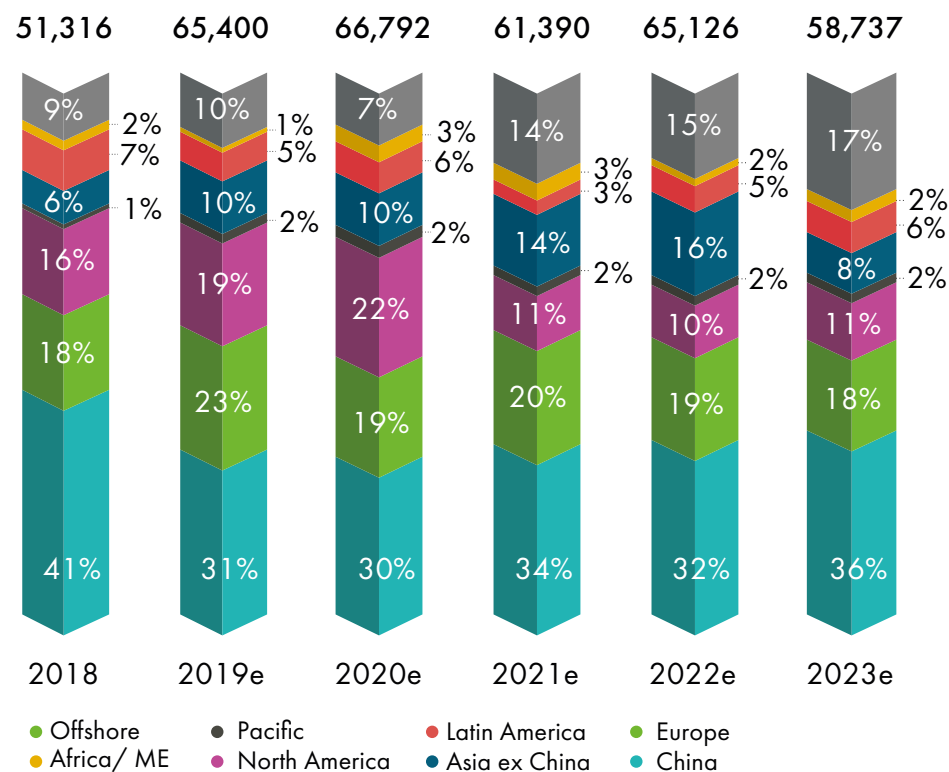
## China

Installations for the next two years are linked to the already existing pipeline of approved projects by the NEA.

Installations as of 2021/22 will be linked to the newly introduced auctions. Currently, it is expected that the market will remain at the level of 20 GW new installations per year.

