



**“ Breakthrough of technology of renewables: is it possible to compete with conventional energy production? Market and technological perspective”?**

# Competitiveness of Renewables

23 November 2017

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CEO Siemens Gamesa Sweden

# Wind Power merged with Gamesa 1 April 2017



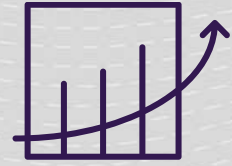
Order Book  
**€20 bn**



Products and technology in  
**90+ countries**



Dedicated employees  
**27,000**



Annual revenue  
**€10 bn**



Installed capacity worldwide  
**75 GW**



Market capitalization  
**€14 bn**

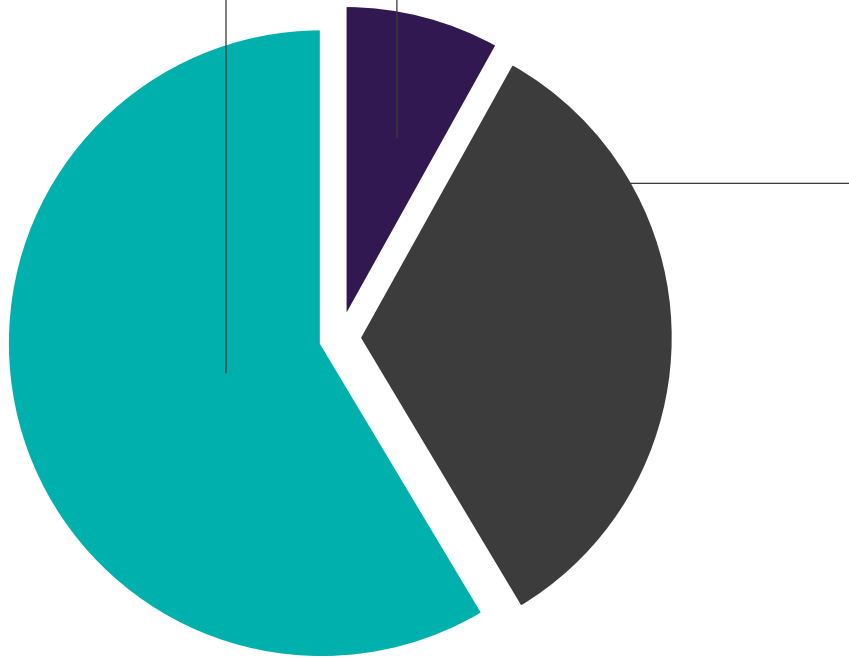
*\* Figures as of May 2017.*

# Siemens Gamesa Renewable Energy Ownership Structure



Siemens AG  
**59%**

Iberdrola  
**8%**



Free-float shares  
**33%**

Siemens Gamesa is a company listed on the Spanish Stock Exchange.

