

# Capital Markets Day 2019 >

Hamburg, 16 October 2019





Today's topics

— EnBW



**Thomas Kusterer, CFO:**  
Corporate and Financial Strategy



**Dirk Güsewell, SVP Generation Portfolio Development:**  
EnBW Renewables – Highlights 2019, market trends and progress



**Dr. Hannah König, Head of Wind and Maritime Technology:**  
From bottom fixed to floating wind projects

**Thomas Kusterer, CFO**

Corporate and Financial Strategy

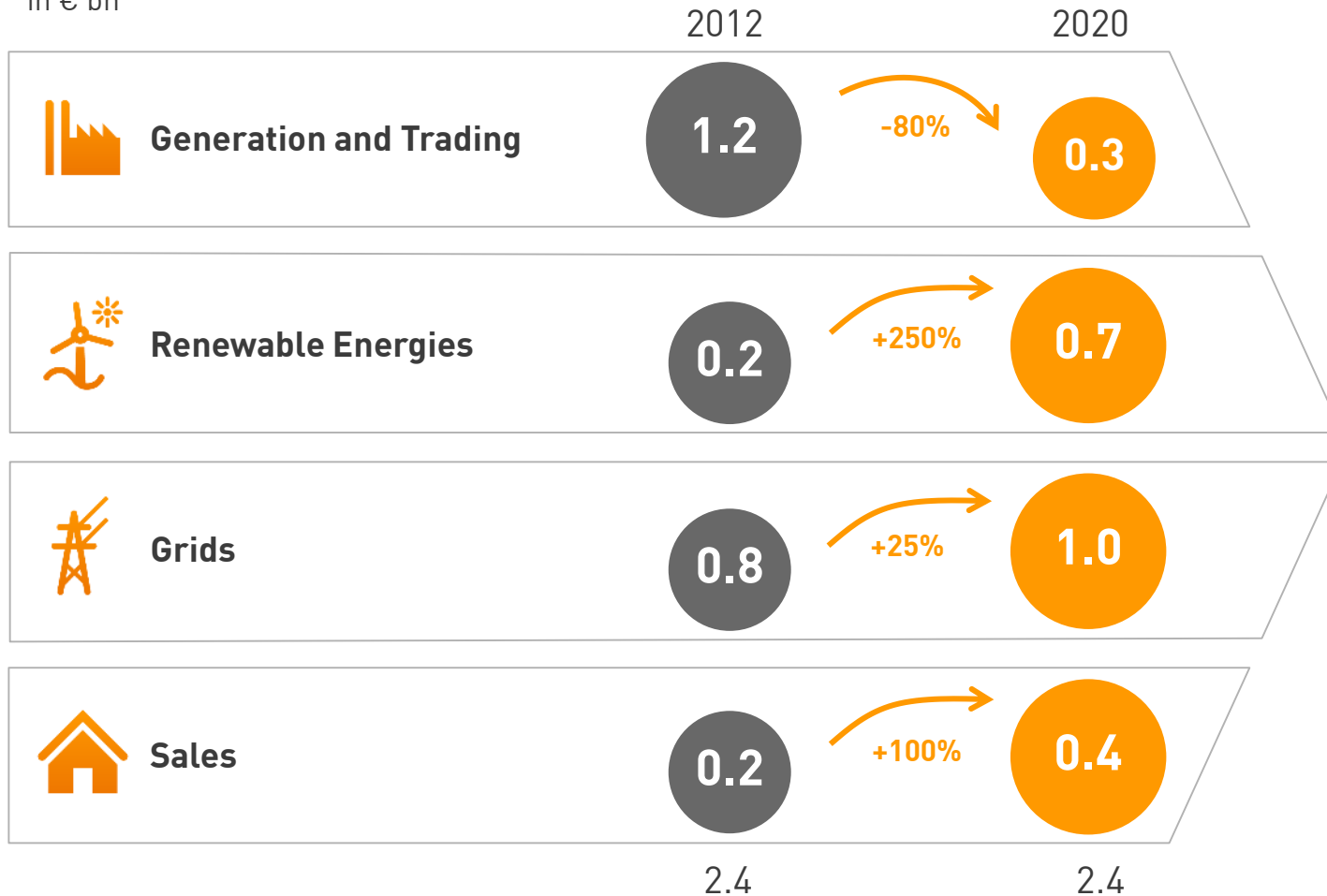


# Strategy 2020: Successful transformation process - earnings target likely to be achieved in 2019



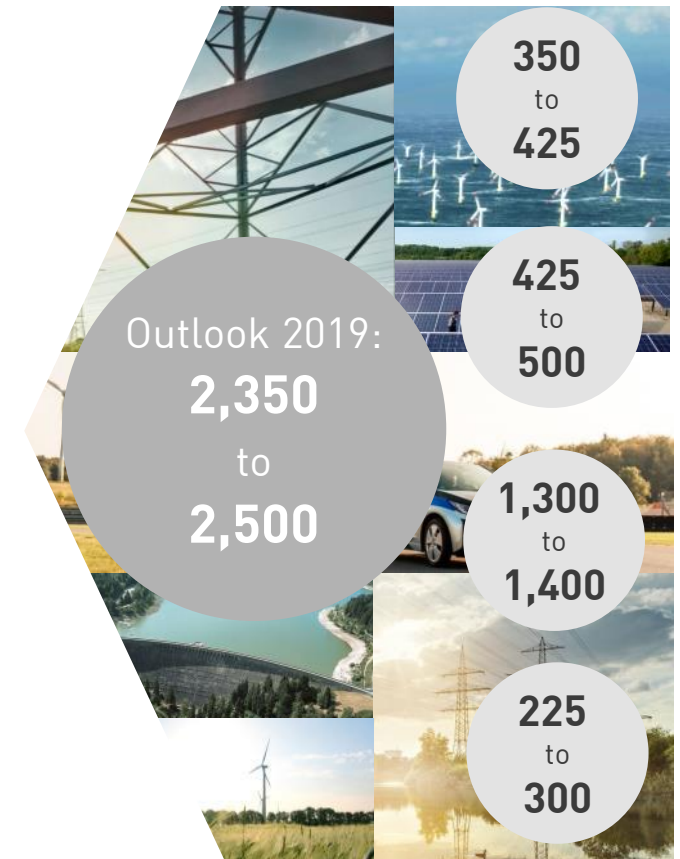
## Adjusted EBITDA

in € bn



## Adjusted EBITDA

in € m



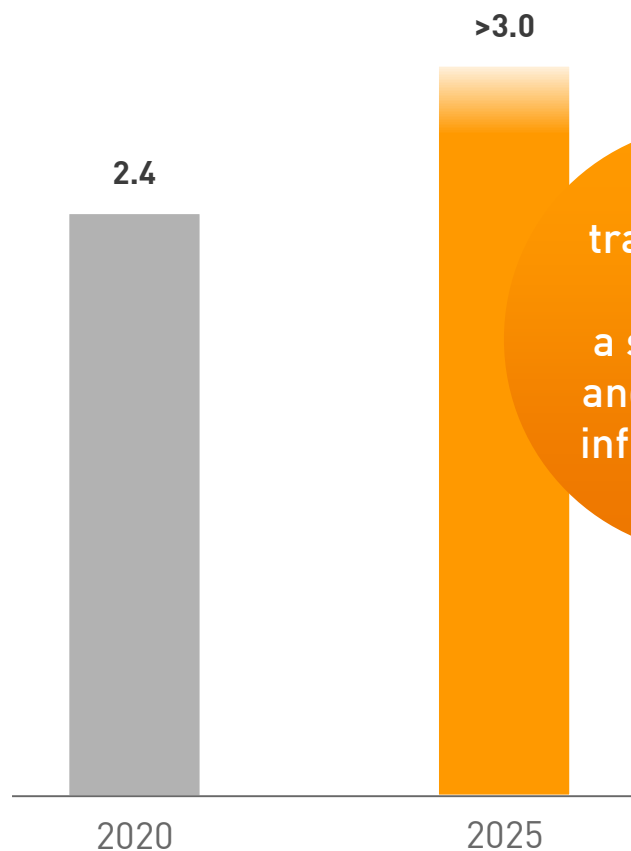


# Strategy 2025: From transformation to growth, acquiring two attractive assets in 2019 already



## Target of increasing the adjusted EBITDA

in € bn



EnBW is transforming itself into a sustainable and innovative infrastructure partner

- > Balanced business portfolio
- > High proportion of stable regulated business
- > Attractive risk-return profile

## Acquisitions support EnBW's strategic development



Purchase price  
~€600 m

Wind & Solar

Telecom

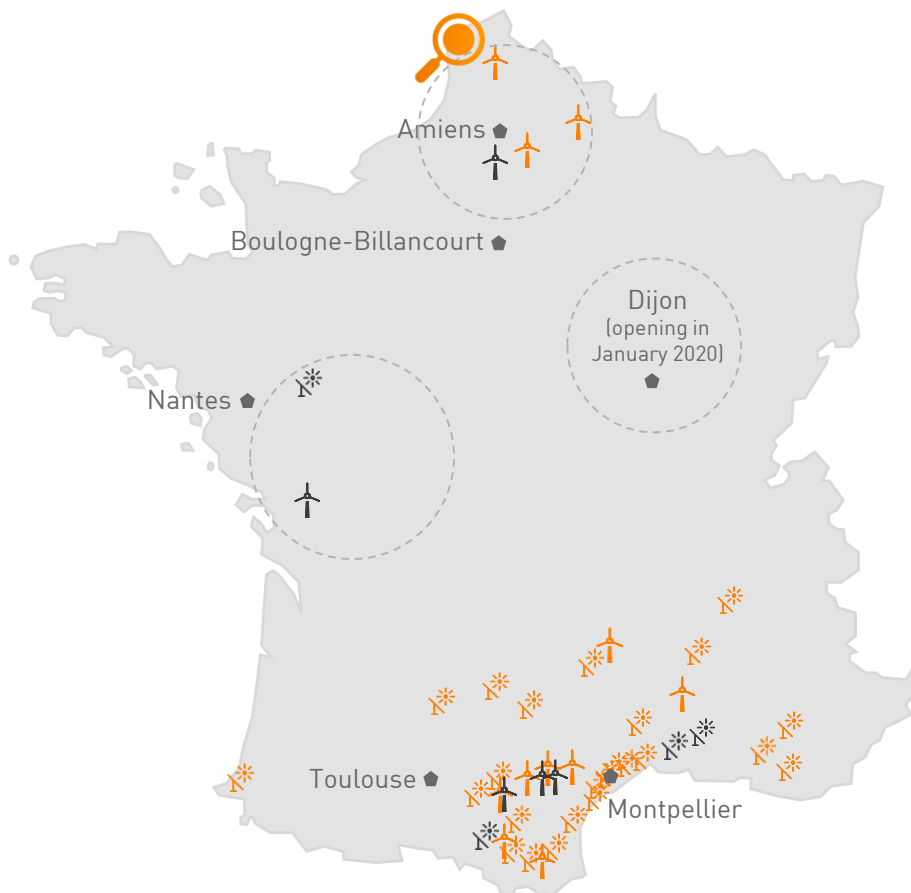
Purchase price  
~€230 m

plusnet






# Valeco's pipeline enables further diversification of wind and solar plants

## The Valeco wind and solar asset portfolio 2019



**Audincthun wind farm** commissioned in summer 2019  
6 Enercon E-92/2.35 MW turbines – installed capacity 14.1 MW



- > Develops, owns and operates
  - > onshore wind 
  - > solar and 
  - > small hydro projects 
- > Main focus on the French Market
- > 133 employees
- > Generation portfolio as of 30.9.2019:
  - > 344 MW wind (100 MW fully consolidated)
  - > 60 MW solar (28 MW fully consolidated)
- > Valeco develops and enhances a wind onshore and solar PV pipeline of approx. **1.7 GW** with **promising market potential** (esp. Hauts-de-France, Bourgogne-Franche-Comté, Nouvelle-Aquitaine)



# Valeco acquisition contributes to EnBW's strategy 2025 – expansion of sustainable generation infrastructure



- > Increase in **production capacity** by 100 MW (at least 35 MW fully consolidated) in 2020
- > **EBITDA contribution** of approx. €15 to 20 m in 2020<sup>1</sup>



- > Solid growth and business model with a **high market potential** based on a **favourable regulatory framework** in France

- > Significant move towards achieving the **strategic target** of 1,000 MW onshore wind capacity by 2020



- > **Portfolio diversification:**
  - > Experienced management and operational team
  - > Project pipeline and strong brand

- > Ideal platform for **synergies and development of business model**



- > **Medium term target:** One of the top five wind and solar players in France

<sup>1</sup>May be higher depending on further full consolidation



# Plusnet well positioned as a nationwide B2B telecom operator with an attractive product portfolio



## Key highlights

### Customers

- > Overall ~25,000 business customers
- > No cluster risk – customer base well diversified

### Sales Organisation

- > Significant experience in B2B sales with long-term employees
- > Strong direct sales channel
- > Indirect sales network with more than 300 partners