## New installations outlook by region

MW and per cent, onshore and offshore

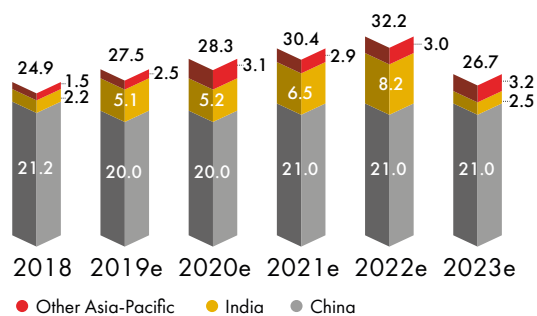
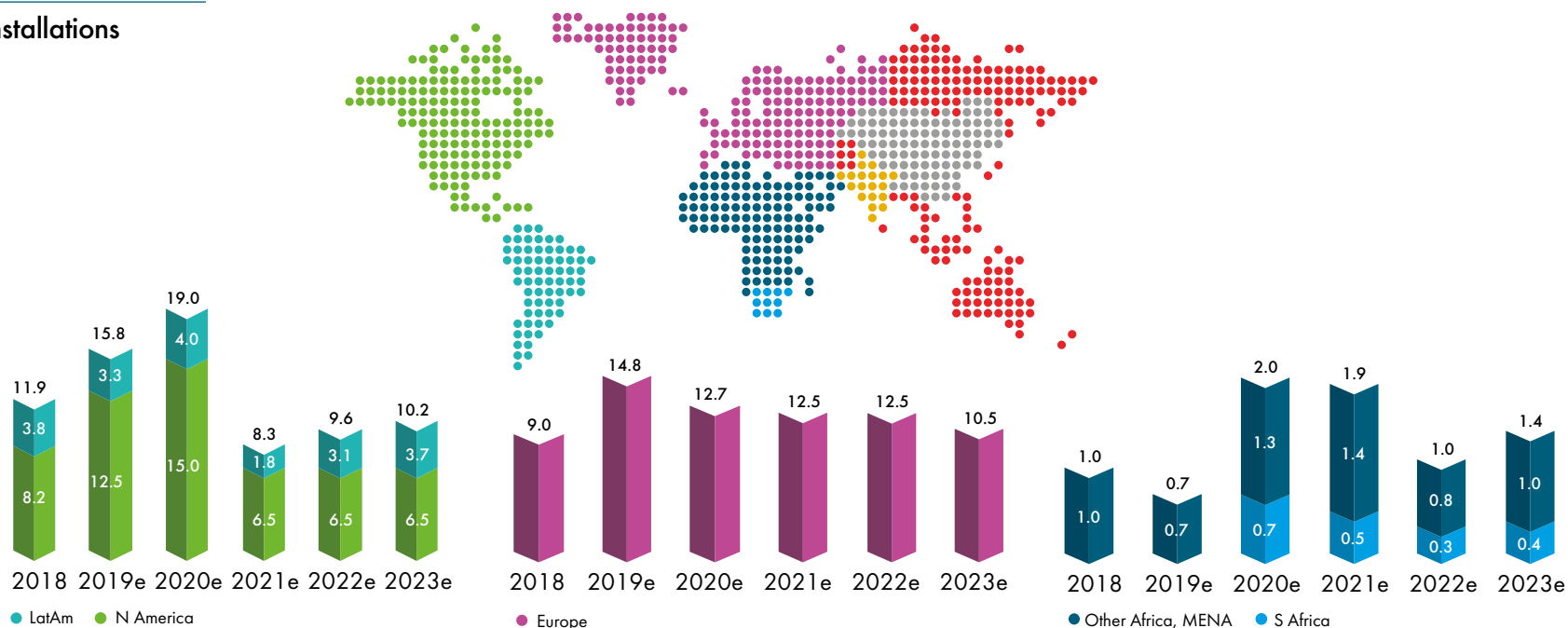


Detailed data sheet available in GWEC's member only area

# Regional onshore wind and offshore wind outlook

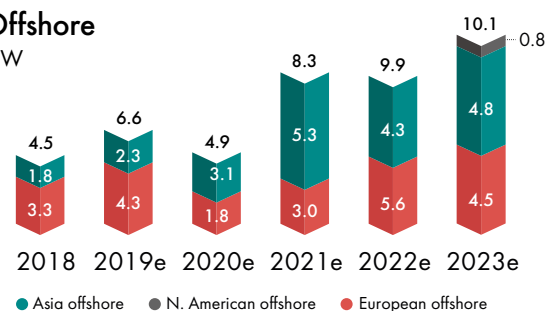
## New installations

GW



## Offshore

GW



Detailed data sheet available in GWEC's member only area

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# APPENDIX





# Global Wind Report - Methodology and Terminology

## Data definitions and adjustments

GWEC reports installed and fully commissioned capacity additions and total installations.

New installations are gross figures not deducting decommissioned capacity.

Total installations are net figures, adjusted for decommissioned capacity.

## Sources

GWEC collects installation data from regional or country wind associations, alternatively from industry experts.

Historic installation data has been adjusted based on the input GWEC received. The 2018 Global Wind Report shows the accurate current and historic data.

## Definition of regions

GWEC has adjusted their definition of regions for the 2018 Global Wind Report, specifically Latin America and Europe.

- Latin America: South, Central America and Mexico
- Europe: Geographic Europe including Norway, Russia, Switzerland, Turkey, Ukraine

## Terminology

GWEC uses terminology to the best knowledge. With the wind industry transitioning certain terminology is not yet fixed or can have several connotations. GWEC is continuously adapting and adjusting to these developments.

## Acronyms

|             |                                 |
|-------------|---------------------------------|
| <b>CAGR</b> | Compound Annual Growth Rate     |
| <b>FTT</b>  | Feed-in-Tariff                  |
| <b>FY</b>   | Financial Year                  |
| <b>GC</b>   | Green Certificate               |
| <b>GW</b>   | Giga Watt                       |
| <b>LCOE</b> | Levelized Cost of Electricity   |
| <b>MW</b>   | Mega Watt                       |
| <b>OEM</b>  | Original Equipment Manufacturer |
| <b>PPA</b>  | Power Purchase Agreement        |
| <b>PTC</b>  | Production Tax Credit           |
| <b>RPS</b>  | Renewable Portfolio Standard    |