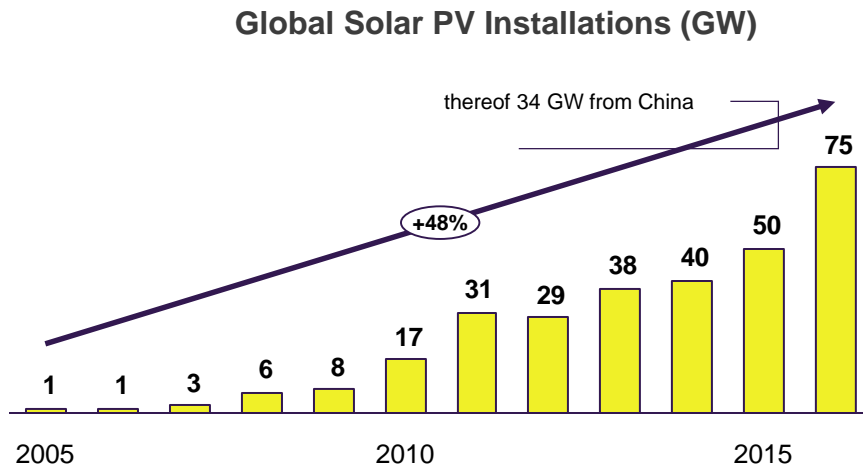
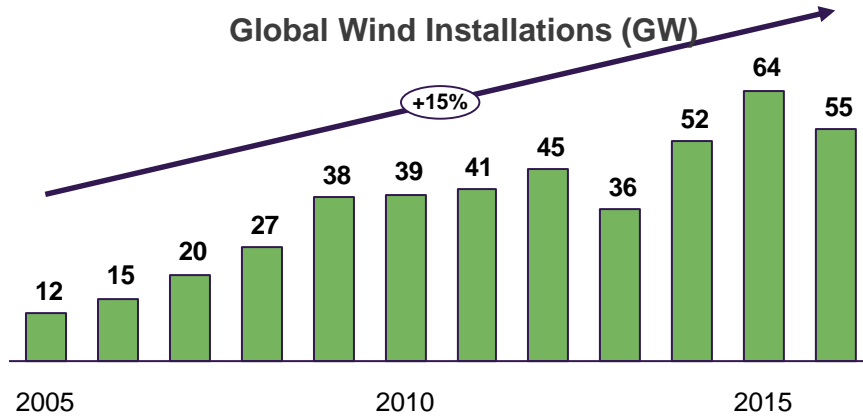
The company is traded on the Madrid, Barcelona, Valencia and Bilbao exchanges, and is a member of Ibex 35.

Breakthrough of technology of renewables:

Is it possible to compete with conventional energy production?

# Market growth and reductions in LCoE are in a positive loop for Renewables

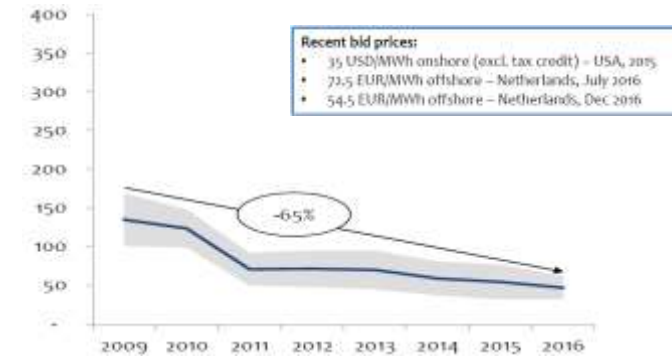
## Global wind and solar PV installations



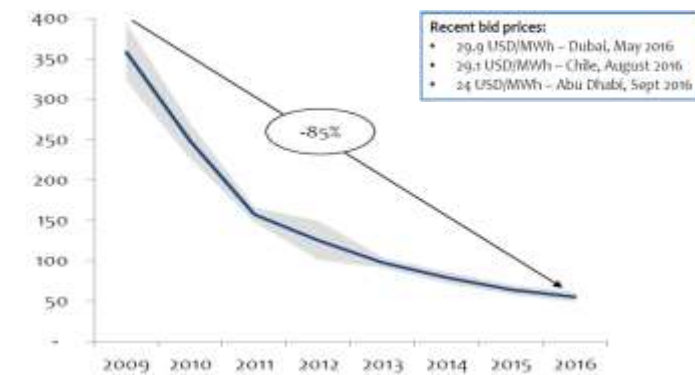
Source: GWEC; IEA-PVPS; IEA; Lazard; Greentech Media; Lawrence Berkeley National Lab