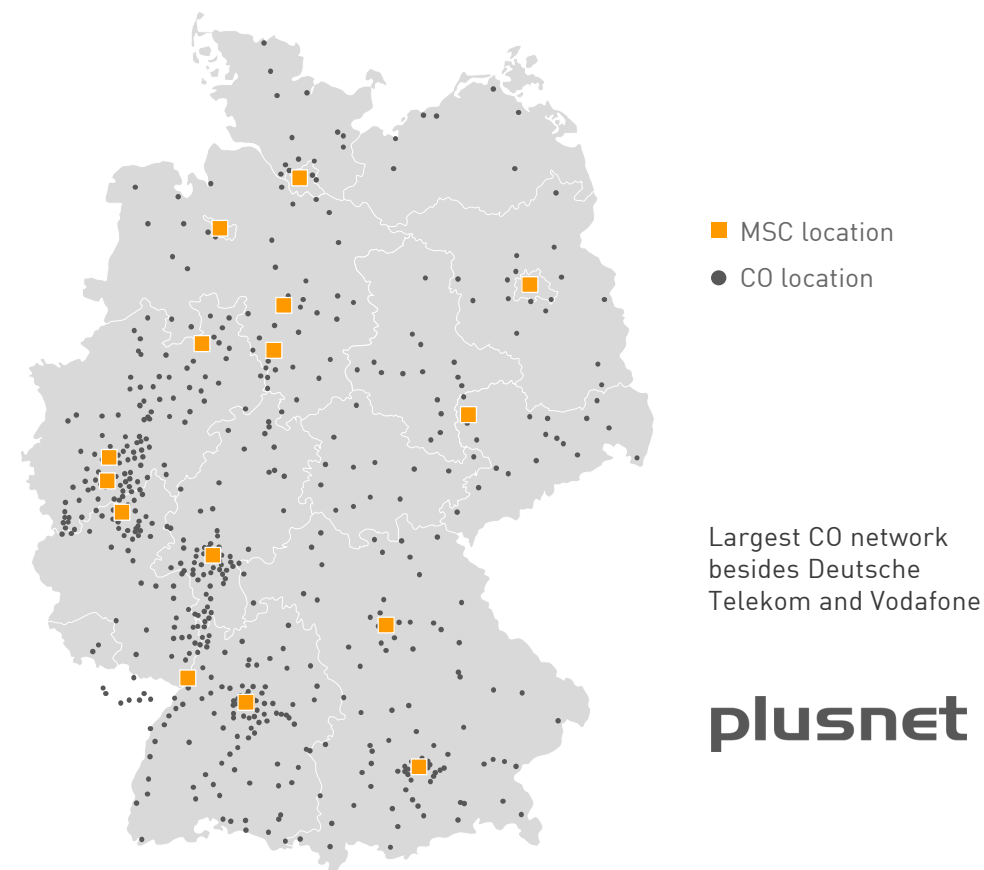
### Network

- > Fully invested, state-of-the-art redundant 100 Gbit/s backbone
- > Business (DSL)-markets: 3rd largest copper-based access network with **1,445 central offices**
- > Largest independent B2B WLL network in Germany: **~150 base stations** and **~1,050 customer links**

### Municipal utility companies in Germany

- > Well positioned to be the go-to provider of
  - > network services
  - > white label
  - > open access solutions

## Central offices network



**plusnet**



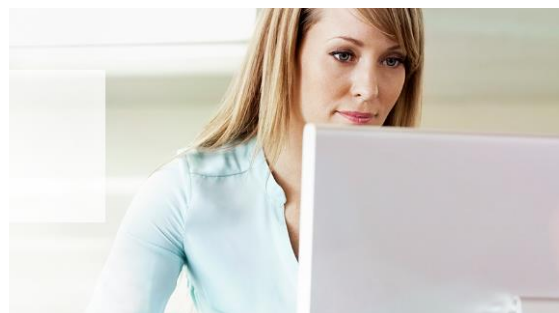


# Plusnet acquisition contributes to EnBW's strategy 2025– developing EnBW into a nationwide infrastructure provider



## > **Complements NetCom's**

highest-capacity fibre-optic networks in BaWü serving >40% of the state's municipalities



- > Sale of **higher value products** (higher bandwidth) to existing B2B customers

- > Plusnet will submit offers to several hundred German **municipal utilities** to plan and operate their networks

# plusnet

## > **Low-risk business model:**

Capex mainly customer driven – no strategic network investments necessary over the next years

- > **Large projects** with well-known large retailers in negotiation or even implementation phase



- > **Consolidating** smaller and regional DSL-networks of other market players



# EnBW sticks to its conservative financial policy



Until  
2020

Internal financing capability:

**RCF / cash-relevant net investments**

Due to acquisitions of Valeco and Plusnet

- > In 2019 below 100%
- > 2017–2020 on average <100%

From  
2021

Debt repayment potential:

**RCF / Net debt**

Higher investments of ~ €2 bn p.a., mainly in grids

- > Suedlink
  - > ~ €10 bn transmission grid project together with TenneT
  - > Intended commercial operation date: 2025
- > Renewables e.g. selective internationalisation

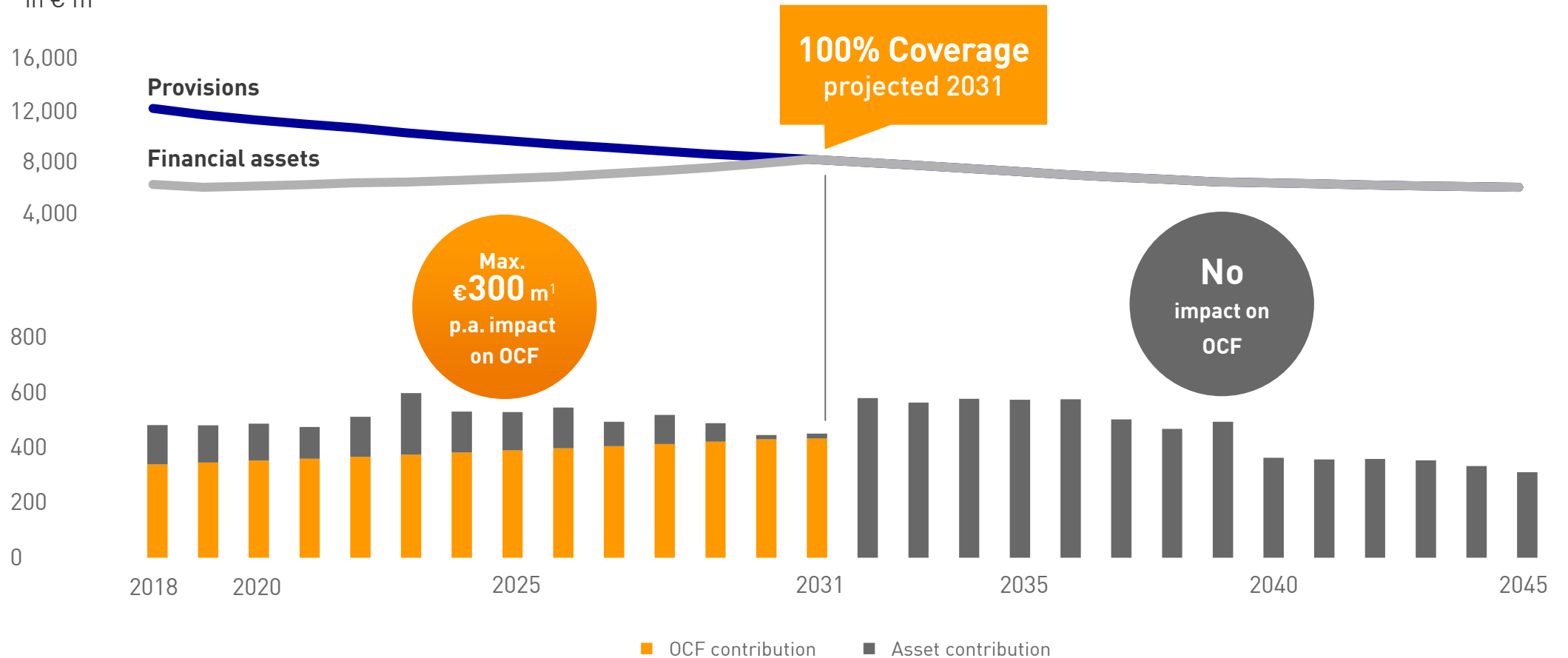


# Cash flow-based ALM model expresses EnBW's high financial discipline despite current interest rate environment



## EnBW's cash flow-based model

in € m



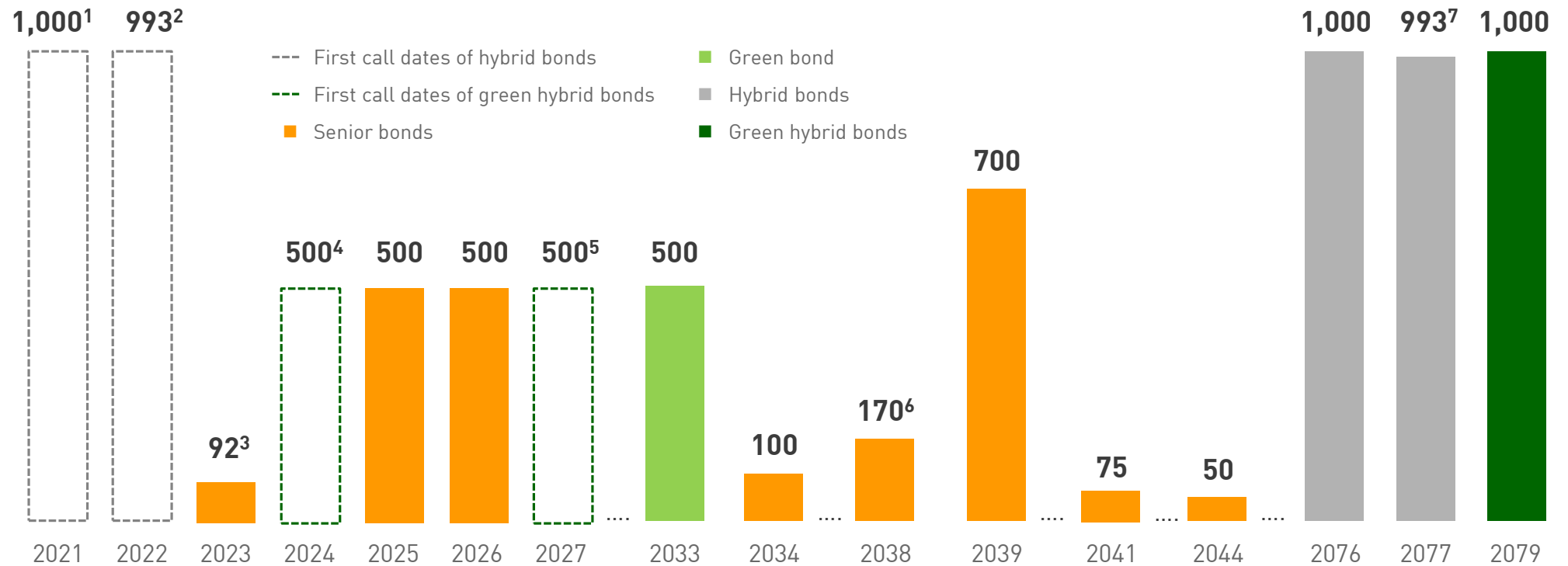
<sup>1</sup> Adjusted for inflation

OCF: Operating cash flow



# Hybrid capital supports senior debt holders

in € m



<sup>1</sup> First call date: hybrid maturing in 2076

<sup>2</sup> First call date: hybrid maturing in 2077; includes USD 300 million (swap in €), coupon before swap 5.125%

<sup>3</sup> CHF 100 million, converted as of the reporting date of 5.8.2019

<sup>4</sup> First call date: hybrid maturing in 2079

<sup>5</sup> First call date: hybrid maturing in 2079

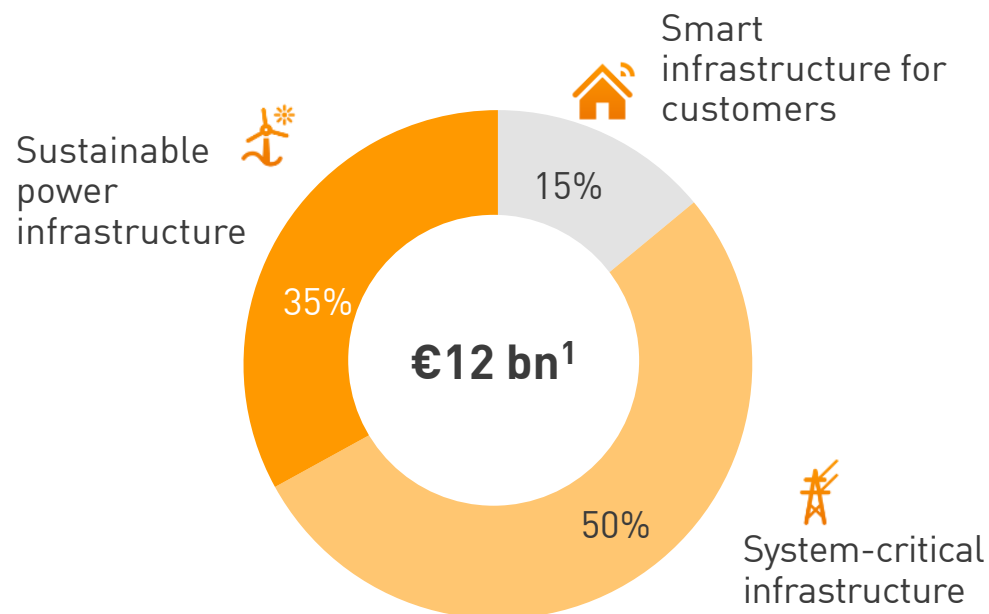
<sup>6</sup> JPY 20 billion (swap in €), coupon before swap 5.460%

