

Global Wind Power Acceleration

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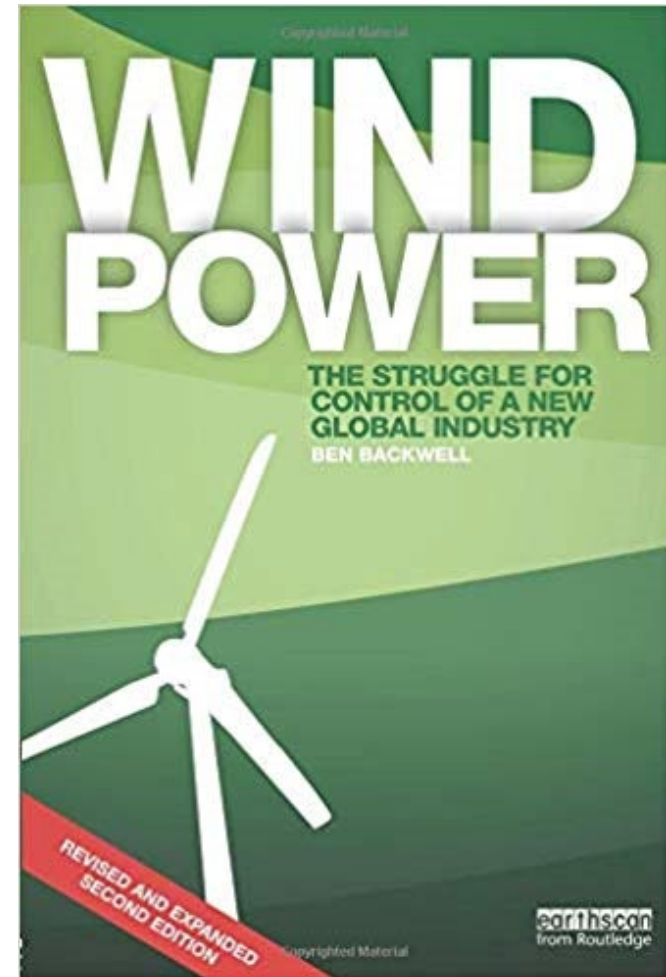


Ben Backwell - **CEO of GWEC**

Author of **Wind Power, the Struggle for Control of a New Global Industry** (Taylor and Francis , 2017)

Former industry consultant (FTI Consulting, Wind Europe)

Former energy journalist and analyst, covering energy policy and markets for 15 years