## ...driven by improved economics of RE

### Levelized cost of Wind Power (US\$/MWh)

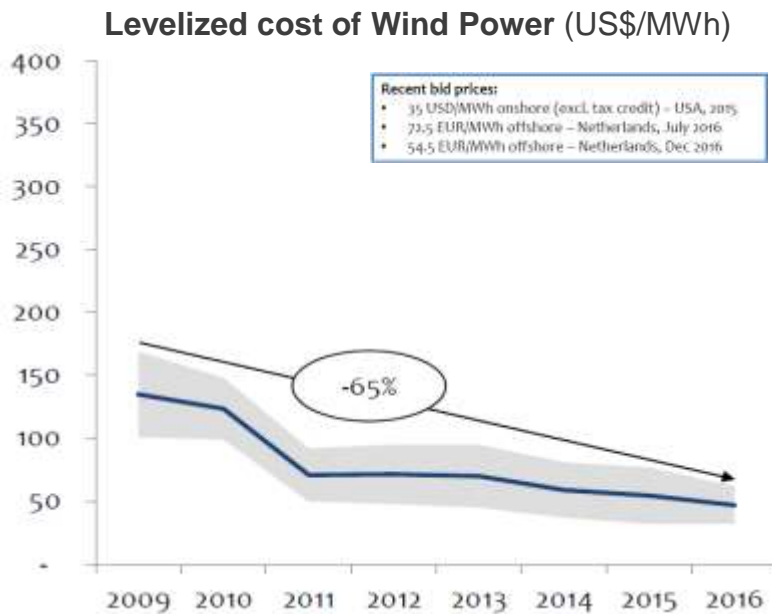


### Levelized cost of utility-scale PV (US\$/MWh)



# LCoE of Wind Power continuously decreases through factors such as technological developments, lower production costs and cheaper financing

Wind Power LCoE development (\$/MWh)<sup>1</sup>



$$LCoE = \frac{CAPEX + OPEX + WACC}{AEP}$$

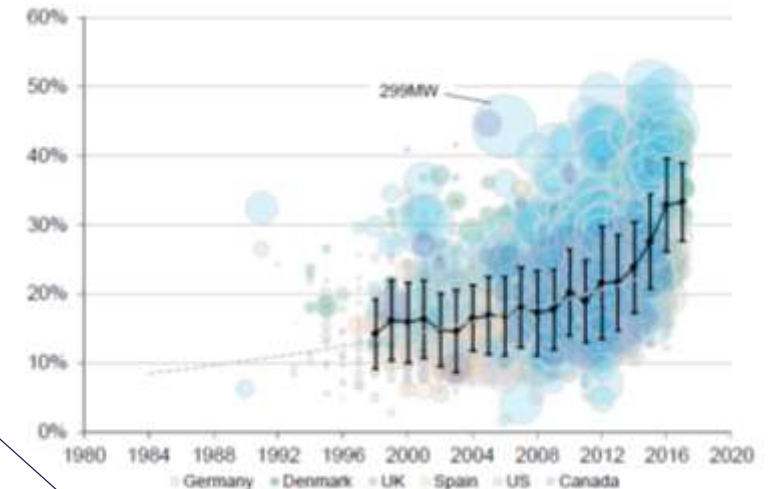
Biggest impacting factors:

- **CAPEX:** Turbine, installation etc.
- **WACC:** Financing cost
- **OPEX:** Service
- **AEP:** Energy production

Higher energy production by:

- Larger generator,
- increased rotor diameters and
- increased hub heights

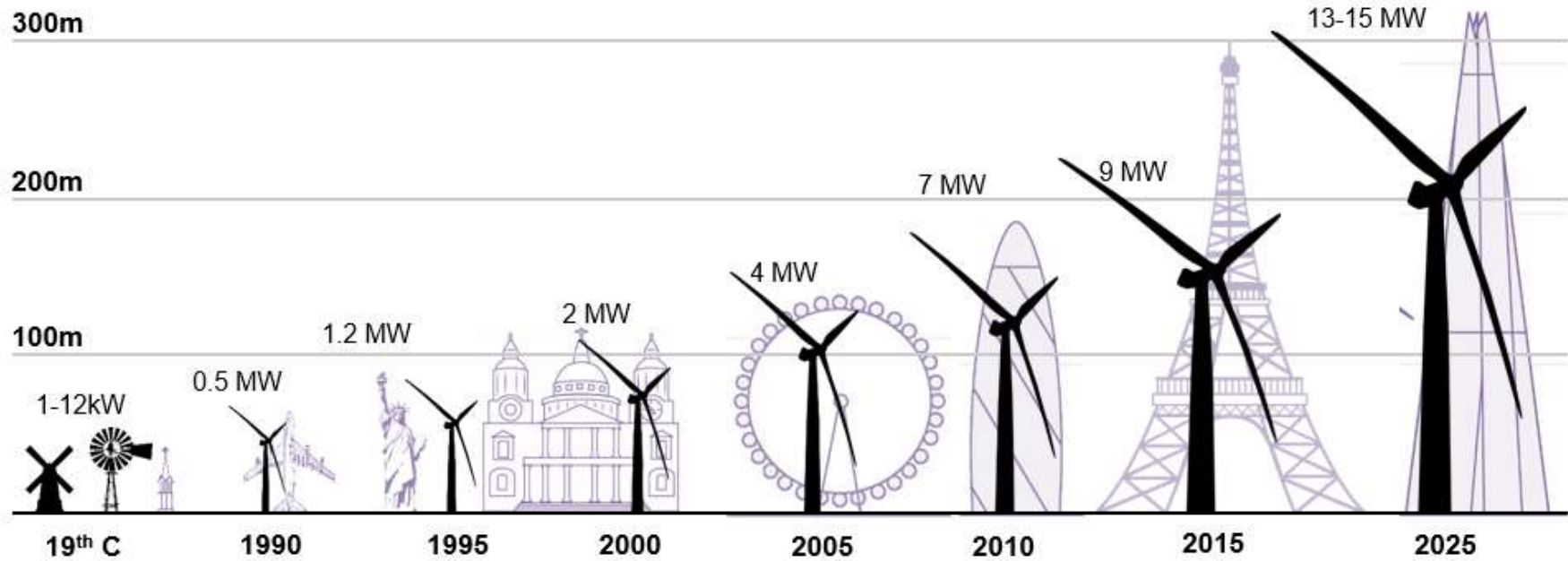
Energy production development



1) WP ST LCoE calculations based on 13% learning curve for each doubling of capacity and IHS Autonomy (Jul-16) capacity additions forecast, Wind ON forecast: BNEF LCOE 17H1 report

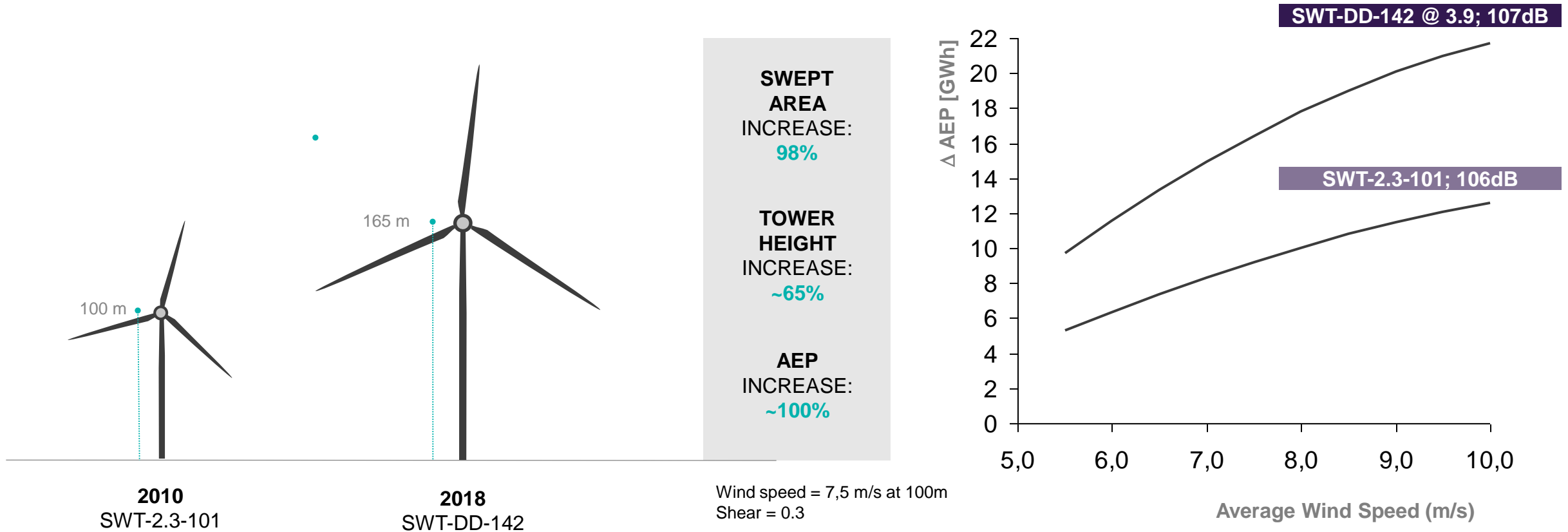
# Turbine dimensions have increased exponentially