<sup>7</sup> Includes USD 300 million, converted as of 5.10.2016



In phase of growth high financial discipline will be maintained

**Allocation of investment spending 2021-2025, thereof 80% in growth**



- > During growth phase rating target remains a solid investment grade rating
- > Further liquidity requirements for managed growth
- > Having a wide variety of funding options, EnBW is likely to become a more frequent issuer in the coming years
- > Support with hybrid capital and partnership models where necessary

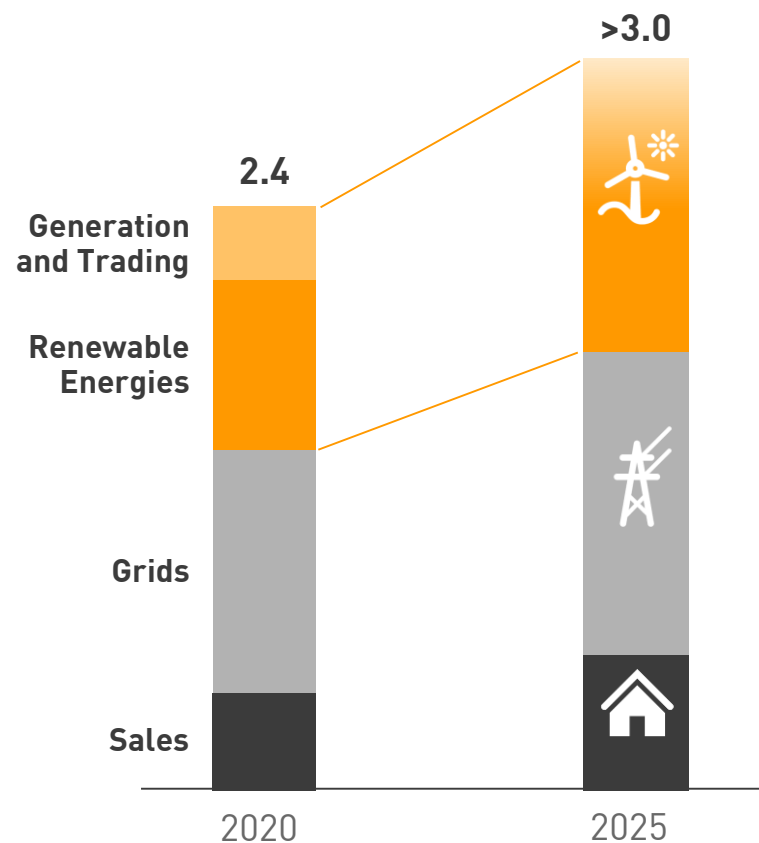


# Strategy 2025: EnBW – a sustainable and innovative infrastructure partner



## Development of earnings

Adjusted EBITDA in € bn



### Sustainable power infrastructure

- › Expansion of renewable energies:
- › Offshore wind
- › Onshore wind and photovoltaics
- › Selective international business activities
- › Active design of decarbonization



### System-critical infrastructure

- › Profitable growth in the distribution grid
- › Significant expansion of electricity transmission grid: Suedlink together with Tennet
- › Growth of network-related service



### Smart infrastructure for customers

- › Reorganisation and digitisation of B2C sales as well as transformation to customer infrastructure business
- › Expansion of the solution portfolio: Contracting
- › New infrastructure-related business areas beyond energy

**Dirk Güsewell, SVP**

**Generation Portfolio Development**

EnBW Renewables – Highlights 2019,  
market trends and progress



1

**EnBW renewables: 2019 highlights at a glance**

2

**Market trends and progress of EnBW's strategy**

3

**Deep dive: Offshore windfarm projects EnBW Hohe See, EnBW Albatros (in construction) and EnBW He Dreiht (planned)**

4

**Offshore wind: Floating offshore technology outlook**





1

**EnBW renewables: 2019 highlights at a glance**

2

Market trends and progress of EnBW's strategy

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Deep dive: Offshore windfarm projects EnBW Hohe See, EnBW Albatros (in construction) and EnBW He Dreiht (planned)

4

Offshore wind: Floating offshore technology outlook



# Renewable Energies at EnBW: Highlights 2019 so far at a glance



- H1 2019: Adjusted EBITDA €204.9 m (up €40.1 m/24.9% on H1 2018); with €425 m - €500 m full year significant increase (up 43%-67%) expected compared to 2018
- Installation of EnBW Hohe See and EnBW Albatros OWPs<sup>1</sup> on track – €415 m EBITDA/year fully consolidated from first full year of operation onwards
- Progress of planning for next OWP EnBW He Dreiht on schedule
- Acquisition of French renewables developer and operator Valeco closed in June
- FID<sup>3</sup> in JV Borusan EnBW Enerji for Turkish onshore wind farms Saros (146 MW) and Kiriköy (72 MW) (YEKDEM feed-in tariff, US\$-based)
- FID for Weesow-Wilmersdorf open-space solar project (184 MW<sub>p</sub>) – first non-feed-in-tariff solar project in Germany

## But:

- Threat of low new builds and new permit approvals for onshore wind in Germany with challenging mid-term outlook

<sup>1</sup> Offshore wind farm project

<sup>2</sup> Commercial operations date

<sup>3</sup> Final investing decision



1

EnBW renewables: 2019 highlights at a glance

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**Market trends and progress of EnBW's strategy**

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Deep dive: Offshore windfarm projects EnBW Hohe See, EnBW Albatros (in construction) and EnBW He Dreiht (planned)

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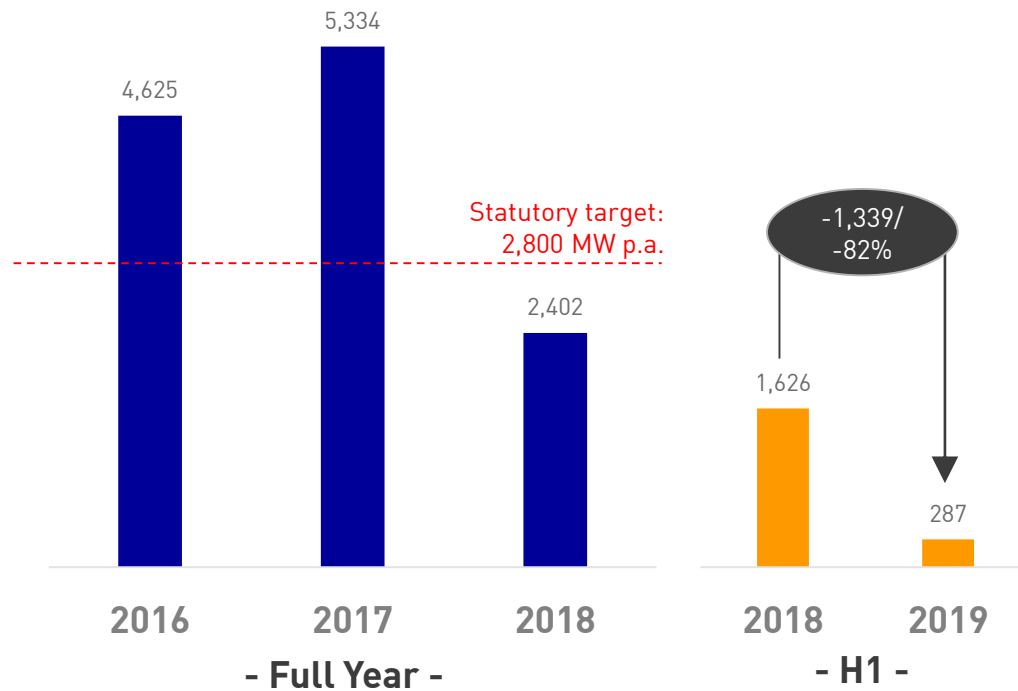
Offshore wind: Floating offshore technology outlook



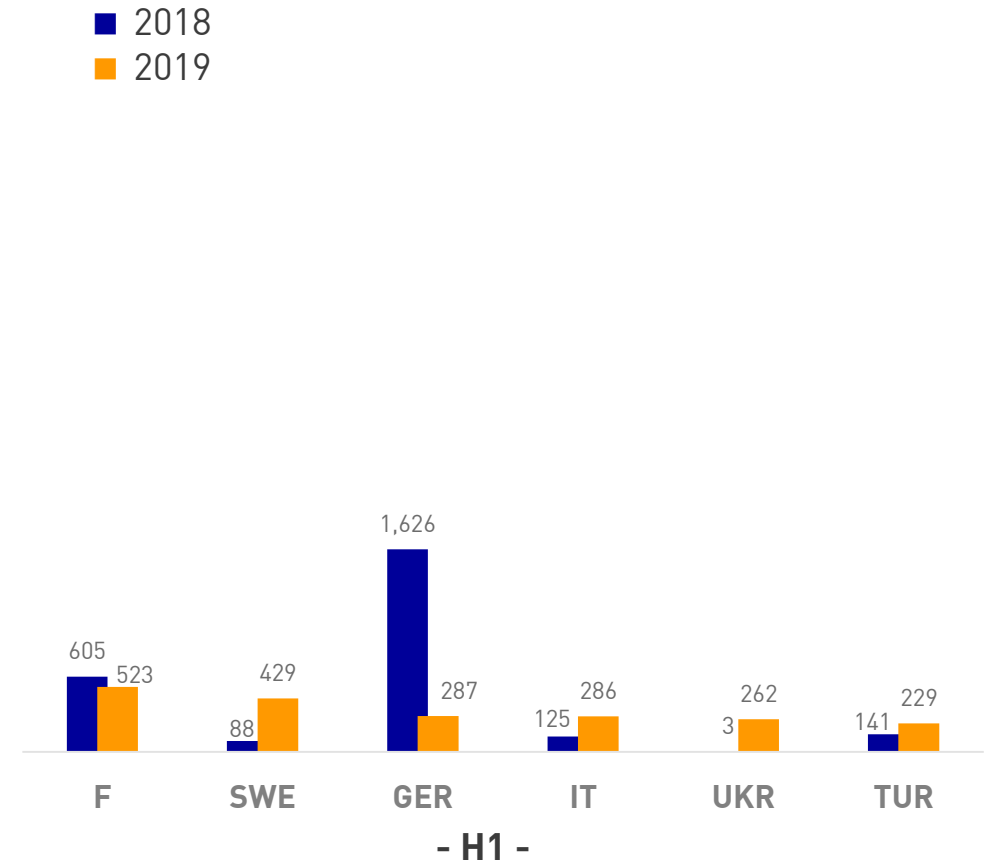
# Market trends: Onshore wind (1/4): Sharp decline in new installations in Germany ...



### New installations, Germany in MW



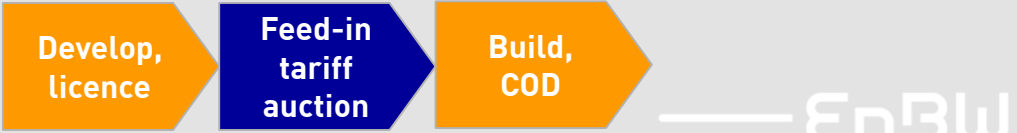
### New installations, Europe in MW



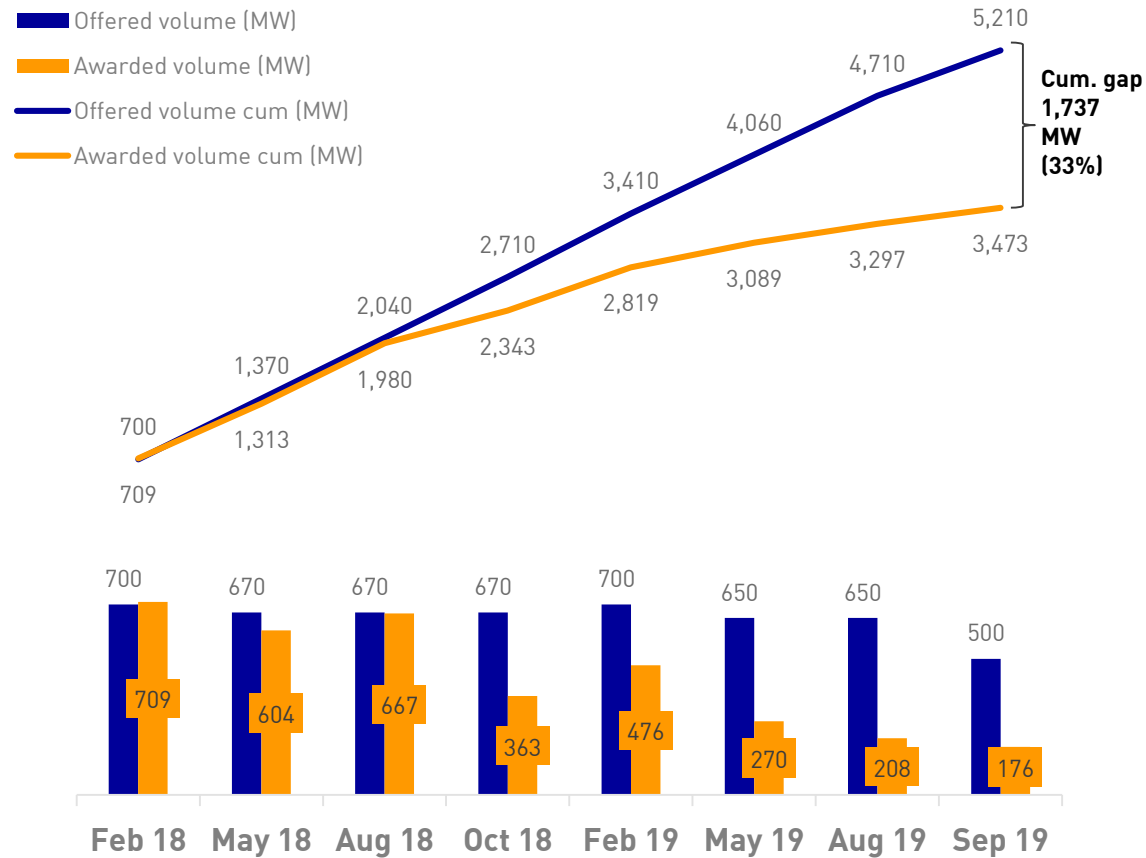
Source: Deutsche WindGuard; WindEurope



# Market trends: Onshore wind (2/4): ...with low participation in feed-in tariff auctions ...



## Feed-in tariff auctions, Germany in MW



## Explanation

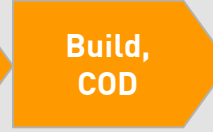
- > Decreasing auction participation quota since 2018. Example: September 2019:
  - > Offered volume: 500 MW
  - > Awarded bids: 176 MW (35%)
  - > Offer surplus: 324 MW
- > Offer surplus is growing, cumulative gap by September 2019: 1,737 MW/33% of total volume offered – foreseeable gap for new installations in 2020
- > Due to lack of competition in the auctions, successful bids close to maximum permissible bid (6.2 cents/kWh)
- > Main precondition for participation: obtained licence