CO Members



C1, C2, and C3 Members



Associations

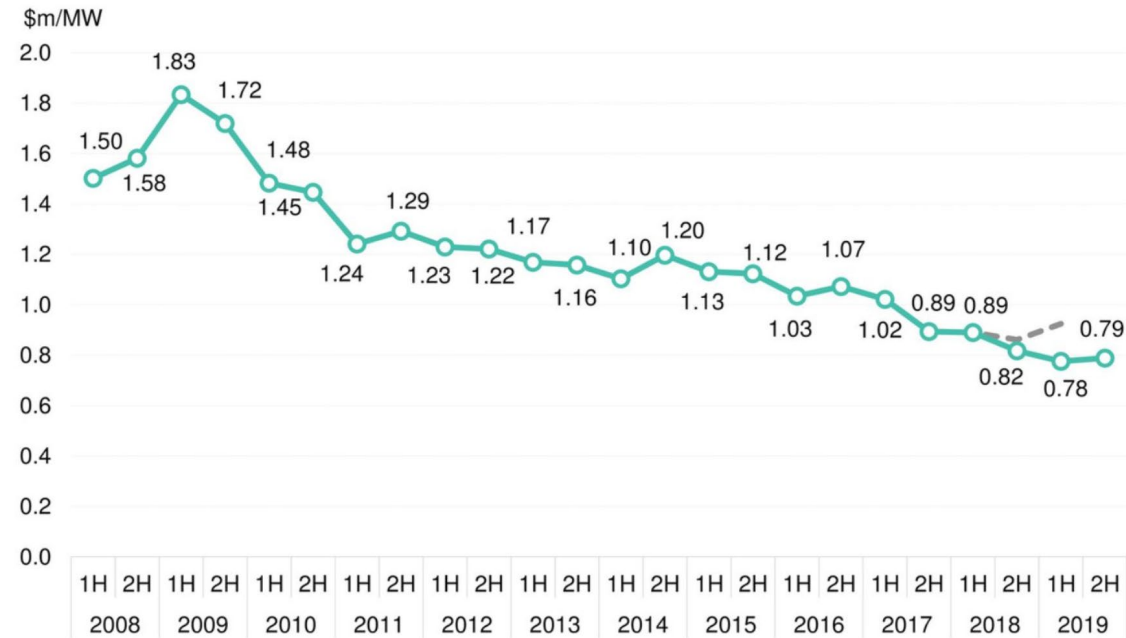


Wind energy is a maturing and competitive industry

Decreasing turbine pricing

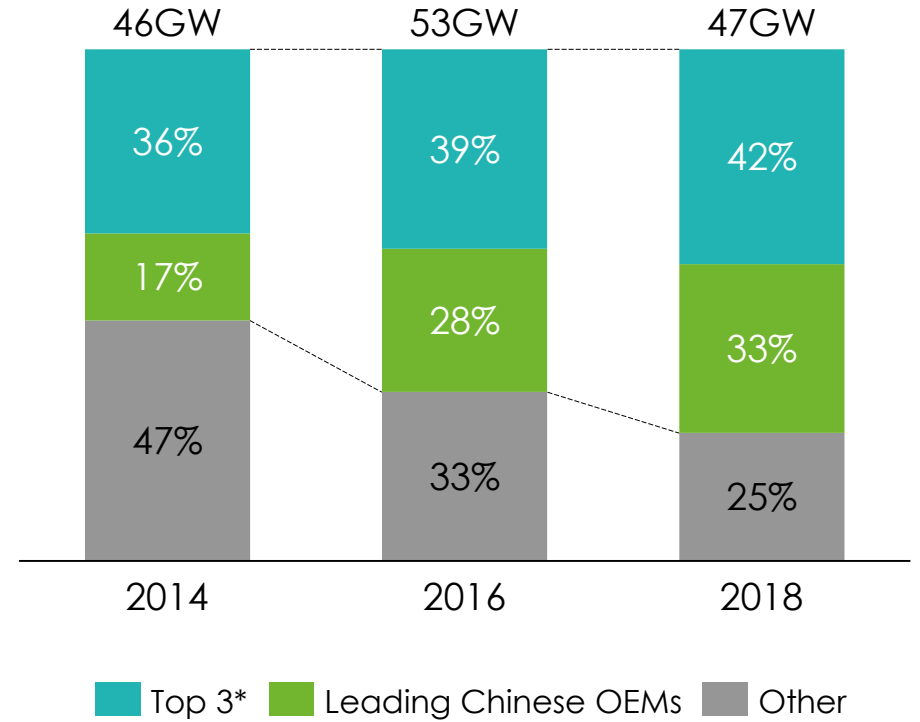
Onshore, USD/ MWh

Turbine price by delivery date



Market shares of top 3 and Chinese OEMs show market dominance

Onshore, per cent



■ Top 3* ■ Leading Chinese OEMs ■ Other

Top 3 – Vestas, GE Renewables, Siemens

Gamesa Renewables*

Leading Chinese OEMs – Goldwind, Envision, Mingyan, UP

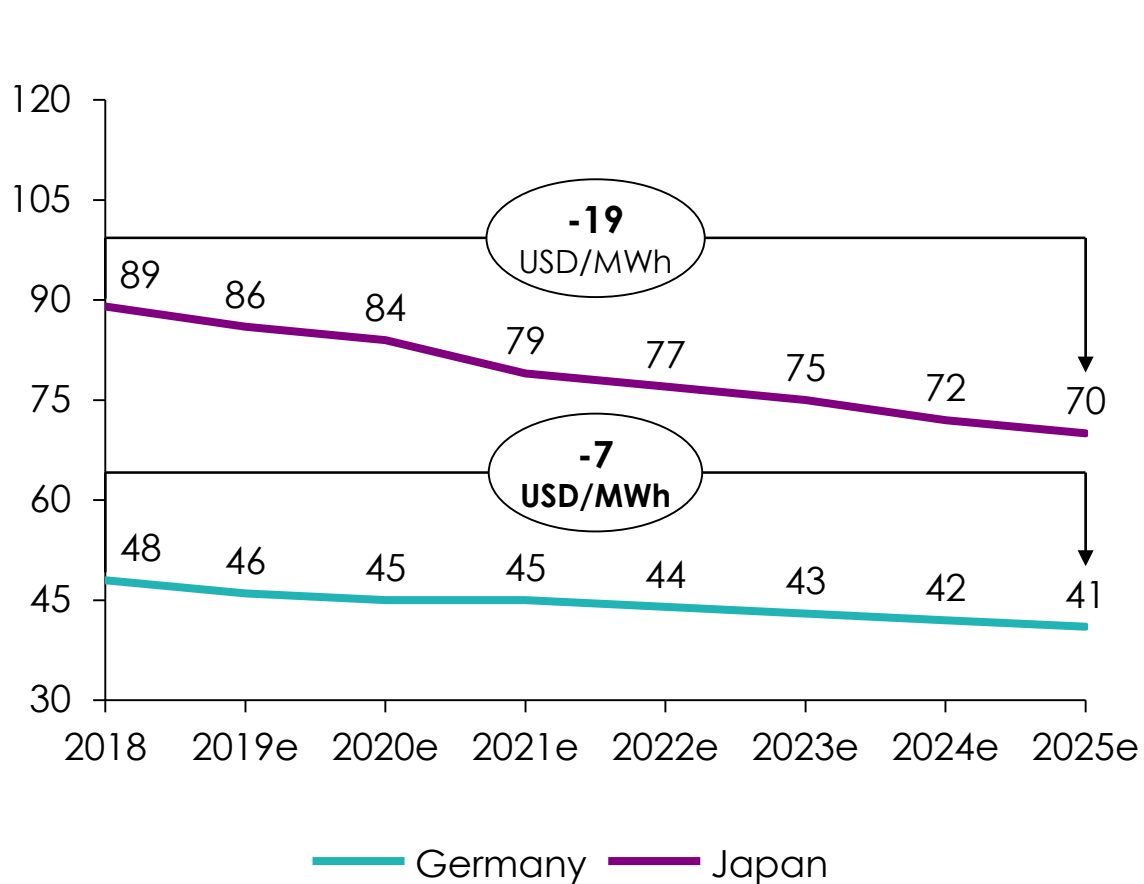
* Siemens and Gamesa combined for 2014 and 2016