## Evolution of wind turbine heights and output



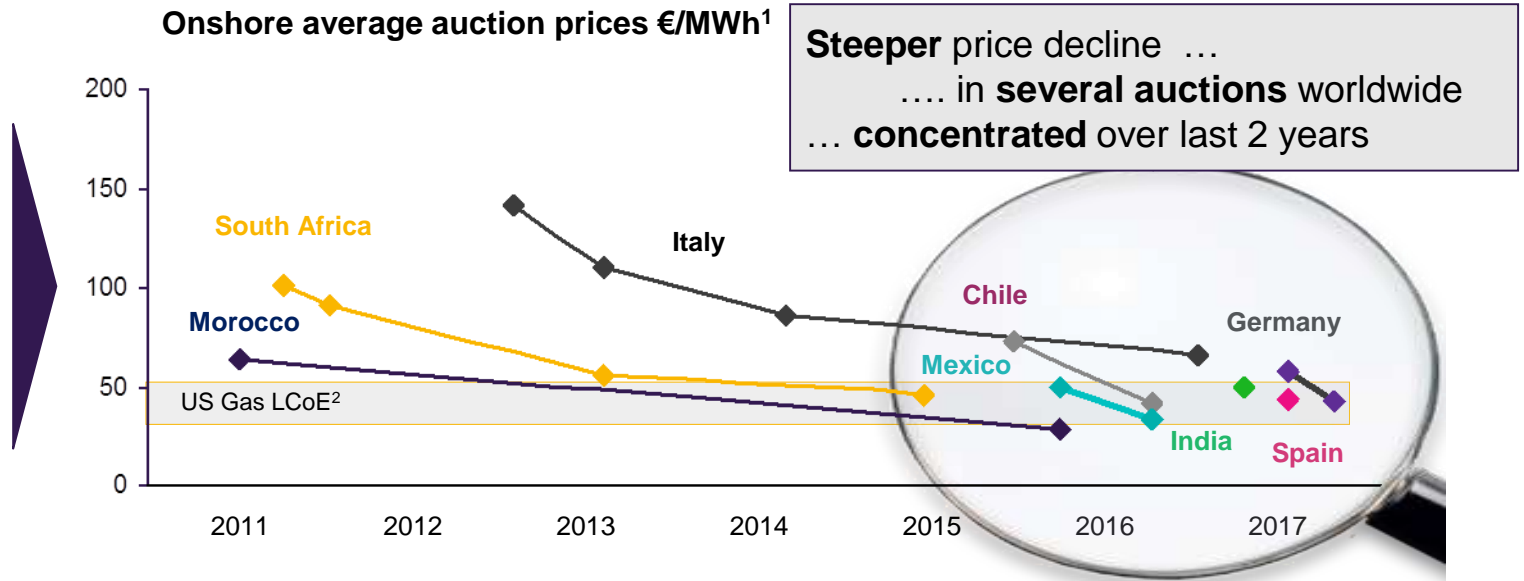
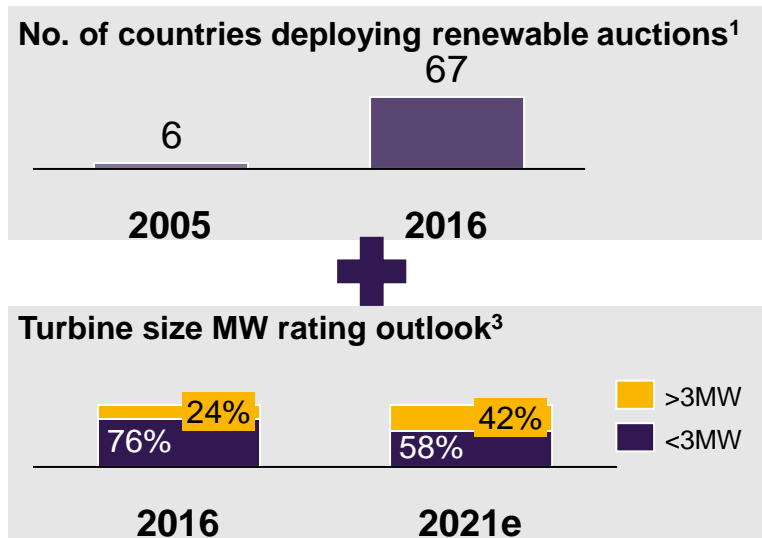
Sources: Various; Bloomberg New Energy Finance