Source: Bundesnetzagentur



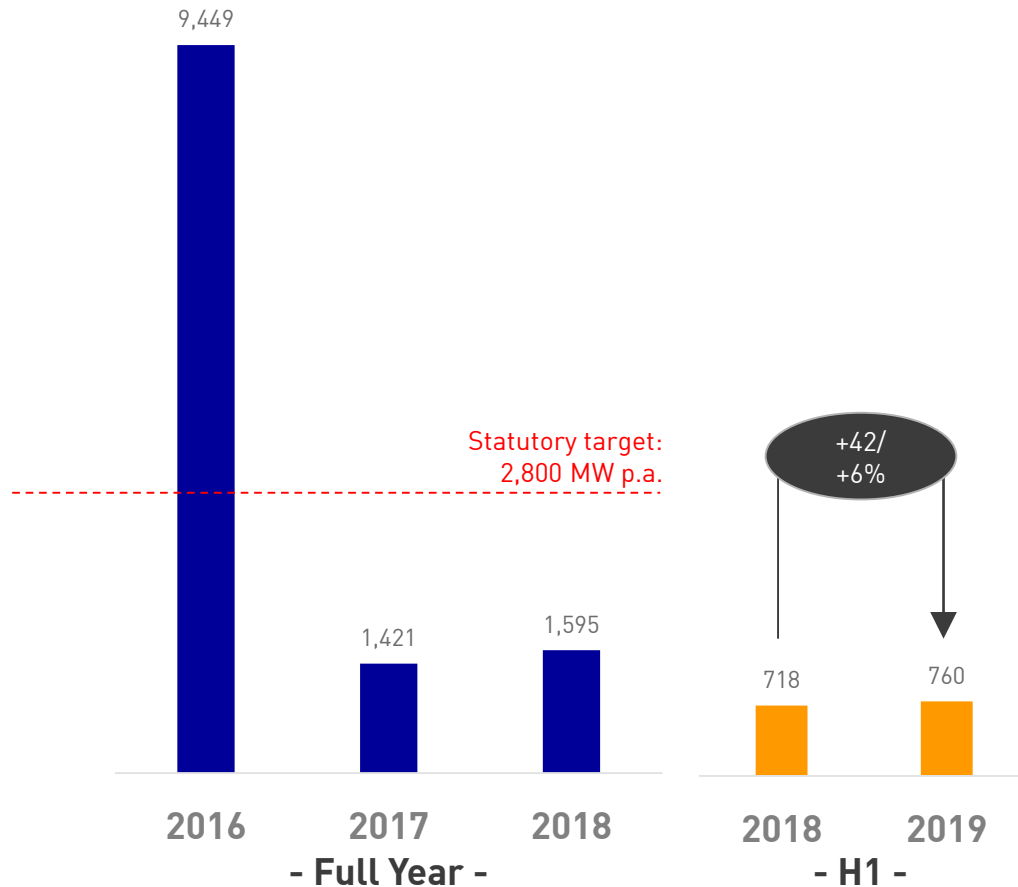
Market trends: Onshore wind (3/4):  
 ... caused by low new licences;

→ no prospects of major change in mid-term ...



### Newly issued licences (BlmSchG)

in MW



### Explanation

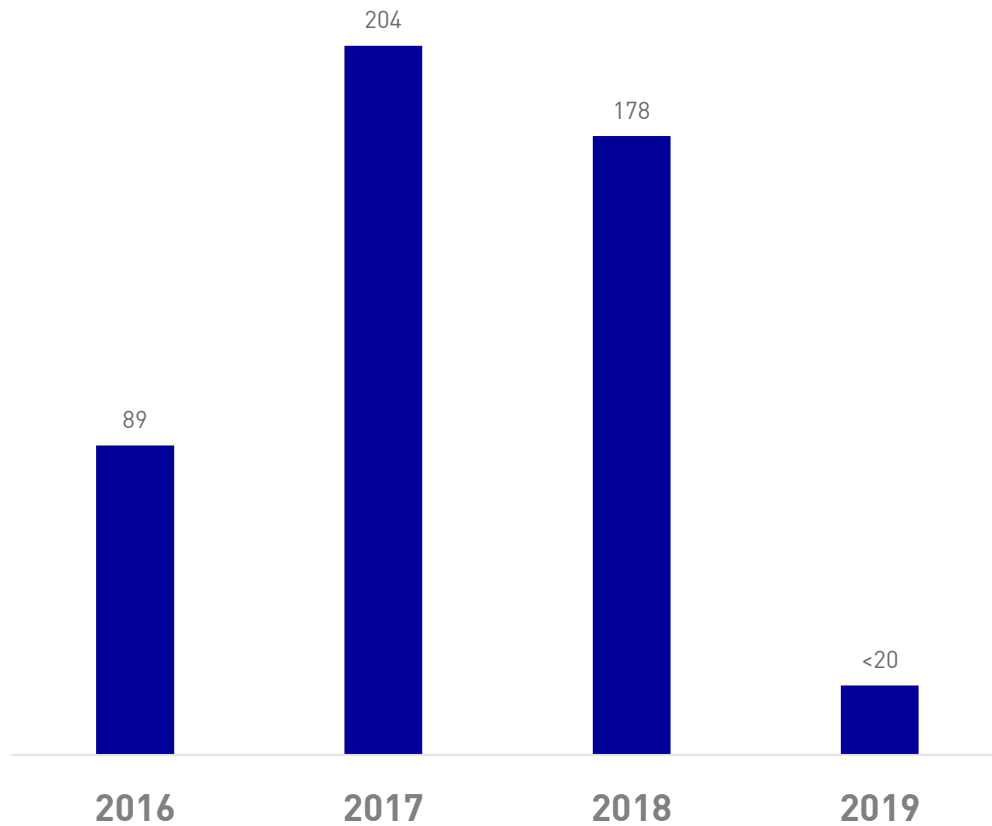
- > New permits alarmingly low due to ...
  - > Tremendous delays in public zoning procedures (“Landesentwicklungsplan”, “Regionalpläne”, “Flächennutzungspläne”);  
→ No BlmSchG permit without zoning
  - > Tremendous delays and extraordinary effort involved in all permit procedures (e.g. environmental impact studies)  
→ Increasing developing costs and risks
  - > Only few new areas being made additionally available for wind energy use
  - > Ongoing discussion on public acceptance
- > As new permits remain low, we expect no recovery of the market in the mid-term



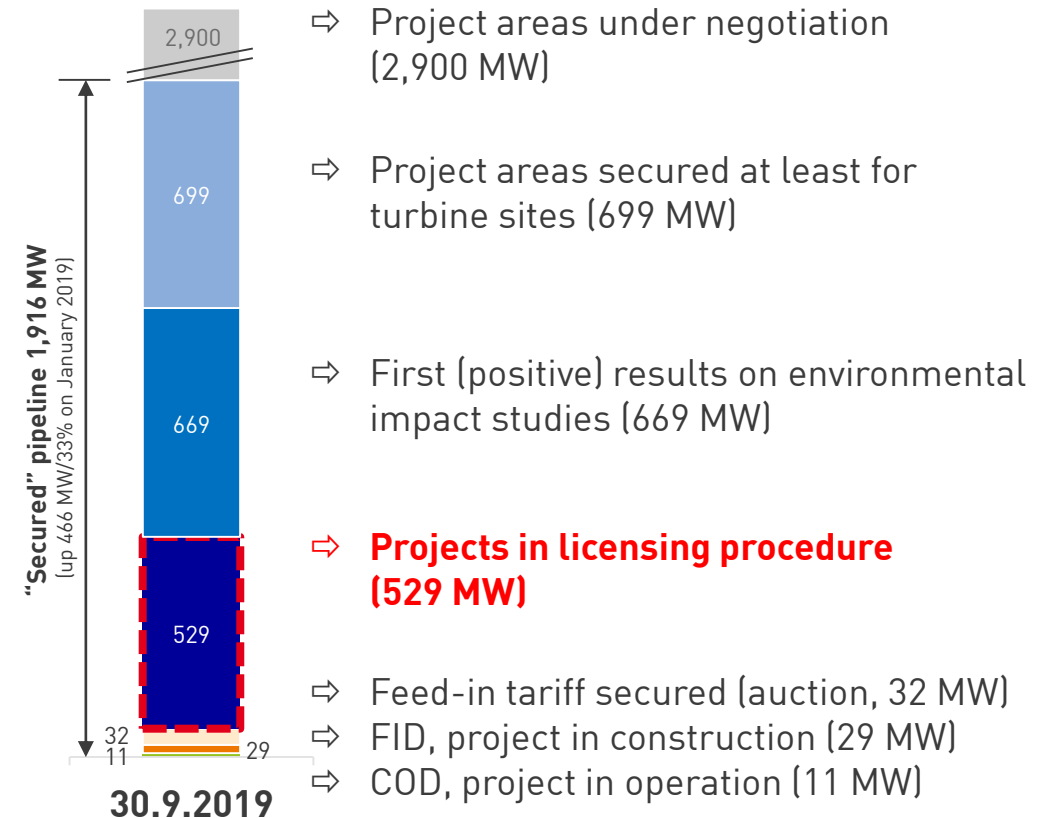
# Market trends: Onshore wind (4/4): ... and EnBW suffers with the market



**New installations EnBW**  
in MW



**EnBW AG project pipeline**  
by stages; in MW



Source: EnBW (including inorganic growth)

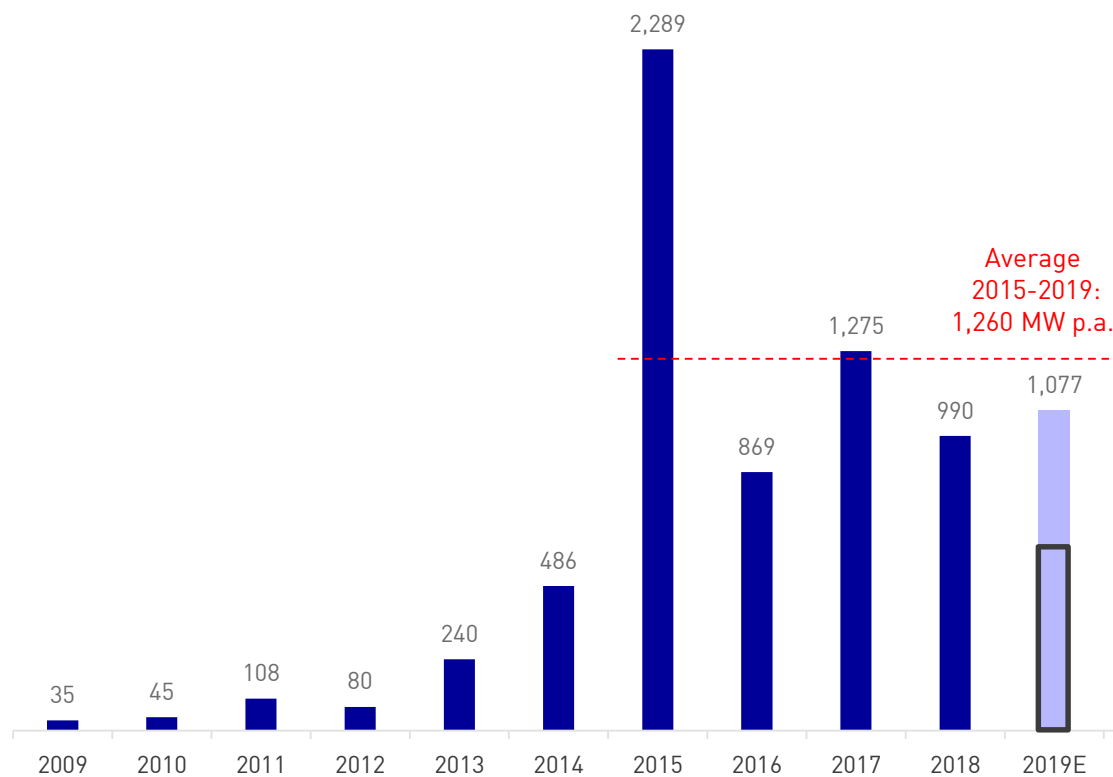


# Market trends: Offshore wind (1/2): Germany with low-ambition targets ...



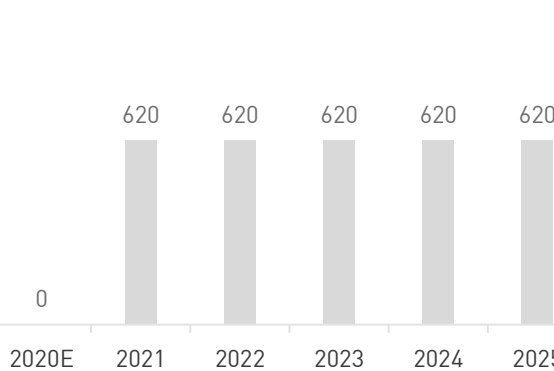
## New installations ... 2009-2020: German Renewable Energy Sources Act (EEG)