Source: GWEC Market Intelligence, BNEF H2 2018 Wind Turbine Pricing Index

Decreasing LCOE secures competitive position for wind

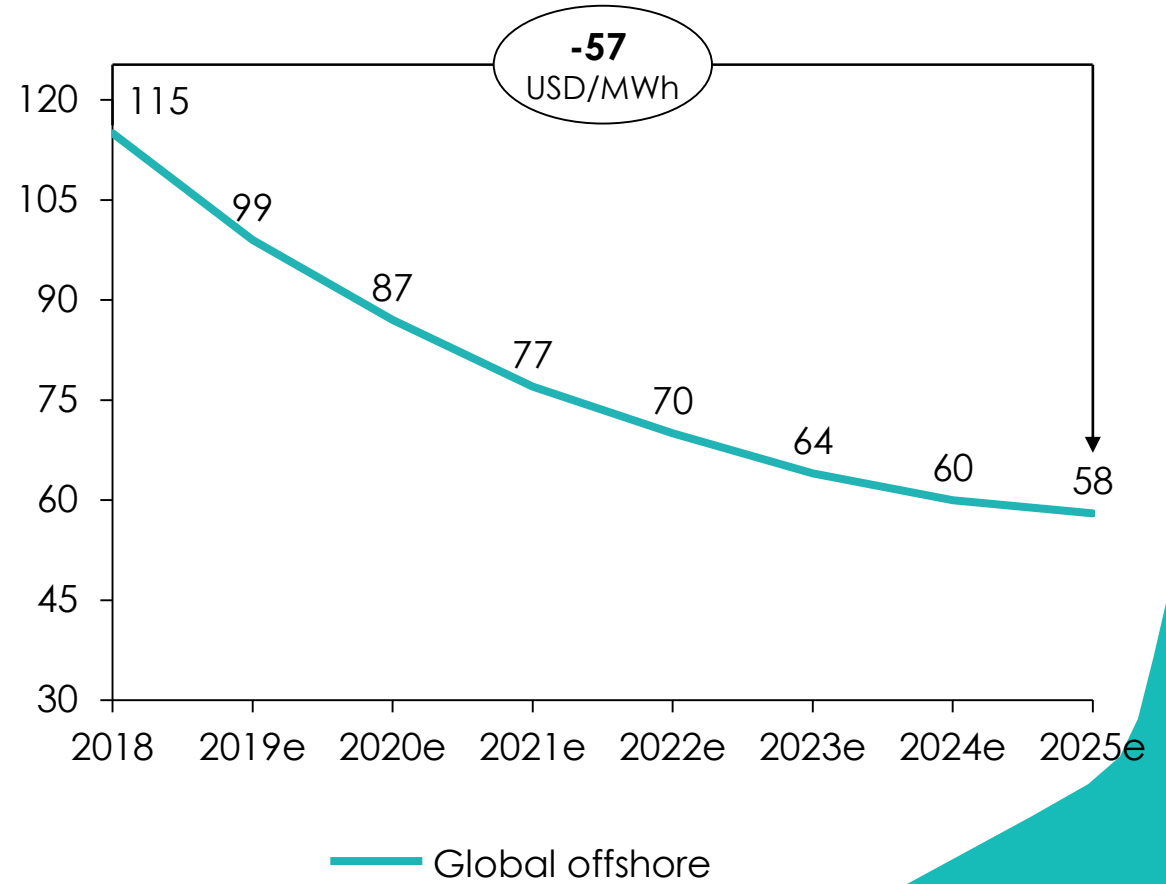
Onshore - Forecasted LCOE

USD/ MWh, Examples Japan and Germany, onshore



Offshore - Forecasted LCOE

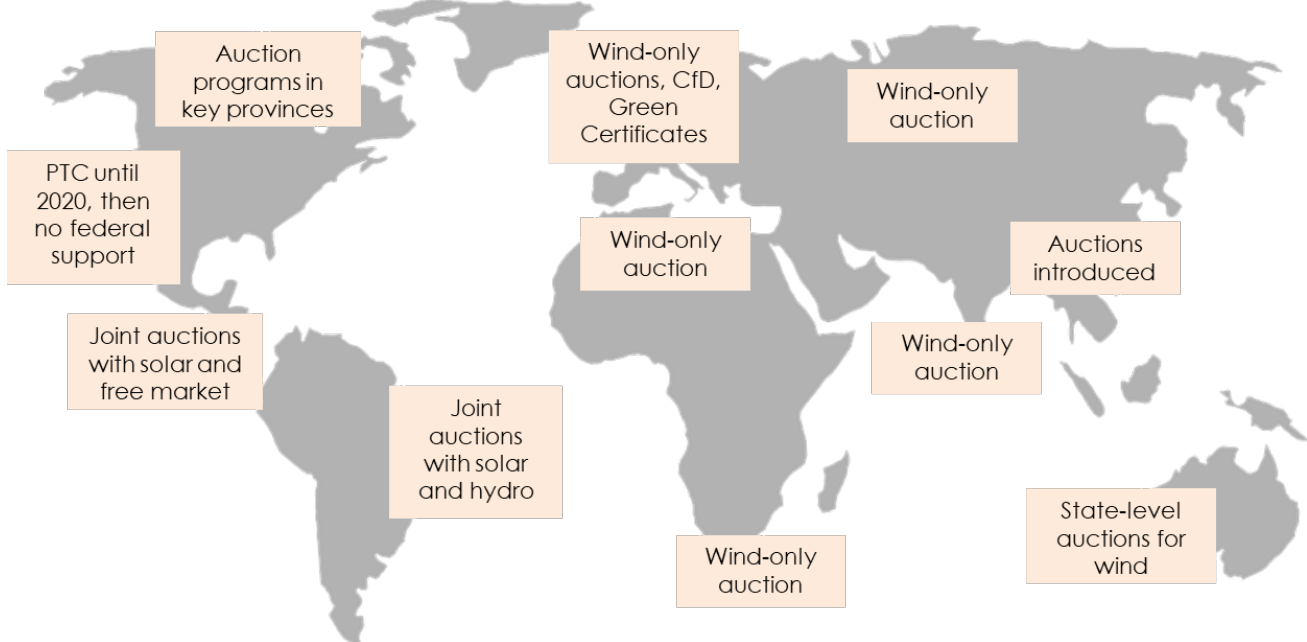
USD/ MWh, global offshore



Market-based mechanisms dominate the global wind market

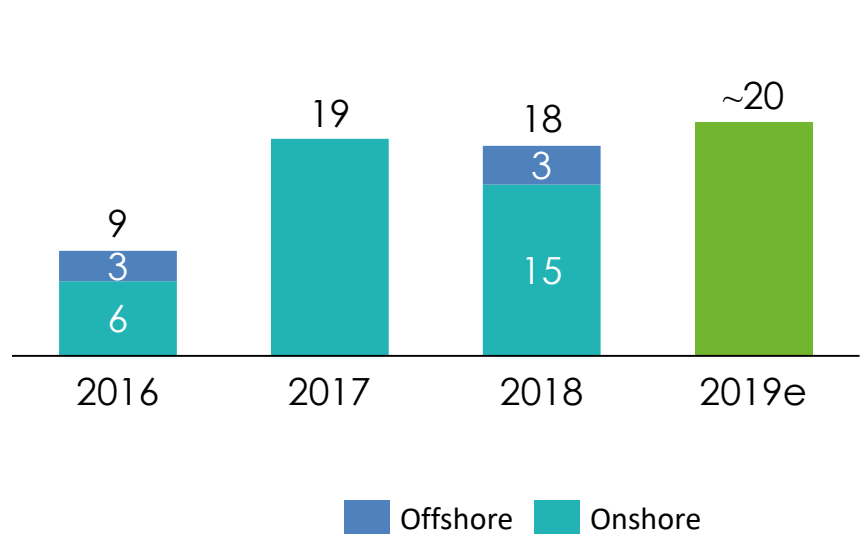
Support scheme and capacity allocation mechanism

Status Jan 2019