## Image usage

|       |                                                 |
|-------|-------------------------------------------------|
| Cover | Vestas Wind Systems A/S                         |
| 3     | West Bengal Renewable Energy Development Agency |
| 3     | Enercon GmbH                                    |
| 3     | Vestas Wind Systems A/S                         |
| 8     | Jose Vega Lozano                                |
| 10    | Enercon GmbH                                    |
| 13    | Vestas Wind Systems A/S                         |

|    |                                                 |
|----|-------------------------------------------------|
| 22 | Noupoort Wind Farm                              |
| 30 | Arkins                                          |
| 34 | Wonderful Engineering                           |
| 38 | West Bengal Renewable Energy Development Agency |
| 42 | Global Wind Day Photo Competition               |
| 44 | Vestas Wind Systems A/S                         |
| 46 | Global Wind Day Photo Competition               |

|    |                                     |
|----|-------------------------------------|
| 48 | Parque eólico Bons Ventos           |
| 50 | Enel SpA                            |
| 52 | Engie Group                         |
| 53 | Global Wind Day Photo Competition   |
| 58 | Siemens Gamesa Renewable Energy S.A |

## About GWEC Market Intelligence

GWEC Market provides a series of insights and data-based analysis on the development of the wind industry. This includes a market outlook, country profiles and policy updates, deep-dives on the offshore market among other insights.

GWEC Market Intelligence derives its insights from its own comprehensive databases, local knowledge and leading industry experts.

The intelligence team in GWEC consists of three strong experts with long-standing industry experience.

GWEC Market Intelligence collaborates with its regional and country member wind association as well as with its corporate members.

**Karin Ohlenforst** –  
Director of Market Intelligence  
**Joyce Lee** – Policy and Operations Director  
**Feng Zhao** – Director of Strategy

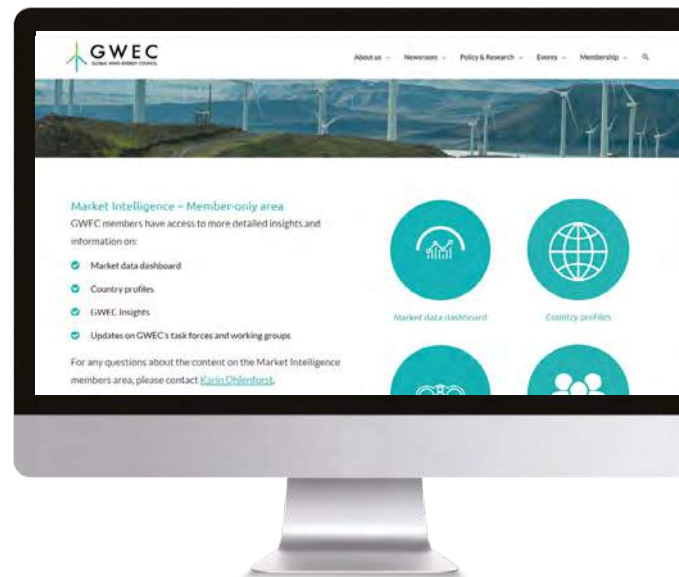
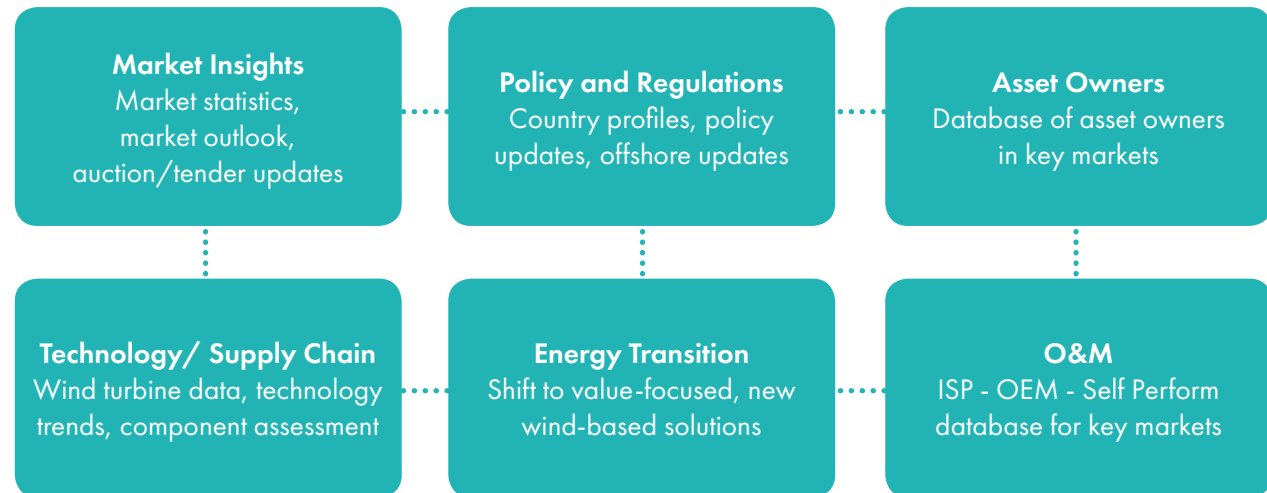
### How to access GWEC Market Intelligence