- State target by 2020 (6.5 GW in operation) likely to be exceeded



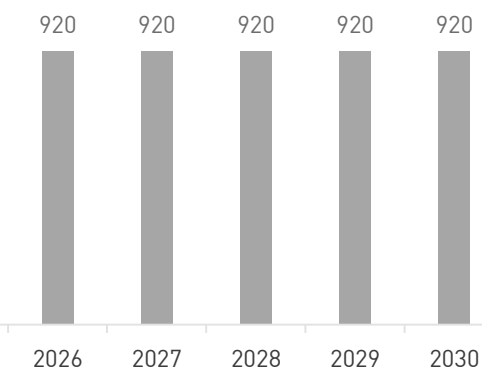
## ... 2021-2025: 'Transition phase' (WSeeG1)

- Projects already tendered in two auctions (2017 and 2018),  $\Sigma$  3,100 MW
- Unsuccessful bidders lost their project licence and had to hand over project documentation to authority
- EnBW successful with EnBW He Dreht and non-subsidy bid; market share 29%



## ... 2026- : 'Central target system' (WSeeG1)

- State target by 2030: 15 GW in operation
- State evaluates areas and brings them to auction (starting in 2021)
- Detailed regulation still under development
- "Last-call privilege" to be considered (unsuccessful bidders/projects from transition phase)



Source: Ministry of Economic and Energy  
 1 Wind-auf-See-Gesetz (WSeeG), EnBW market research (2019 and 2020)

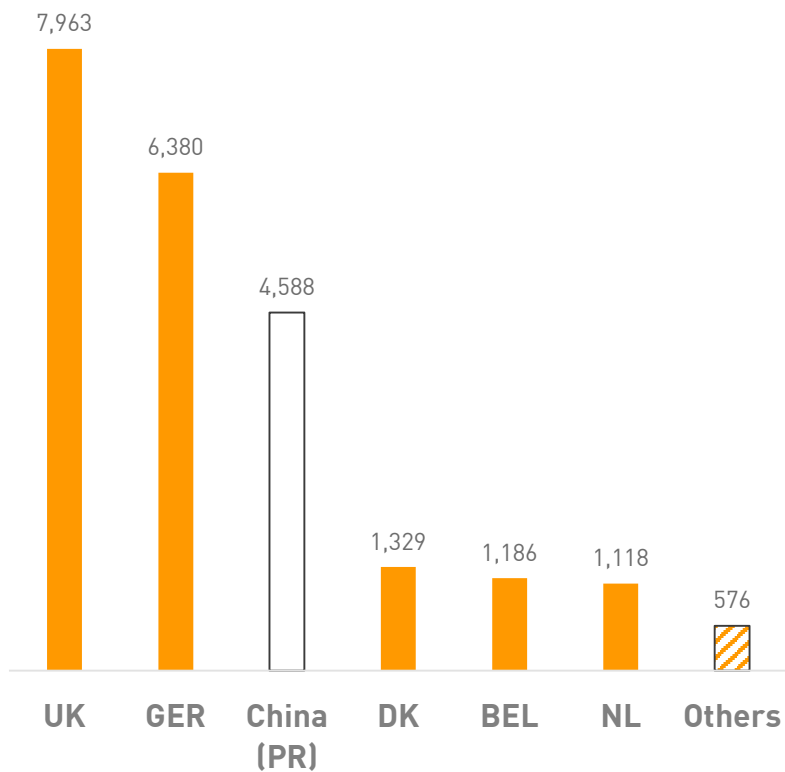
EnBW Hohe See/Albatros (609 MW)





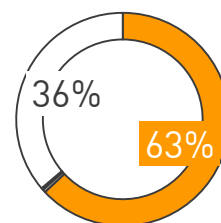
# Market trends: Offshore wind (2/2): ... while Asia and US are ramping up

## In operation, world in MW; as of 31.12.2018



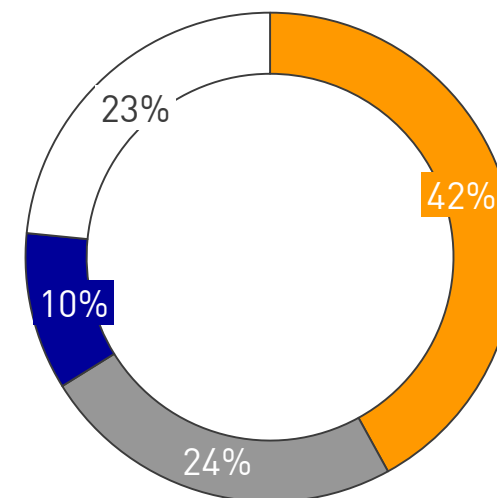
## New installations , world in MW

### 2016-2018



Average growth:  
3.3 GW p.a.

### 2028-2030



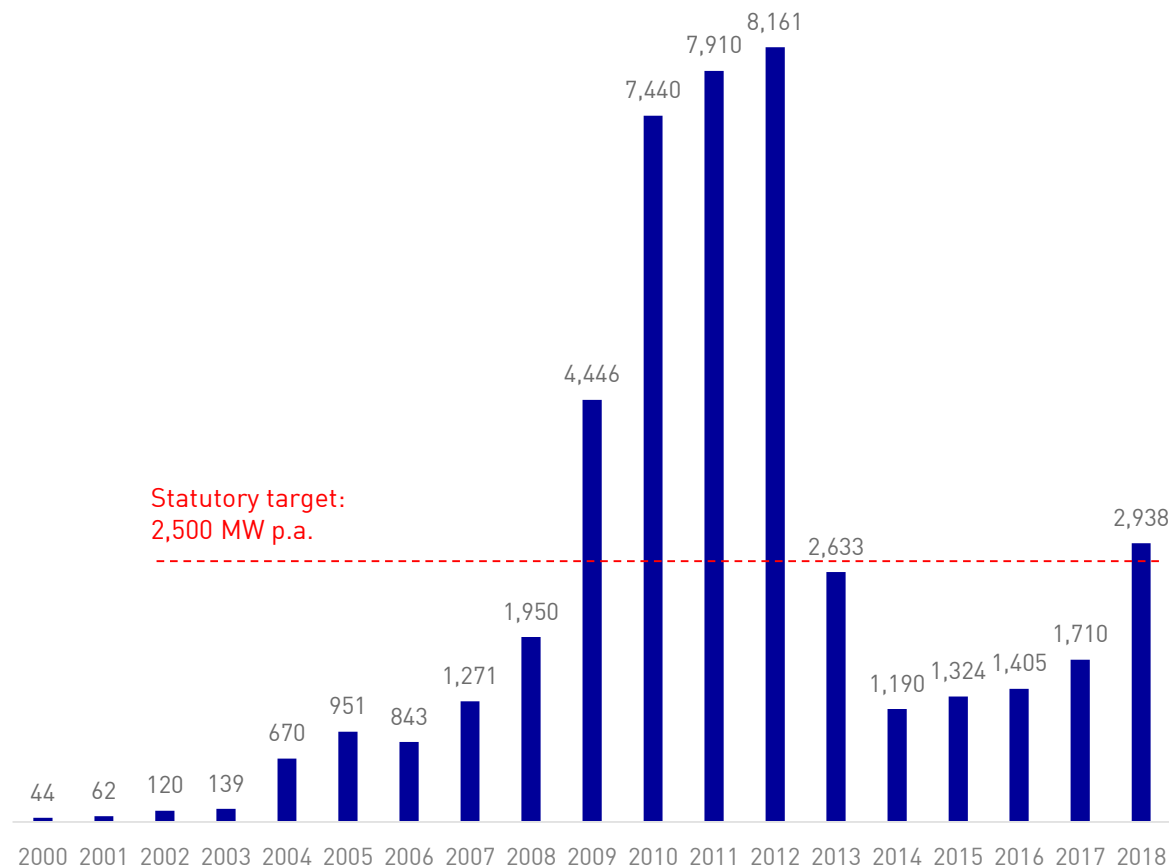
Average growth:  
12.8 GW p.a.

- Europe
- Asia (without PRC)
- US
- PR China



# Market trends: Solar: Recovering after four hard years

## New installations, Germany in MW



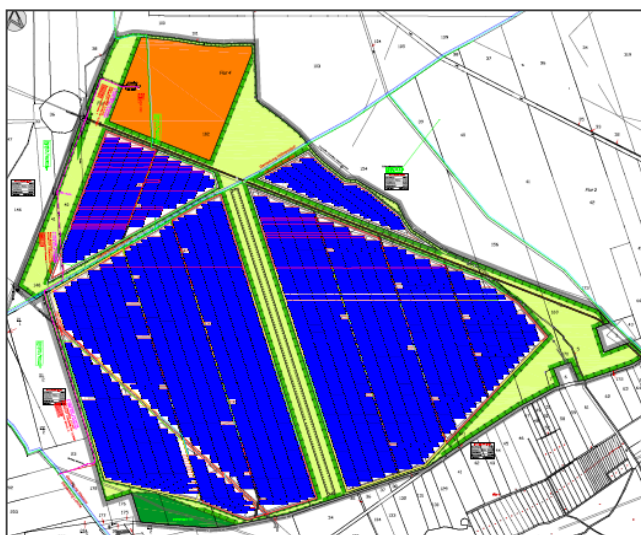
Statutory target:  
2,500 MW p.a.

## Explanation

- > New installations back on track
  - > LCOE increasing (higher efficiency due to lower capex and higher output)
  - > New sites feasible due to "Öffnungsklausel" (zoning option for German states)
- > EnBW successful in auctions (16 successful bids, No. 6 in Germany)
- > Rapid increase in LCOE: solar will be first to reach market price in Germany
- > EnBW decided to integrate solar as third technology in renewable portfolio



# Market trends: Solar – Weesow-Willmersdorf: FID for first industrially optimise and scaled solar project in Germany








## Explanation

- Project area: 209 ha (owned by EnBW)
- Capacity to be installed: 184 MW (DC)
- Project designed and optimised for 40 years of operation (eg. public zoning plan (“Bebauungsplan”) allows operation until 2060)
- Technical design, prequalification and testing of modules with support from Fraunhofer ISE (Fraunhofer Institute for Solar Energy Systems)
- Project will not have German feed-in tariff, but will benefit from other important renewable privileges (e.g. preferential grid connection and power offtake, compensation in event of interrupted or reduced grid connection ...); options for power sales under development (e.g. PPA with industrial offtaker)
- FID, start of construction on site in early 2020, COD by 2020 year end
- Two additional areas secured and under advanced development



# “Selective” internationalisation of EnBW’s renewables business: Rationale

-  **Strategic goal attainment and growth** >
  - **Limited growth opportunities in Germany**
  - **Potential to compensate** with growth abroad
-  **Pipeline and capacity utilisation** >
  - Ensure **productivity** and **value creation** in established teams
-  **Risk diversification** >
  - **Reduce strong dependence on German market environment** (market development, regulation, weather conditions, etc.)
-  **Economies of scale/competition** >
  - Ensure sufficient **size/economies of scale** for EnBW to hold its own against competitors in the long term
-  **Monetisation of expertise** >
  - **Commercialise accumulated experience and expertise**
-  **Positive feedback to home market** >
  - **Positive feedback to German business**
  - Opportunities/impetus for development of **EnBW’s culture** as a whole



# “Selective” internationalisation of EnBW’s renewables business: Status in Taiwan

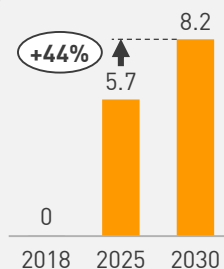


## Market environment

- > **Good wind conditions and long-term pipeline** under challenging conditions (geology, typhoons, etc.)
- > **Still a young market;** political and regulatory **uncertainties** in view of upcoming elections but cross-party **commitment to renewables**
- > Very strong **competition** in capacity allocation, high **pressure on feed-in tariffs** combined with extensive, cost-driving **local content requirements**