Auction capacity for wind

MW, capacity captures by wind during auctions

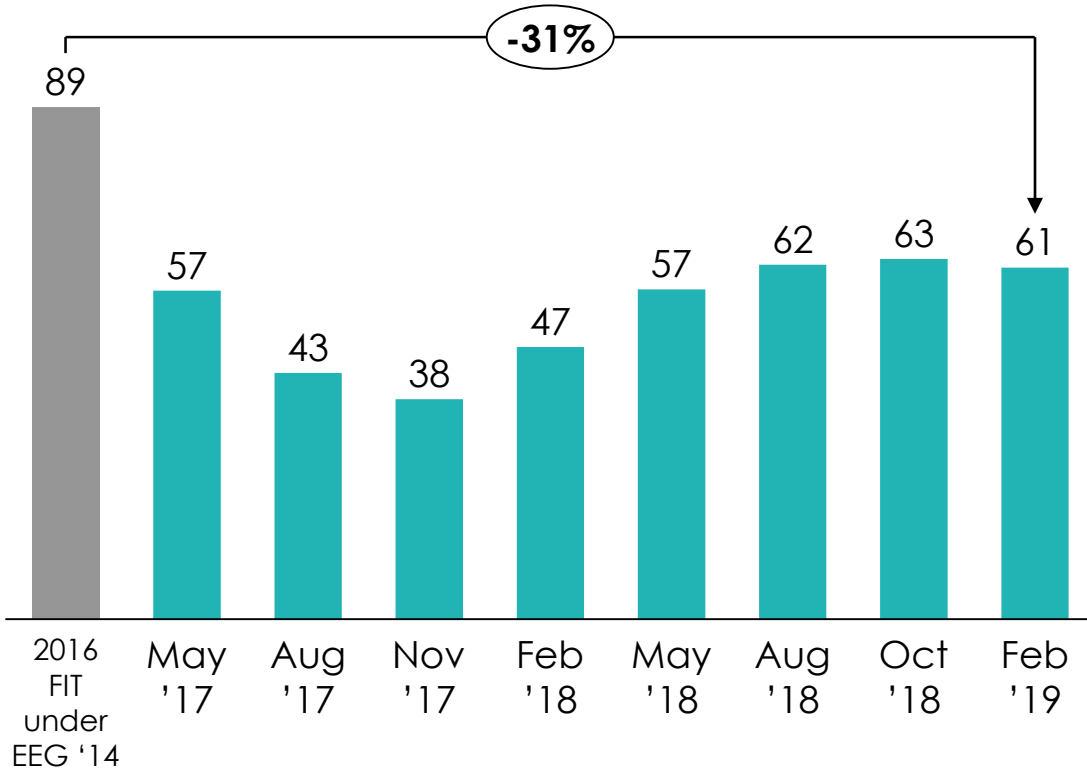


- **Technology-specific auctions and tenders (“Wind only”) dominate to allocate onshore and offshore capacity**
- **Several markets have or plan to move to neutral or joint technology auctions to increase competition and reduce cost even further**

Source: GWEC Intelligence, National sources

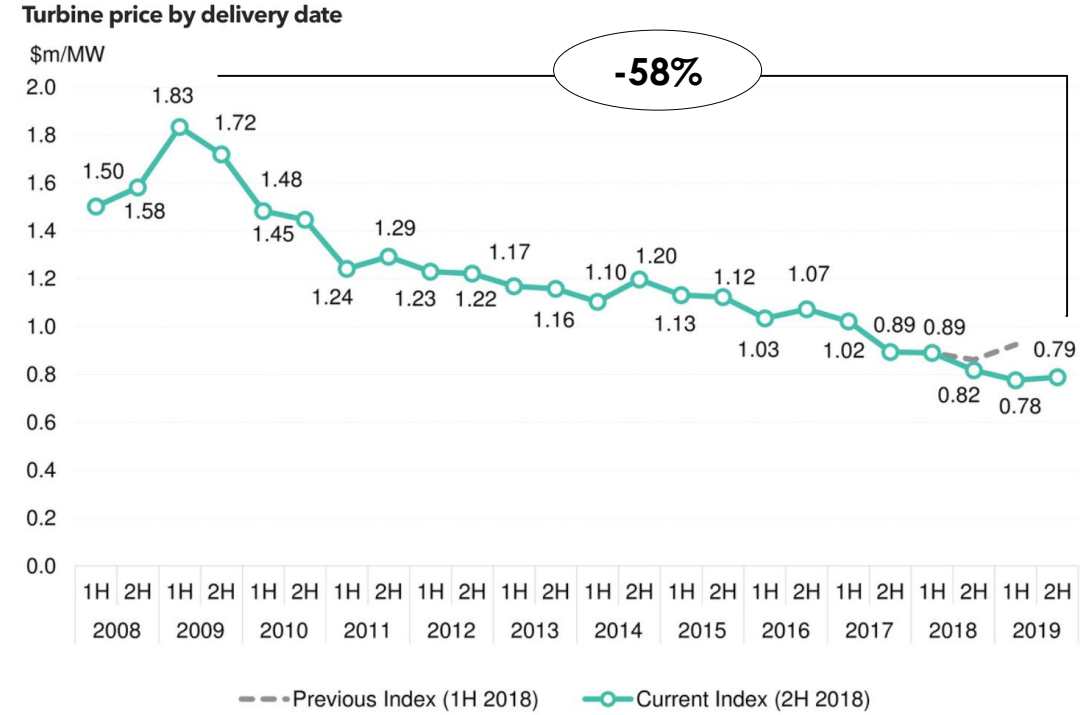
Competitive pressure due to decreasing bids and prices