# Production has doubled in less than 10 years.





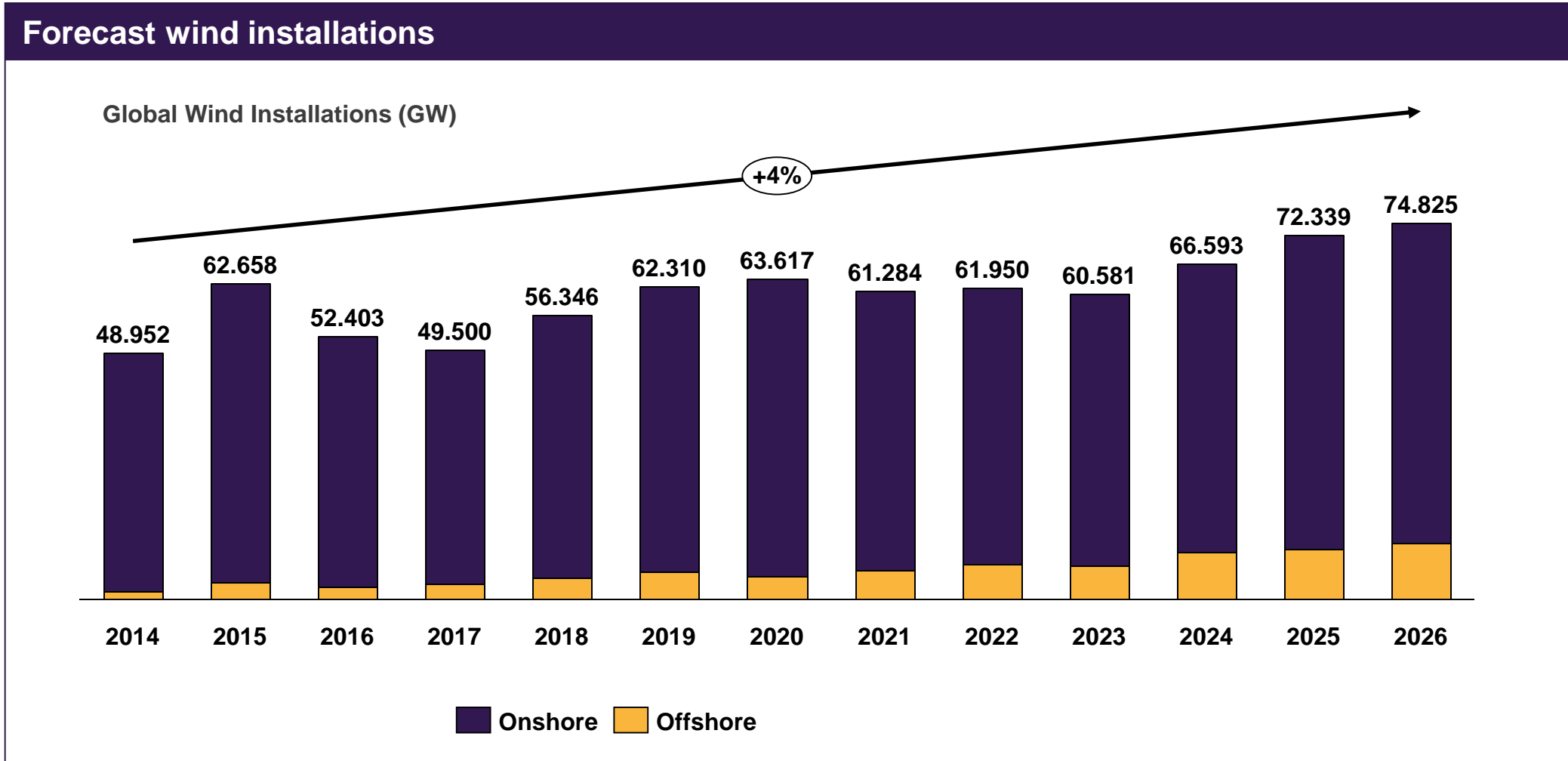
# Technological development and widespread introduction of auction schemes is driving price per MW down