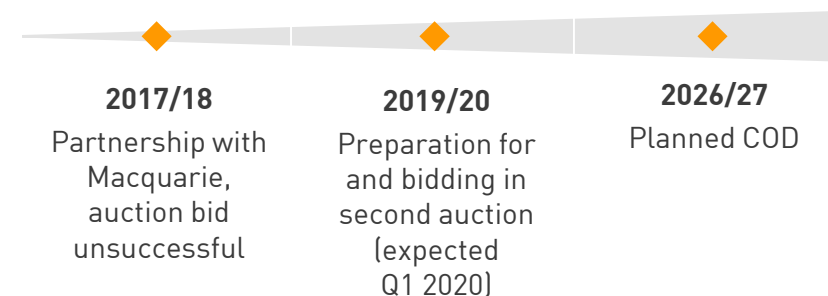
## Market growth

Onshore wind new builds in GW



- > Offshore wind relatively new on policy agenda
- > 5.7 GW of projects with IBN by 2025
- > In long term, up to 10 GW planned by 2020 (8.2 GW assumed)

## Activities to date and subsequent steps



- > Cooperation with Macquarie and Swancor to **develop up to 2 GW** (“Formosa 3”)
- > Launch of **EnBW Asia Pacific** to build local presence and for active stakeholder management
- > Development of further **EnBW project opportunities** independently of project partners



**Attractive growth market with challenges due to intensive competition among developers, volatile regulatory environment and demanding local content requirements**



# “Selective” internationalisation of EnBW’s renewables business: Status in United States

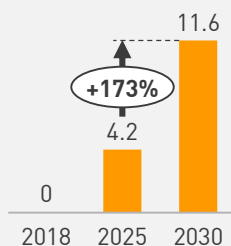


## Market environment

- > **Ambitious targets for renewables** both in **East Coast states** and **California**; limited capacity for expansion of onshore wind and PV
- > **Very good wind and land conditions in North-East USA** (comparable with North Sea) with prospects of long-term PPAs (20-25 yrs.), already intensive **competition for limited number** of state-auctioned **marine leases for offshore wind farms**
- > Project development in **California more demanding** due to water depths, **competition there so far moderate**

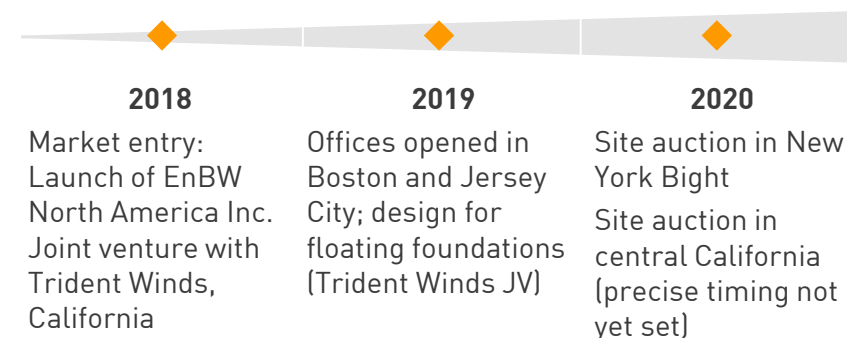
## Market growth

Onshore wind new builds in GW



- > Large sites (1-2 GW) allow projects with 800 – 1200 MW
- > First 800 MW large-scale project in operation on East Coast by 2021/2022
- > 10-15 GW possible by 2030 – party dependent on market-readiness of floating foundation technology

## Activities to date and subsequent steps



- > **Parallel market entry** in **East Coast** and **California** taking account of local conditions
- > **Cultivation of East Coast market stepped up with team expansion in 2019** and lessons learned from 12/2018 Massachusetts marine lease auction an advantage for bidding in **New York Bight Lease auction (Q1 2020)**; potentially further opportunities
- > JV in California to make use of **local expertise** and **networks**; development of **floating foundations expertise –good basis for lease auction** (expected 2020)



**Market still in early stages but very good growth prospects and scope for large-scale projects and new technologies; competition intensifying**



# “Selective” internationalisation of EnBW’s renewables business: Status in Sweden

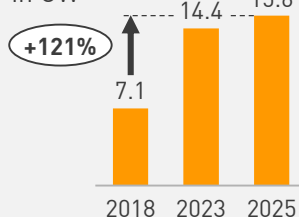


## Market environment

- > **Very good wind conditions** (2,500-3,000 Vbh/a) and **good land availability**; **market prices lower than Central Europe** due to proximity to Norwegian hydro power
- > End of subsidy regime means large proportion of long-term market-based PPAs; **opportunities for market players with trading expertise**
- > Looking ahead: **growth in repowering activity** in industrialised south of Sweden

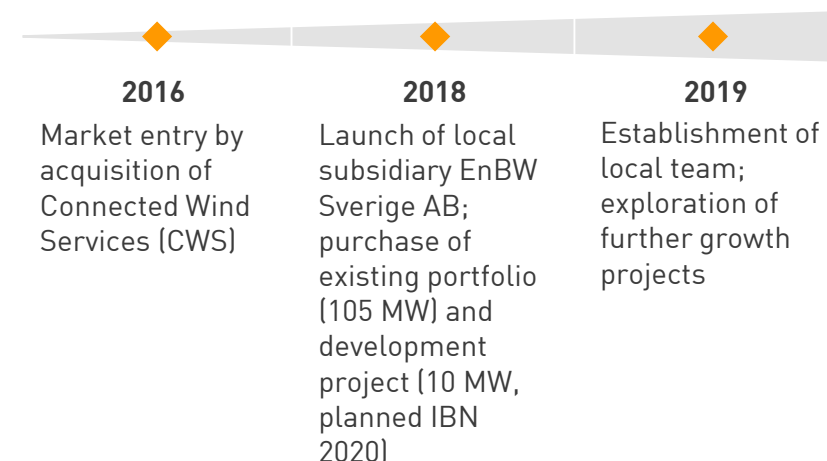
## Market growth

Onshore wind new builds in GW



- > Growing proportion of large projects (e.g. Markbygden with approx. 10 TWh output p.a.)

## Activities to date and subsequent steps



- > Able to **leverage market presence of CWS** (Swedish market leader for producer-independent system maintenance)
- > Start as **projects consolidator**; subsequently establish **own project development** activities
- > Able to **leverage EnBW expertise in trading and financing** for large-scale projects/transactions



**Very good growth prospects from relatively low base; EnBW is well placed with experience in large-scale projects and market knowledge**



# “Selective” internationalisation of EnBW’s renewables business: Status in France

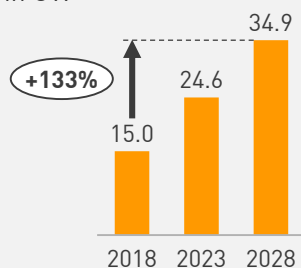


## Market environment

- > One of the **largest European onshore markets** with **significant growth**
- > **Tendering outcomes** and **market premium tariffs** so far relatively high (€65 to €74/MWh)
- > Currently two parallel subsidy regimes: Tenders and feed-in premium (FIP); **transition to competitive tendering** from 2020

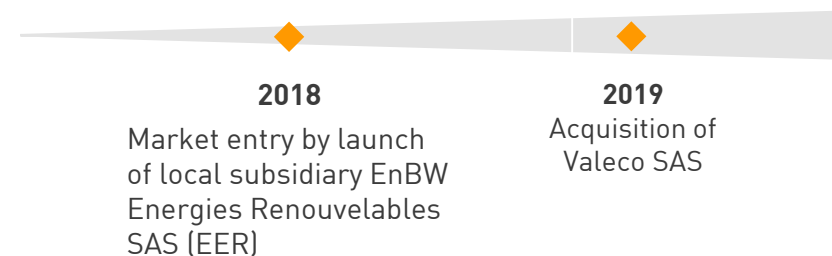
## Market growth

Onshore wind new builds in GW



- > Expansion targets 2023/28 under French energy mix plans (PPE)
- > New tendering design from mid-2020 with two rounds of 1 GW p.a. each

## Activities to date and subsequent steps



- > Acquisition of Valeco secured **320 MW (gross) in operation** and **entry into project development business** throughout France (current pipeline approx. 1,700 MW at various stages)
- > **New builds** of **100 MW wind** and PV (gross) planned in 2019
- > **Operation** of own wind farms and for third parties



**Challenging, but attractive market with relatively large volume and good operating environment; market entry with established, reputable partner makes it possible to grow in future “with the market”**





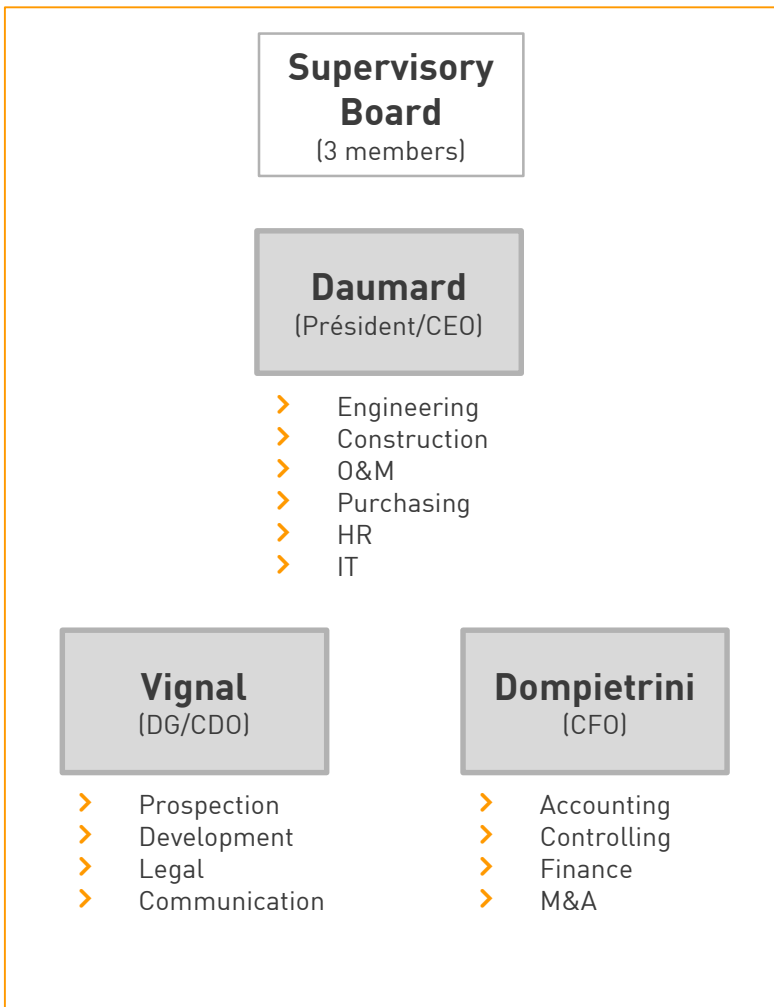
## France: Rationale for the acquisition of Valeco



- Upscaled **platform** in one of the **biggest markets for renewable energy** in Europe
- **Immediate effect on profits** given the existing operational asset portfolio, **big step ahead in reaching EnBW's operational renewable target** in 2020 („1,000 MW wind onshore operational“)
- Well founded growth option for the future through **existing project pipeline**
- Active along the **entire value chain**: developer, constructor and operator
- **Technology fit**: Wind and solar
- **Well established and long-term experienced, proven track record** in the market
- **Good market penetration** with the regional offices, **complementary fit with EnBW activities** (EnBW's development team will be integrated to cover central region of France for Valeco)
- Ideal **platform for synergies** (purchasing and position towards main suppliers, O&M, financing ...) and development of business model (e.g. wind offshore in France)



# New management and organisation in place



## François Daumard (Président, Chief Executive Officer)

- > Born in 1966, French citizen
- > Master degree in Engineering (ENSMM)
- > With Valeco since 2009 (Managing Director at Valeco Ingénierie and Valeco O&M)
- > Before: Areva T&D (2000-2009), Alstom (1994-1999) and Schneider Electric (1992-1994)



## Philippe Vignal (DG, Chief Development Officer)

- > Born in 1971, French citizen
- > Master degree in Law (LL.M.)
- > With EnBW since 2018 (Managing Director of EnBW Energies Renouvelables)
- > Before: Managing Director at WPD France (since 2004)



## Christel Dompietrini-Parisot (Chief Financial Officer)

- > Born in 1972, French citizen
- > Master degree in Internal Auditing and Corporate Finance (IAE and ESLSCA)
- > With Valeco since 2019
- > Before: Biotope (CFO, 2012-2019), DBF Autos (CFO, 2006-2012), Alstom (2000-2006)



# Post Merger Integration process ongoing



## Valeco PMI: eight workstreams, lead bilaterally

1	Legal & HR	Legal shaping of the group incl. governance codex
2	Commercial Functions	Establish financial reporting and reevaluate financing
3	Operations	Migrate O&M tools and processes and exchange on best practise
4	Project Development	Exchange on tools and best practise for development
5	Trading	Implement energy sale process (e.g. aggregation) via EnBW trading
6	Purchasing	Supplier strategy and harmonisation of purchasing instruments
7	IT	Harmonise on IT infrastructure (hardware and software)
8	Valeco / EER <sup>1</sup> Matters	Integrate EnBW's project development in France into Valeco