- Corporate GWEC-Members
- Wind energy associations
- Non-GWEC Members

### Subscription

Contact **Feng Zhao** [feng.zhao@gwec.net](mailto:feng.zhao@gwec.net)

## GWEC Market Intelligence Areas



GWEC Market Intelligence created a Member only area to provide more in-depth market intelligence to GWEC's members and their employees.

[Click here to get your login](#)

| Reports                                                                  | Frequency          |
|--------------------------------------------------------------------------|--------------------|
| <b>Wind Energy Stats/ Market Data</b>                                    |                    |
| Wind stats 2018 (and historic)                                           | Annual             |
| Global Wind Report                                                       | Annual             |
| Wind Energy Statistics (Jobs, wind energy generated, number of turbines) | Annual             |
| <b>Country Profiles/Policy Updates</b>                                   |                    |
| Country profiles onshore, Country profiles offshore                      | Quarterly / Ad-hoc |
| Ad-hoc policy updates                                                    | Ad-hoc             |
| <b>Market Outlook</b>                                                    |                    |
| GWEC Market Outlook for the next five years                              | Semi-Annual        |
| <b>Supply Side Data</b>                                                  |                    |
| Supply data by OEMs, by market , by technology, by turbine size          | Annual             |
| <b>Auction / Tenders</b>                                                 |                    |
| Auction trends and learnings                                             | Annual/Quarterly   |
| Auction results database                                                 | Annual/Quarterly   |
| <b>TF - Offshore Wind Market</b>                                         |                    |
| Global offshore report                                                   | Annual /Quarterly  |
| Market Entry Opportunity                                                 | Annual /Quarterly  |
| Global offshore project pipeline                                         | Annual /Quarterly  |
| <b>Components Assessment</b>                                             |                    |
| Gearbox (2019), followed by other components in 2020                     | Special report     |
| <b>Wind Asset Owners/ Operators</b>                                      |                    |
| Ranking of wind asset owners and operators globally, in key markets      | Annual             |
| <b>O&amp;M</b>                                                           |                    |
| ISP - OEM - Self-Perform database                                        | Annual             |
| <b>Energy transition, Digitalization, Hybrids</b>                        |                    |
| Position Papers/studies - Value shift, Corporate PPAs,                   | Special report     |
| Government support to wind and other ("true cost of coal")               | Special report     |
| New Solutions, GWEC policy recommendations                               | Special report     |



Gender diversity drives innovation, opens new pathways for technology deployment, brings valuable perspectives to social and economic development and provides a richer pool of talent for key and emerging industries. In the landscape of global issues requiring strong stewardship and a skilled workforce, few areas are as critical as the transition to a sustainable energy system.

Yet, the renewable energy sector continues to be dominated by men: Women make up less than one-third of the renewables workforce, and 75 per cent of them perceive gender-related barriers in the sector.

In order to advance the role of women as agents of change in

society and promote best practices within the wind industry, the Global Wind Energy Council (GWEC) is teaming up with the Global Women's Network for the Energy Transition (GWNET) to launch the Women in Wind Global Leadership Program. The programme, running from May 2019 to January 2020, is designed to accelerate the careers of women in the wind industry, support their pathway to leadership positions and foster a global network of mentorship, knowledge-sharing and empowerment.

In launching this programme, GWEC and GWNET call on other stakeholders in the renewables industry to recognise the importance of equal participation in the fight against climate change

and the promotion of sustainable development. We affirm that our efforts are in alignment with UN Sustainable Development Goal 5 (achieve gender equality and empower all women and girls) and Goal 7 (ensure access to affordable, reliable, sustainable and modern energy for all).

**Follow our journey and apply for participation at <https://gwec.net/>**

To become a Leading or Supporting Partner, please contact Deny Tenenblat at [deny.tenenblat@gwec.net](mailto:deny.tenenblat@gwec.net).

Jointly organised by:





## Global Wind Energy Council

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