Average winning auction bids – Example Germany
EUR/ MWh, onshore wind



Despite recovering auction bids and adapted auction rules, support level is 30% below FIT

Global turbine prices – excluding China
USD/ MWh



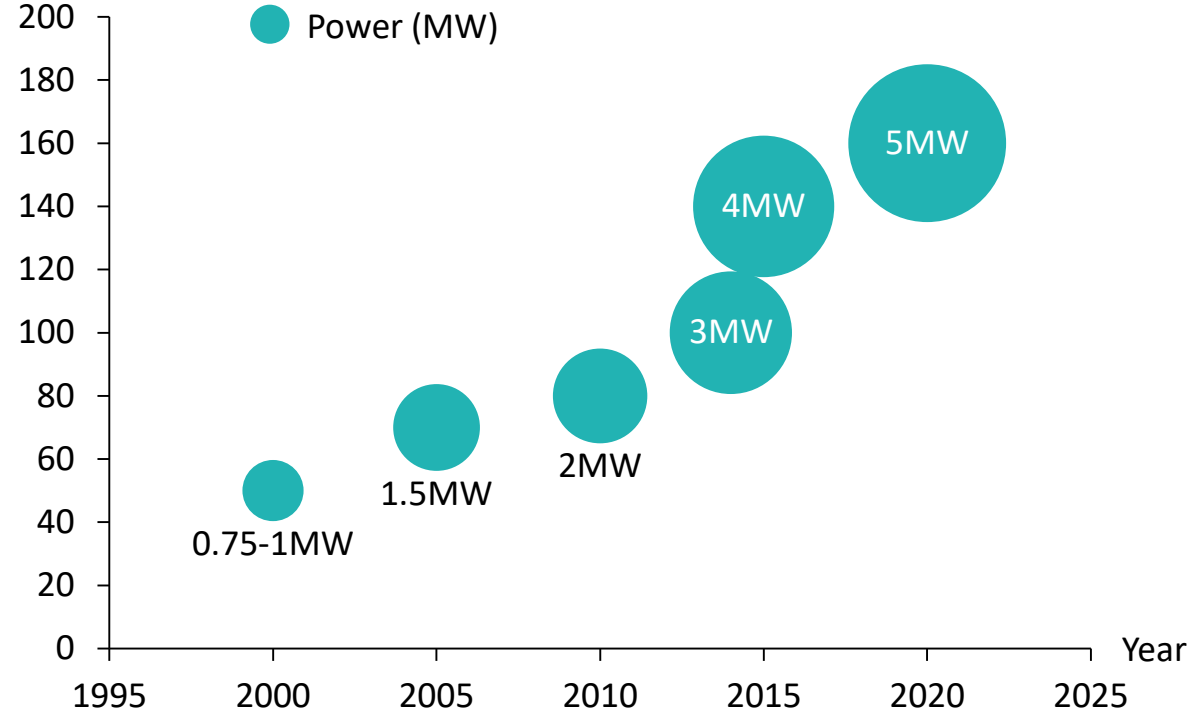
Source: GWEC Intelligence, BNEF Wind Turbine Pricing Index Dec 2018

Innovation and efficiency are key growth drivers

Turbine sizes and power rating to increase

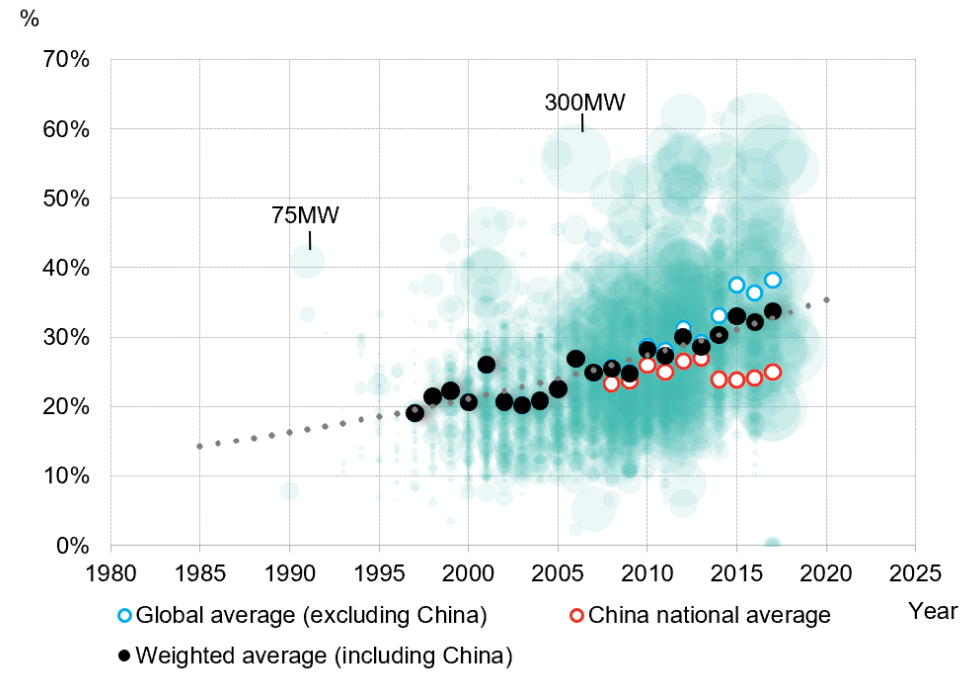
Onshore wind turbine size development*

Rotor size (m)