## PMI-Approach



- **Temporarily** installed project organisation **to prepare interfaces as well as support and accompany management** during the **integration of Valeco** in the EnBW Group
- At the same time **focus on strengths and powers of Valeco** as a flexible and market oriented "speedboat"
- Define **further actions to develop Valeco into a Top 5 player** in the French market until 2025
- **Bilateral approach:** All workstreams and work-packages are lead together by key persons of both companies
- **Scope**
  - Implement **guiding principles and interfaces**
  - Clarify and solve **DD findings**
  - Implement basis for **synergies**
  - Finalize **Group structure**

<sup>1</sup> EnBW Energies Renouvelables SAS



- **Operations and project portfolio in renewables on track in 2019**
- **Market development in solar bringing new opportunities in Germany, but limited growth prospects in wind** for the mid-term future
- **Germany will remain the main market** for EnBW's renewables strategy ...
  - **Onshore:** focus on pipeline projects and thus growth on an organic basis
  - **Offshore:** following COD of EnBW Hohe See and EnBW Albatros OWPs, ongoing planning for EnBW He Dreiht
  - **Solar:** third technology in EnBW renewables portfolio, ramp up growth especially with industrially scaled and optimised projects in the market
- **“Selective internationalisation” launched in 2018 is nonetheless beginning to pay off;** we will focus on the selected markets (onshore wind: France, Sweden; offshore wind: Taiwan, US) and examine technological cross-selling opportunities; enables **EnBW to compensate impacts** of challenging marketing situation and thus limited growth potential in Germany and to **strengthen global competitiveness**
- **Development of costs (LCOE) in renewables is encouraging;** we are preparing to seize the opportunity starting with solar; being among the **best-in-class in efficiency** and **capable of acting** in this new market situation **across the entire value chain (including trading and market sales)** will be even more important than before

# Dr. Hannah König, Head of Wind and Maritime Technology

From bottom fixed to floating  
wind projects



1

EnBW renewables: 2019 highlights at a glance

2

Market trends and progress of EnBW's strategy

3

**Deep dive: Offshore windfarm projects EnBW Hohe See, EnBW Albatros (in construction) and EnBW He Dreiht (planned)**

4

Offshore wind: Floating offshore technology outlook



## Chilehaus – unique, prestigious, iconic

- › Symbol of Hamburg’s economic recovery after World War I and one of the city’s flagship buildings
- › Located in Hamburg’s Kontorhaus district, a commercial quarter with a long history and protected as UNESCO World Heritage

## EnBW’s Offshore Wind Competence Centre

- › All competences under one roof: Project Management, Engineering, Procurement, Controlling, Operation & Maintenance
- › 160 employees, most of which work in Offshore Wind
- › Short ways ensure direct communication and avoid loss of time

## Construction Office EnBW Hohe See & EnBW Albatros

- › Established in the Chilehaus, on the same floor as general EnBW office
- › Direct access to the colleagues from design and fabrication phase, no loss of information



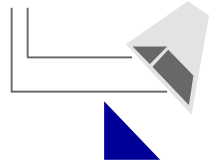


# Offshore wind portfolio and project pipeline in Germany



- > Installed capacity end of 2019: **945 MW**
- > Secured pipeline: **900 MW**

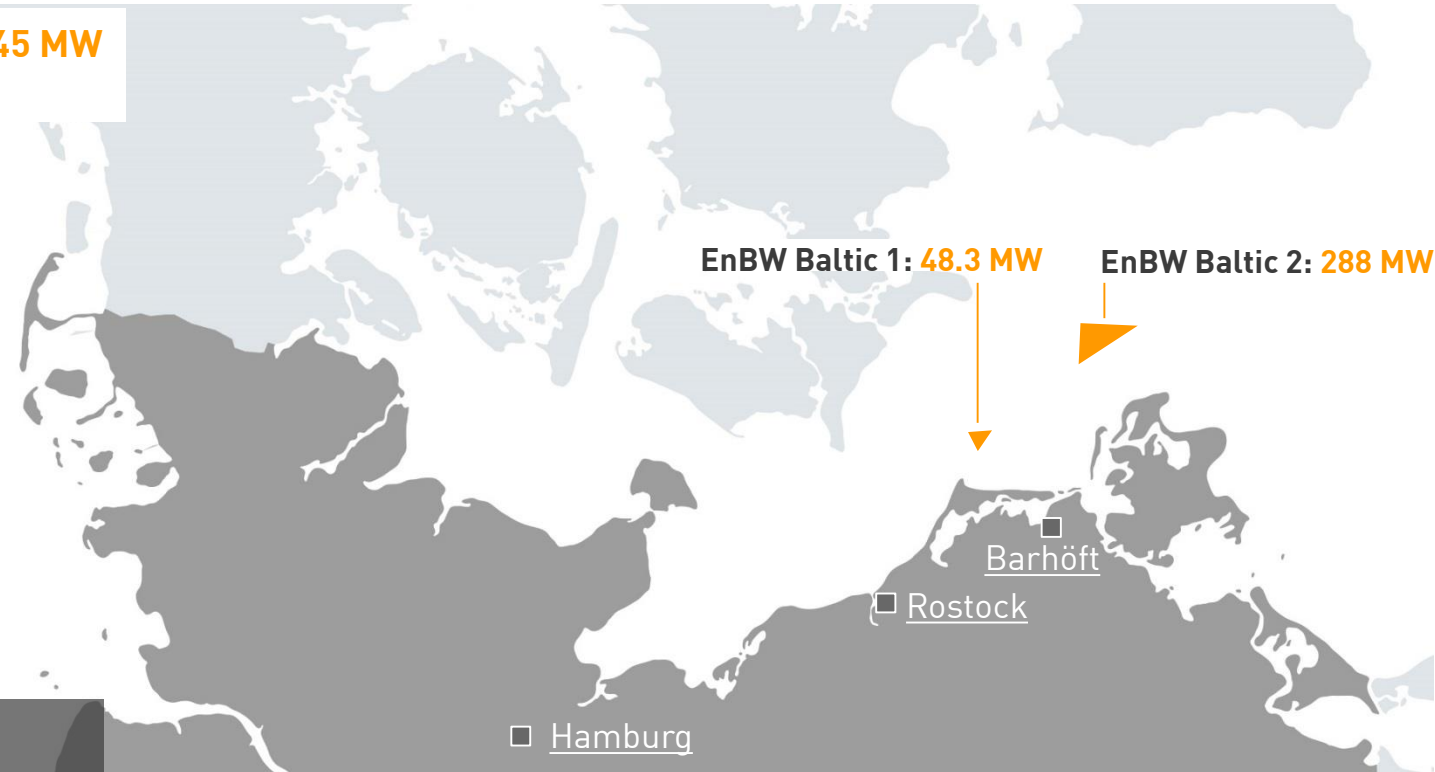
EnBW Hohe See: 497 MW<sup>1</sup>  
 EnBW Albatros: 112 MW<sup>1</sup>



EnBW He Dreiht: ~ 900 MW

EnBW Hohe See: 497 MW  
 EnBW Albatros: 112 MW

- > 71+16 = 87 x Siemens SWT 7.0-154 on monopile foundations
- > Commissioning ongoing
- > Shareholders: EnBW (~50.1%) & Enbridge Inc./CPPIB (~49.9%)



EnBW Baltic 1: 48.3 MW

EnBW Baltic 2: 288 MW

EnBW Baltic 1: 48.3 MW

- > 21 x Siemens SWT 2.3-93
- > Commissioned in 2011
- > Shareholders: EnBW (~50.1%) & 19 municipal utilities (~49.9%)

EnBW Baltic 2: 288 MW

- > 80 x Siemens SWT 3.6-120
- > Commissioned in 2015
- > Shareholders: EnBW (~50.1%) & Macquarie, PGGM and ÄvWL (~49.9%)

<sup>1</sup> Planned commercial operation date (COD) - end of 2019

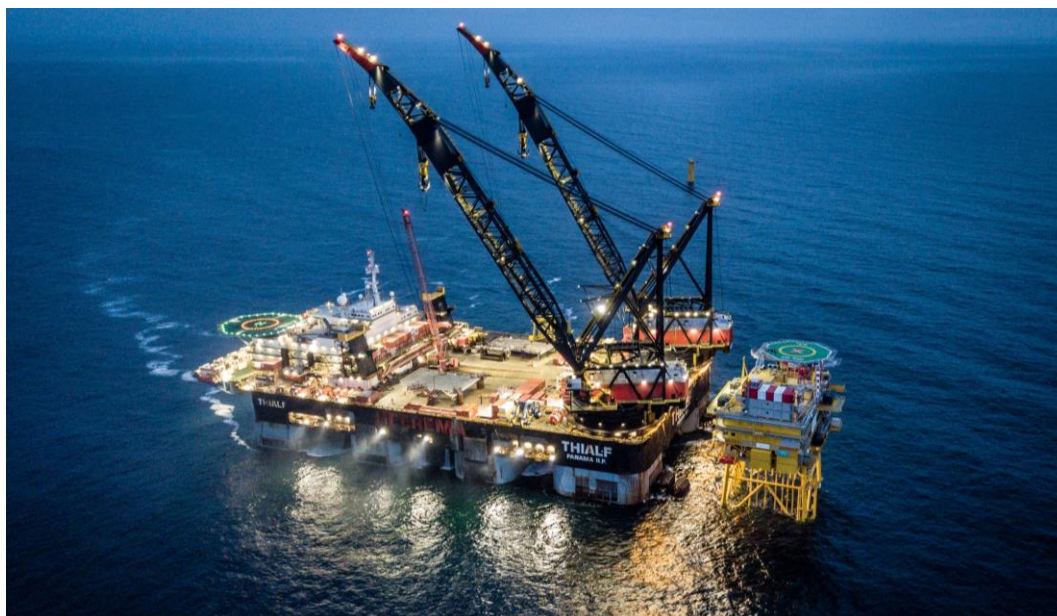




# Completing EnBW Hohe See & EnBW Albatros



	<b>Hohe See</b>	<b>Albatros</b>		
> <b>Grid connection</b>	August 2 <sup>nd</sup> 2019	tbd <sup>1</sup>	> Location	German North Sea
> <b>Turbines installed</b>	71/71	16/16	> Gross output	87 x 7.0 MW = 609 MW
> <b>Turbines commissioned</b>	71/71	0/16 <sup>1</sup>	> Wind turbines	Siemens SWT-7.0-154
> <b>Completion</b>	Planned for end of year 2019		> Foundation Structure	Monopile
> <b>Contribution to EBITDA</b>	€415 m per year		> Operations Life	25 years
			> Water Depth	40 m
			> Coastal Distance	105 km
			> Annual Average Wind Speed	Ø 10.1 m/s
			> Annual Full Load Hours	Ø 4,000
			> Compensation	EEG – Compression Model
				18.4 ct/kWh for 8 years
				14.9 ct/kWh for 4.5 years



<sup>1</sup> As of 4 October 2019



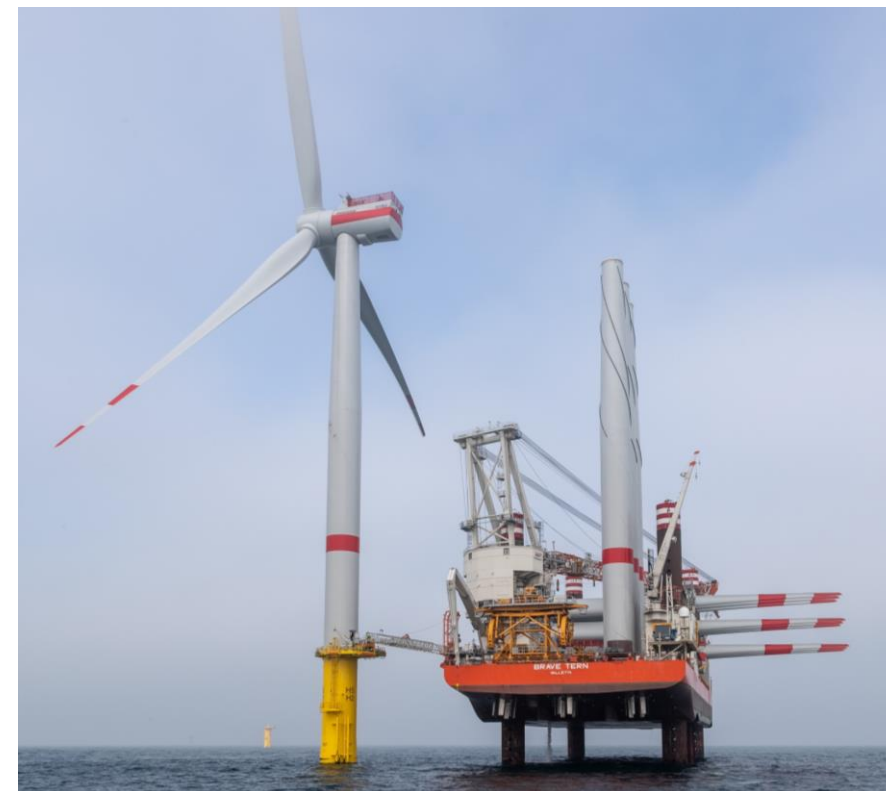
# EnBW Hohe See & Albatros: Wind Turbine & Foundation

- First time combination of these packages in the German offshore market
- Siemens Gamesa Renewable Energy as general EPCI contractor with GEOSEA NV as subcontractor for the foundations
- Gearless Wind Turbine (Direct Drive): fewer components, low weight relative to geared turbines; based on 6 MW predecessor (direct development)