- Clear global trend towards **auction based** market mechanism for new wind power installation leads to **aggressive price decrease**
- Technological development (e.g. higher ratings) within wind turbines leading to lower LCoE

1) IRENA 2017 & own data source 2) BNEF NEO 2016 3) MAKE 2016 turbine trends report

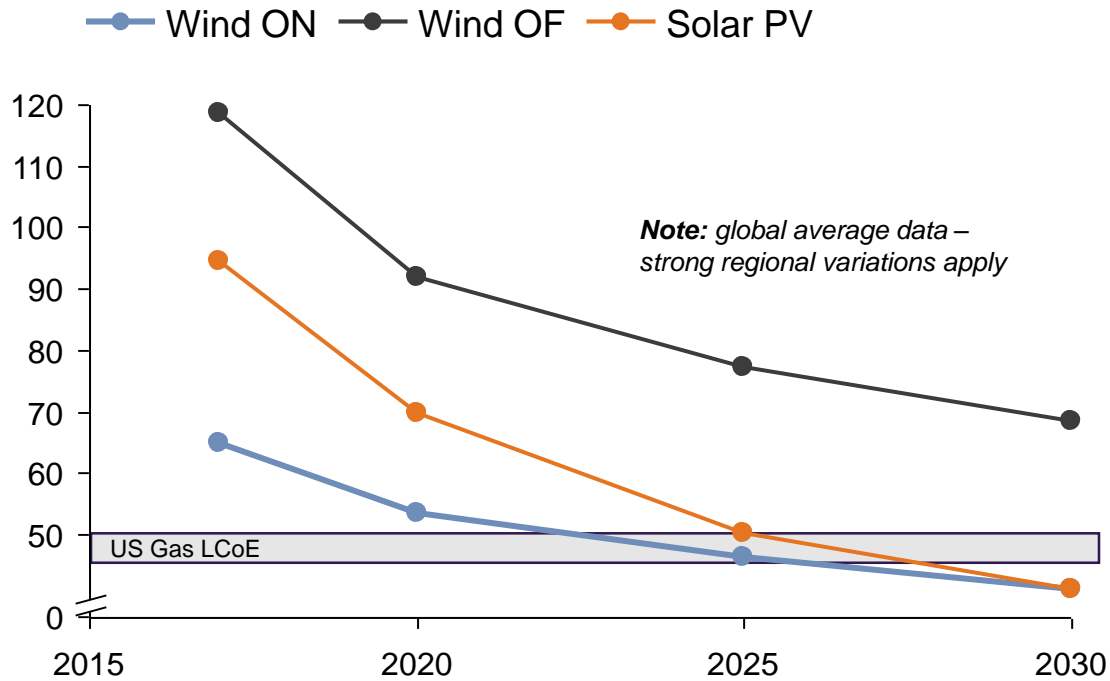
# Wind power installations are expected to continue on high level with moderate yet sustained growth