Capacity factors continue to improve

Development of onshore wind capacity factor, per cent



* Average turbine size
Source: GWEC Market Intelligence, WindEurope, BNEF

Modularization to improve cost competitiveness of wind energy

Areas impacted by modularization	Rational for modularization	Expected cost reduction
<ul style="list-style-type: none">• Product design• Component Sourcing• Manufacturing/ Assembly• Transport/ logistics• Installation• Service/ maintenance	<ul style="list-style-type: none">• Better and faster response to changing market conditions• Increased options for configuration• Easier scalability (e. g., rotor extension) without major design changes	<ul style="list-style-type: none">• Standardization of components and larger production volume for large components• Reduced installations time• Reduced logistic and transportation cost

Source: GWEC Market Intelligence, WindpowerMonthly, Enercon, Vestas

Digitalization – potential to revolutionize wind energy

Technical applications/ Internet of Things



Data analytics



- Improved **reliability** and **availability**
- Better **predictability** of maintenance needs
- More data insights for better **asset management** across fleets

Unlocking potential

Performance

Risk Mgmt.

Productivity

- ⇒ Increased Annual Energy Production, increased return opportunities
- ⇒ Better risk management, improved maintenance
- ⇒ Safe return opportunities increase attractiveness to invest in wind energy

Growing wind industry leads to OEM consolidation and new asset owners

Recent merger/ acquisitions of leading turbine manufacturers

Examples

Y2015

- Acciona Group takes over Nordex and **Nordex** integrates Acciona's wind turbine business
- As part of a larger acquisition, **GE Renewables** integrates Alstom's wind business

Y2016

- Siemens Wind and Gamesa form **Siemens Gamesa Renewables**

Y2017

- **GE Renewables** buys leading blade manufacturer LM Wind Power
- **Enercon and Lagerwey** build a strategic partnership

Y2018

- Vestas buys energy analytics company **Utopus**

Y2019

- Acquisition rumors concerning **Suzlon, Senvion**

* Preliminary
Source: GWEC Market Intelligence, BNEF

Changes among the leading wind asset owners

Examples

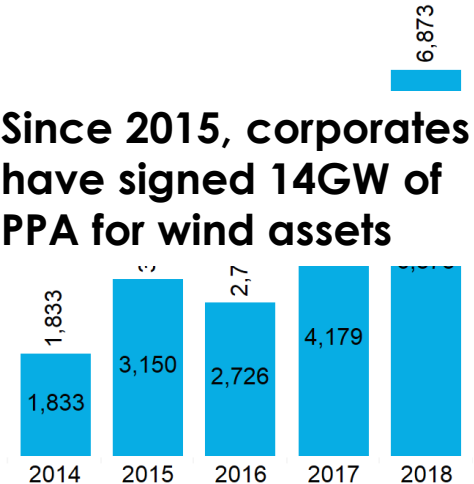
Table 3: Top 20 wind asset owners (cumulative capacity YE 2012)

Rank	Asset owner	Cumulative capacity YE 2012 (GW)*	% market share
1	China Guodian Corporation	13.7	4.9
2	Iberdrola	13.3	4.8
3	NextEra Energy	10.3	3.7
4	China Huaneng Group	7.8	2.8
5	China Datang Corporation	7.4	2.6
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19	RWE	2.0	0.7
20	SSE	1.9	0.7

2012 – Leading wind asset owners are utilities

- Guodian
- Iberdrola
- NextEra

Since 2015, corporates have signed 14GW of PPA for wind assets



Large corporates, investors and financial companies steadily increase their ownerships of wind assets – leading to changes in return expectations

Increased focus on system integration an opportunity for wind

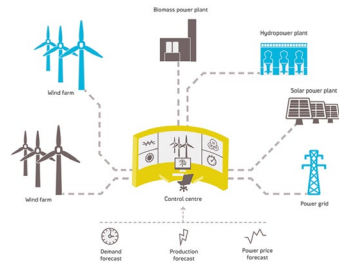
Co-location, Hybrid solution

- Wind energy plus another energy source and/ or a storage solutions
- Fully integrated or combination of several projects
- Sharing of grid access as key element



Complementary solution/ virtual power plant

- Two wind energy projects in different locations
- Virtually managed as complementary solution



Financial solution

(Corporate Sourcing models, free market mechanism/ trading)

- Financial solution with or without physical delivery of electricity
- Includes tools like corporate PPAs, risk management and revenue swaps



Onsite provision, off grid solutions

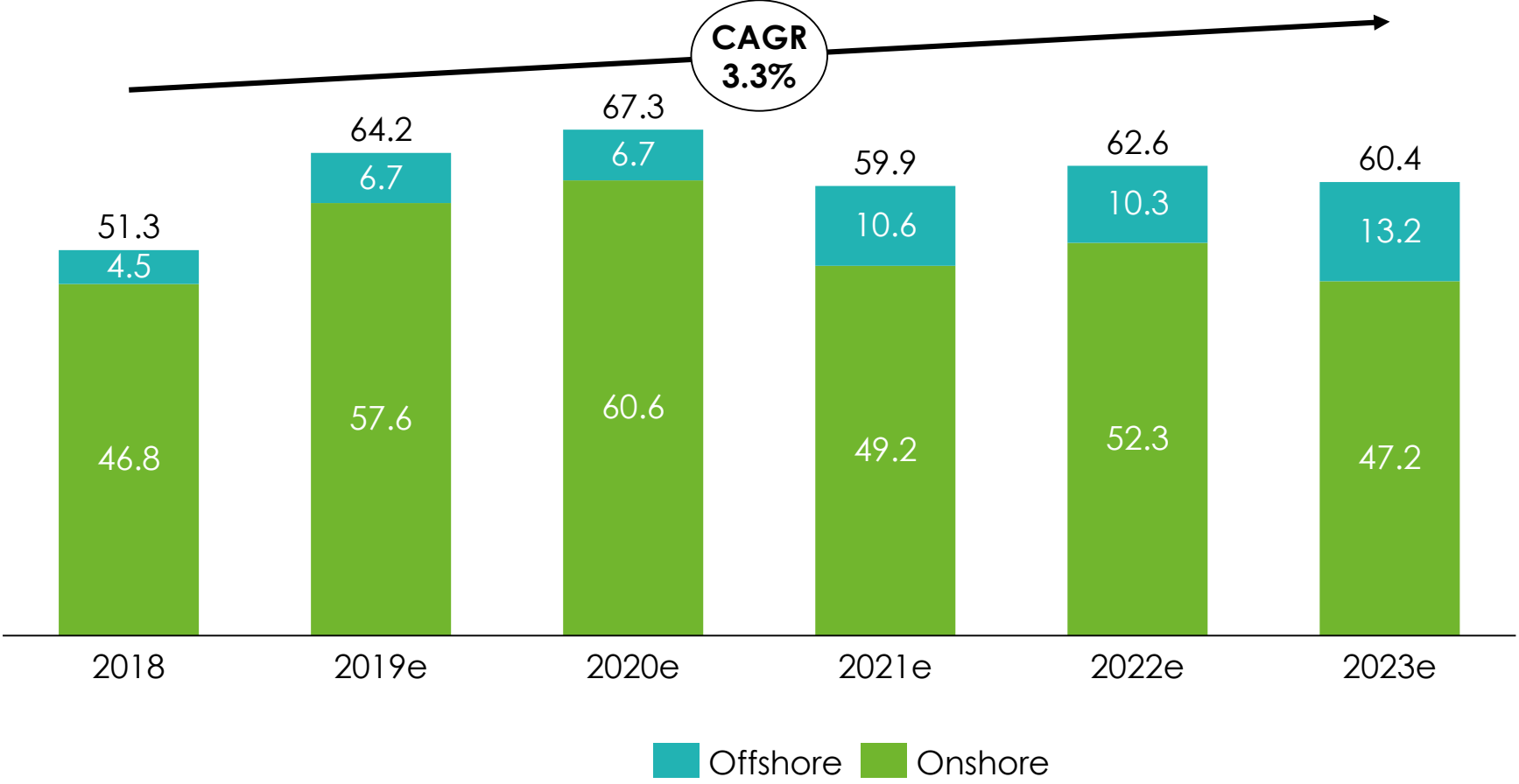
- Micro-grid or decentralized solution
- Can include storage or complimentary energy source to secure supply



Source: GWEC Market Intelligence, Industry experts, Windlab, Equinor (Statkraft), Gamesa