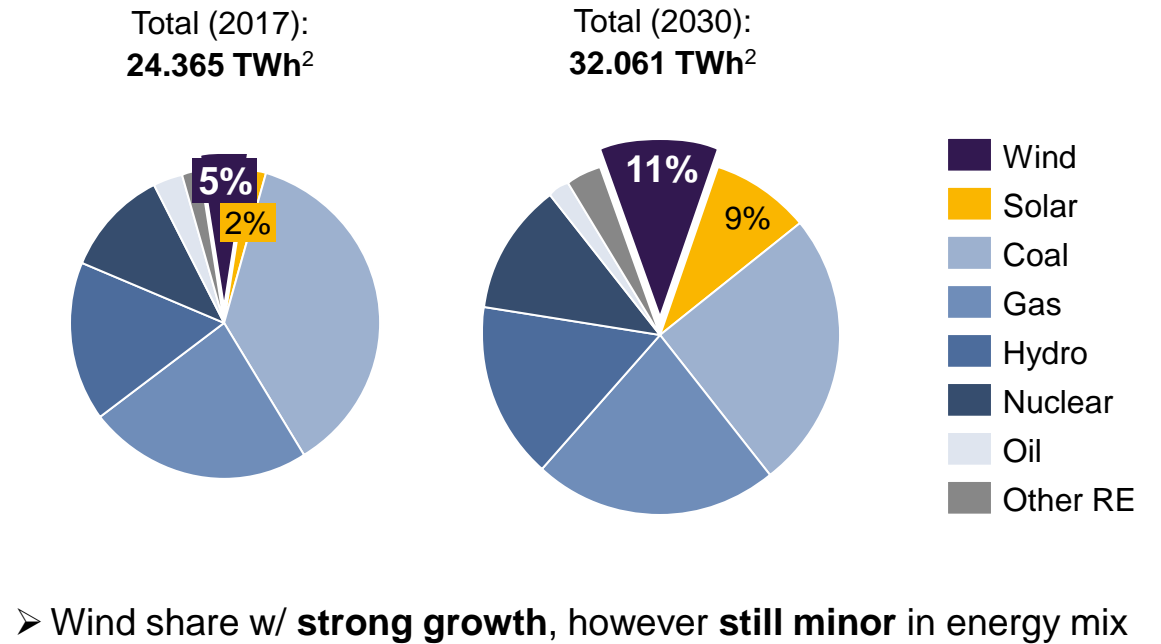
Source: MAKE Q3/2017 Onshore Market Outlook, 2014–2026e (incl. repowering)

# The future: LCoE reduction over past decades expected to continue, making wind a preferred choice for our customers

LCoE development (\$/MWh)<sup>1</sup>



Electricity production (in TWh)<sup>2</sup>



1) WP ST LCoE calculations based on 13% learning curve for each doubling of capacity and IHS Autonomy (Jul-17) capacity additions forecast  
**Wind ON + Solar PV** forecast: BNEF LCOE 17H1 report weighted avg. LCoE of CN, US, IN, CA, GE, UK, MX, BR, JP, AU (Apr-17), **US Gas** forecast BNEF NEO 2016  
 2) IHS Autonomy (July 2017)

**We are at the tipping point when renewables can be the economically smart choice**

**“Nothing Trump Does Can Save Coal  
Don't blame liberals and regulations; blame  
capitalism and technology.”**

Bloomberg 15 November 2017 19:21

**Maybe the questioned needs to be rephrased**

**Breakthrough of technology of renewables:**

**is it possible for conventional energy production to compete with renewables?**

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**Competitiveness of Renewables**

**Thank you!**

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