GWEC's outlook on the growth of the wind industry

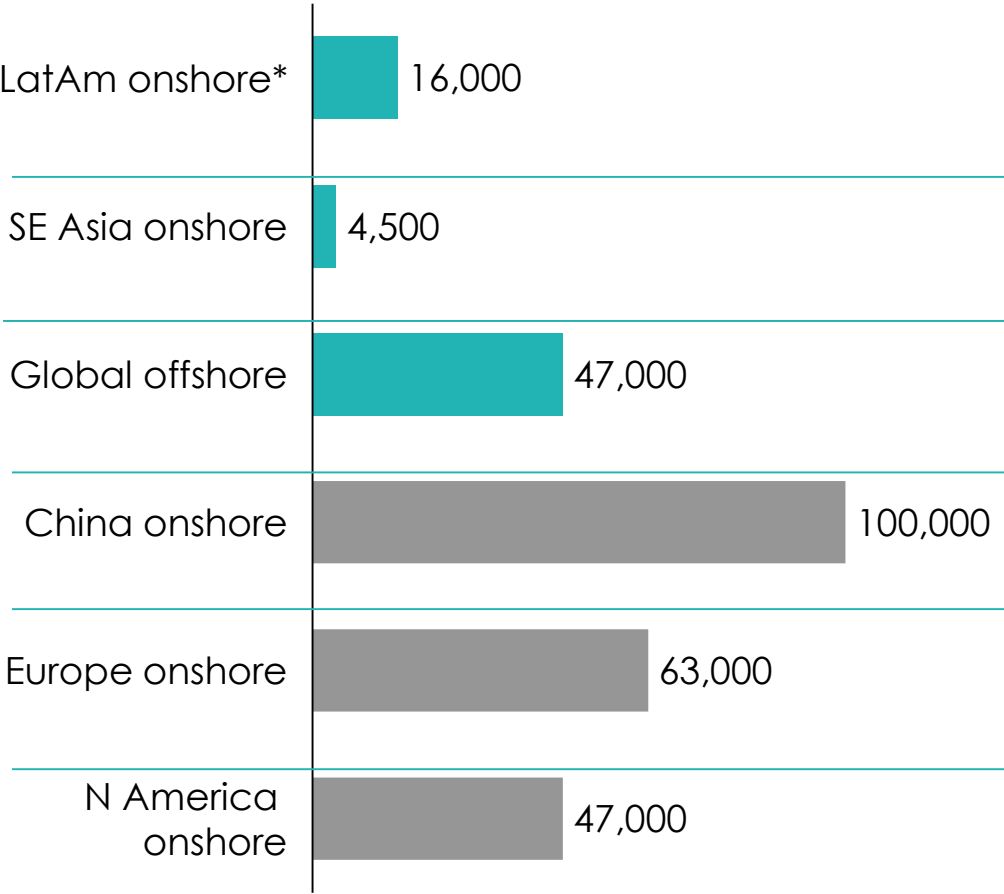
New installations
GW



Source: GWEC Market Intelligence

Asia, Latin America and offshore will drive future growth

Total new capacity between 2019 to 2023 MW



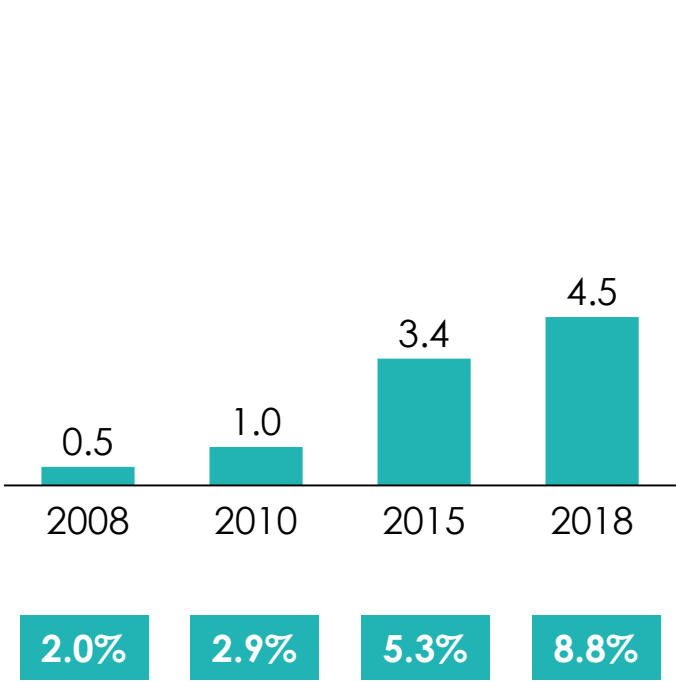
Key growth drivers

- Stable auction schemes and government commitment
- Bilateral/ Open-market opportunities due to competitiveness
- Strong government commitment and competitiveness of wind vs. fossils
- Cost competitiveness, efficiency increases and strong government commitment
- Progress towards market-based mechanisms and competitiveness of wind
- Stable auction, support schemes and competitiveness of wind
- Competitive economics of onshore wind

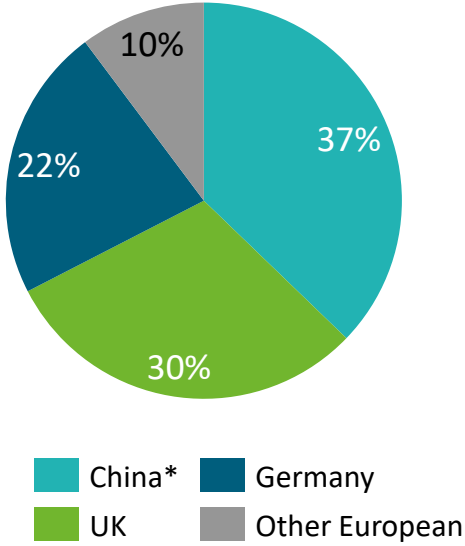
* Including Mexico
Source: GWEC Intelligence

Offshore wind growing globally

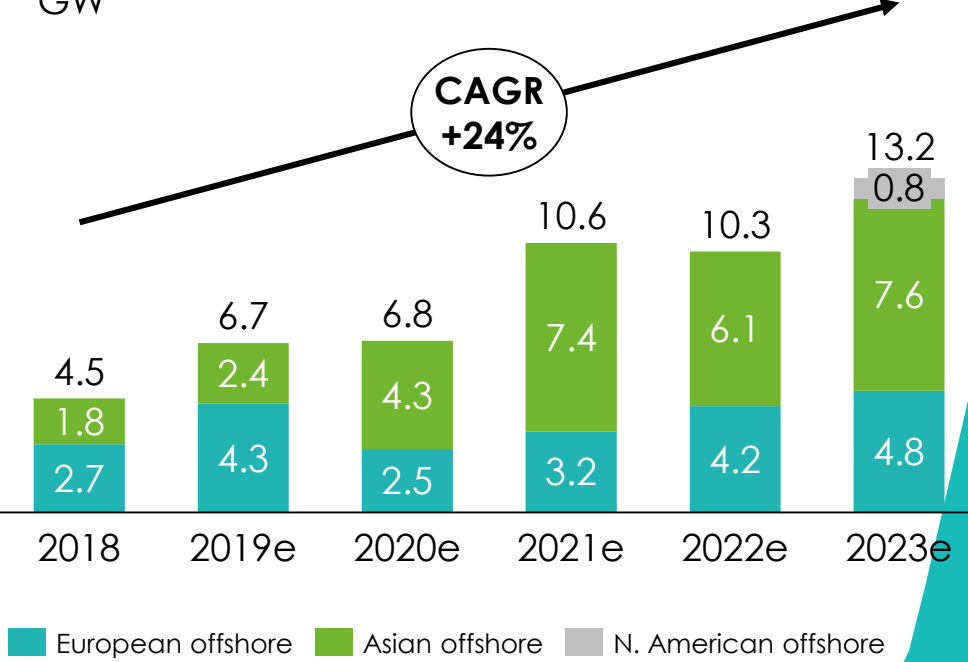
New offshore installations and offshore share of total installations, GW and per cent



New installations 2018
Per cent
100% = 4.5GW



New installations - GWEC's Market Outlook on the global offshore market, GW



* Preliminary
Source: GWEC Market Intelligence

Thank you!

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