<b>Wind turbine:</b>	87 x SWT-7.0-154
Rotor Diameter:	154 m
Rotor Swept Area:	18.626 m <sup>2</sup> (~2.6 football fields)
Hub Height:	105 m
Tower/Nacelle Weights:	395 t/360 t
<b>Monopile:</b>	<b>Transition Piece:</b>
Length: 72 m	Length: 28 m
Diameter: 8 m	Diameter: 6 m
Weight: 1,100 t	Weight: 440 t

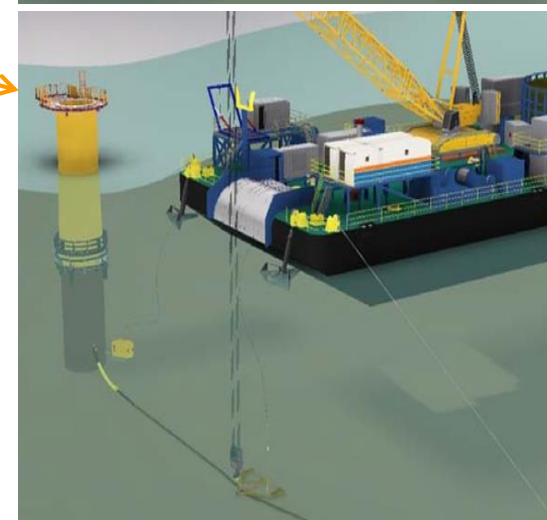
Total weight wind turbine and foundation  
~2,300 t (Eiffel Tower steel weighs ~7,300 t)





# EnBW Hohe See & Albatros: Inner Array Cables

- › EPCI contractor: VBMS GmbH (with TKF and JDR as cable sub-contractors)
- › Installation of 130 km of 33 kV cable segments is done in two steps:
  - › Step 1: Lay the cables
  - › Step 2: Bury the cables





## EnBW Hohe See: Offshore Substation



- EPCI agreement with a joint venture between ENGIE Fabricom (BE), Iemants NV (BE) and Crompton Greaves Holdings Belgium NV (BE)
- Closed topside steel structure on jacket foundation with 8 rammed piles
- Foundation weight (including piles): 2,900 t
- Topside weight (equipped): 4,200 t
- Diesel emergency power supply for the WTGs in case of power failure
- Designed for unmanned operation (emergency shelter only)
- Access by ship or helicopter landing platform





# EnBW Albatros: Offshore Transformer Module

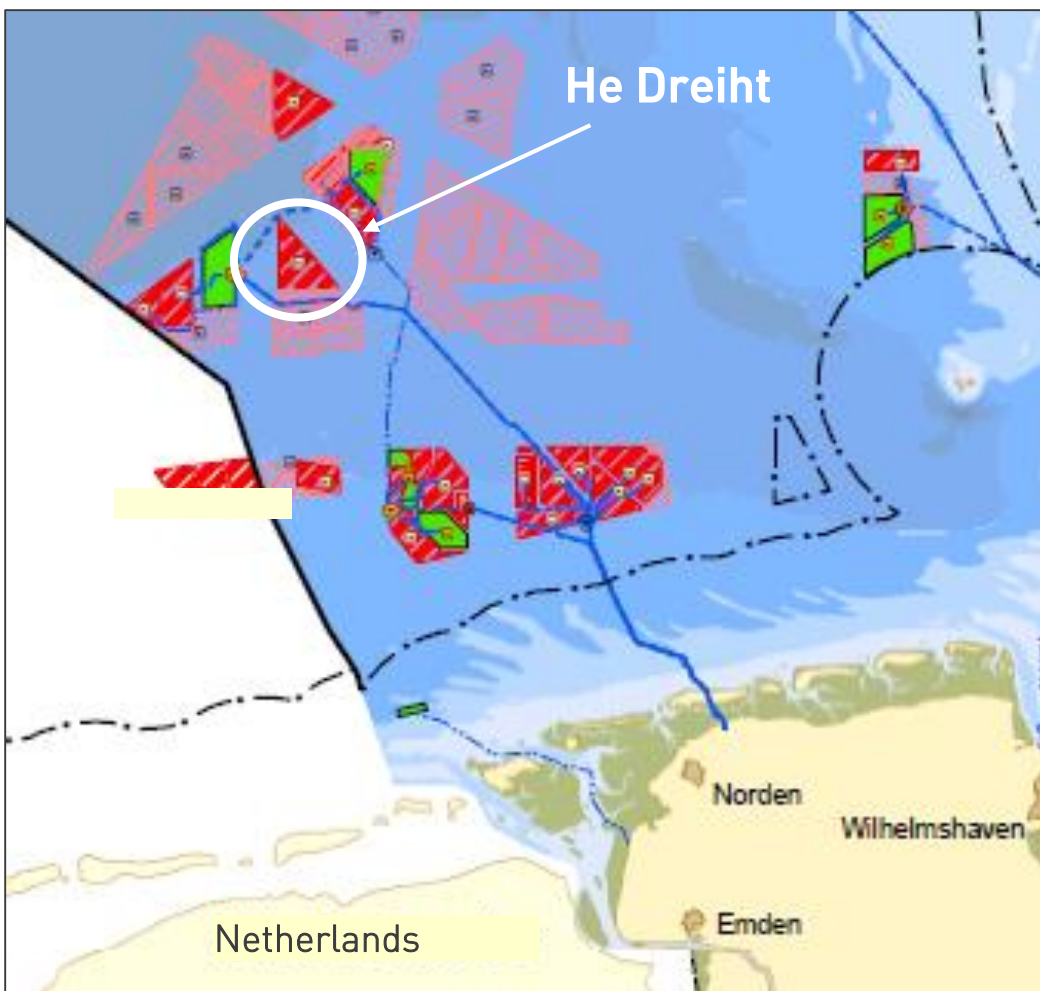


- EPCI contractor is Siemens Gamesa Renewable Energy
- Open Deck Structure - 2 decks (main and cable deck)
- Low environmental impact through oil-free platform, ester instead of oil and cooling
- Monopile foundation – same design as wind turbine foundation
- Foundation weight (including piles) is 1,600 t and topside is 1,200 t
- Central emergency power supply with batteries





# Update on EnBW He Dreiht



## Technical aspects

- › Size: 63 km<sup>2</sup>
- › Water depth: 39-40 m
- › Distance to shore: 85 km
- › Wind speed:  $\bar{c}$  10.1 m/s
- › Years of operation: 25 (EEG 2017)
- › Maximum of 900 MW generation capacity<sup>1</sup>

## Timeline

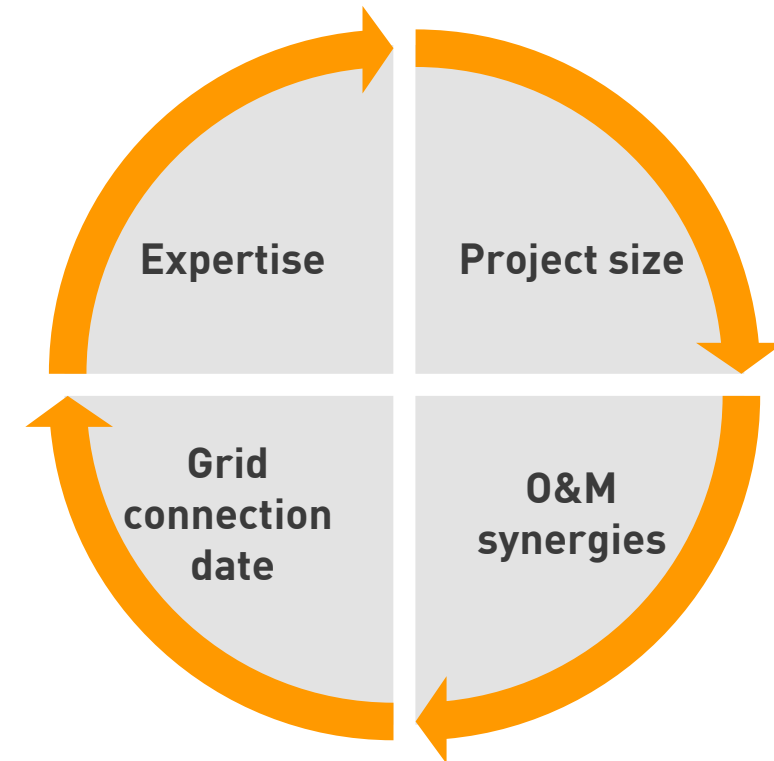
- › WTG tender in 2020
- › FID until mid-2023
- › Grid connection: Borwin 5 (NOR-7-1) in accordance with Offshore Network Development Plan (O-NEP 2025)
- › Commissioning and start of operation in 2025

<sup>1</sup> Grid connection capacity of 900 MW



## Reminder: Unique conditions allowed zero subsidy bid

- 1. Project development, realisation and operation by a company**  
with profound experience and existing portfolio
- 2. Size:** 900 MW – by far the largest single project in the auction  
→ In the meantime, Orsted combined individual projects to one of 900 MW
- 3. Synergies:** EnBW He Dreiht is located in the direct vicinity of EnBW Hohe See and EnBW Albatros  
→ considerable synergies during operation
- 4. Time of commissioning:** Due to grid connection in 2025, EnBW He Dreiht will:  
→ benefit from cost reduction, innovation and technological progress within the offshore industry in the coming years  
→ fully operate in a more favorable market environment (e.g. phasing out of nuclear power in Germany completed)

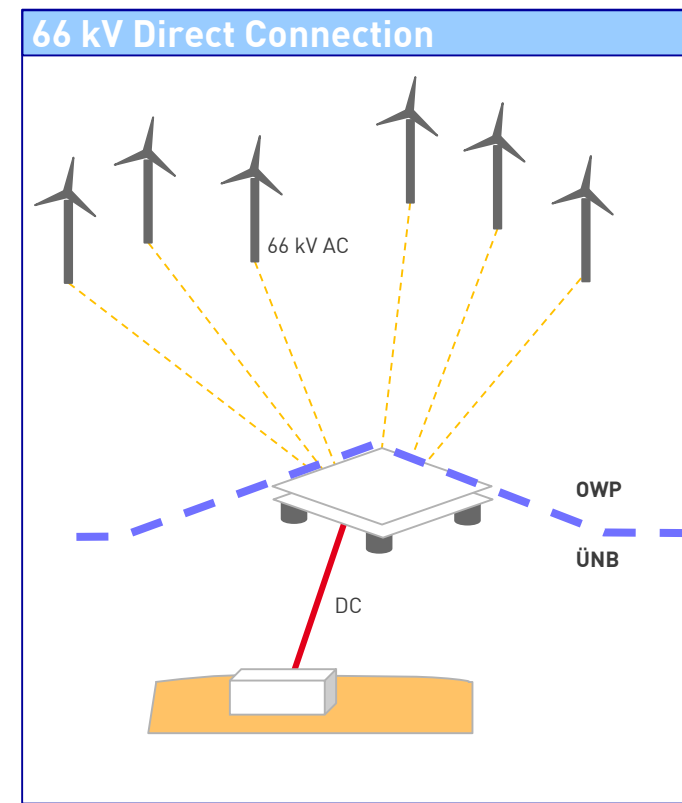
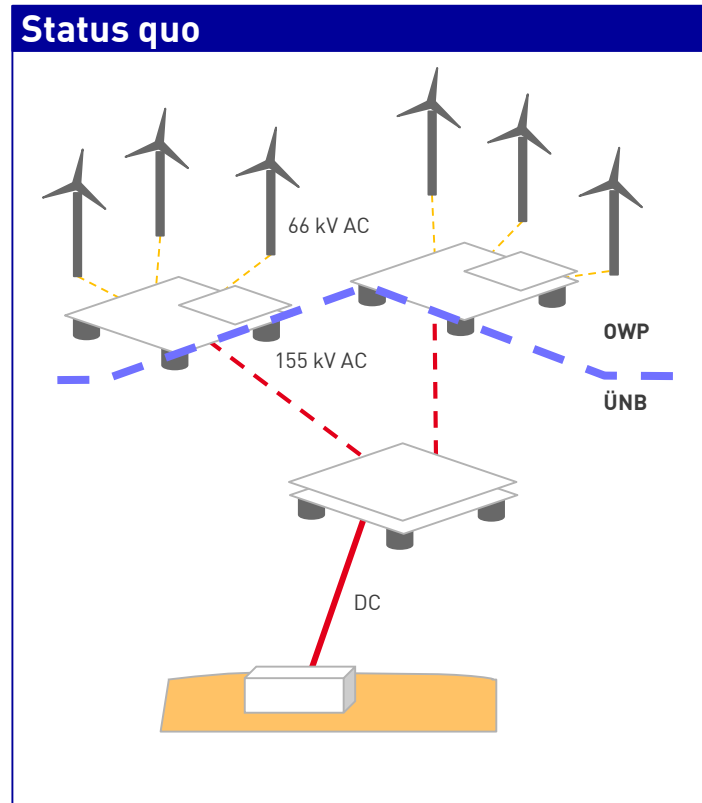




# EnBW He Dreiht: Major milestones since 2017 <sup>(1/2)</sup>

## Agreement with TenneT on direct connection at 66 kV

- > No offshore substation needed, CAPEX reduction by €70 to 100 m



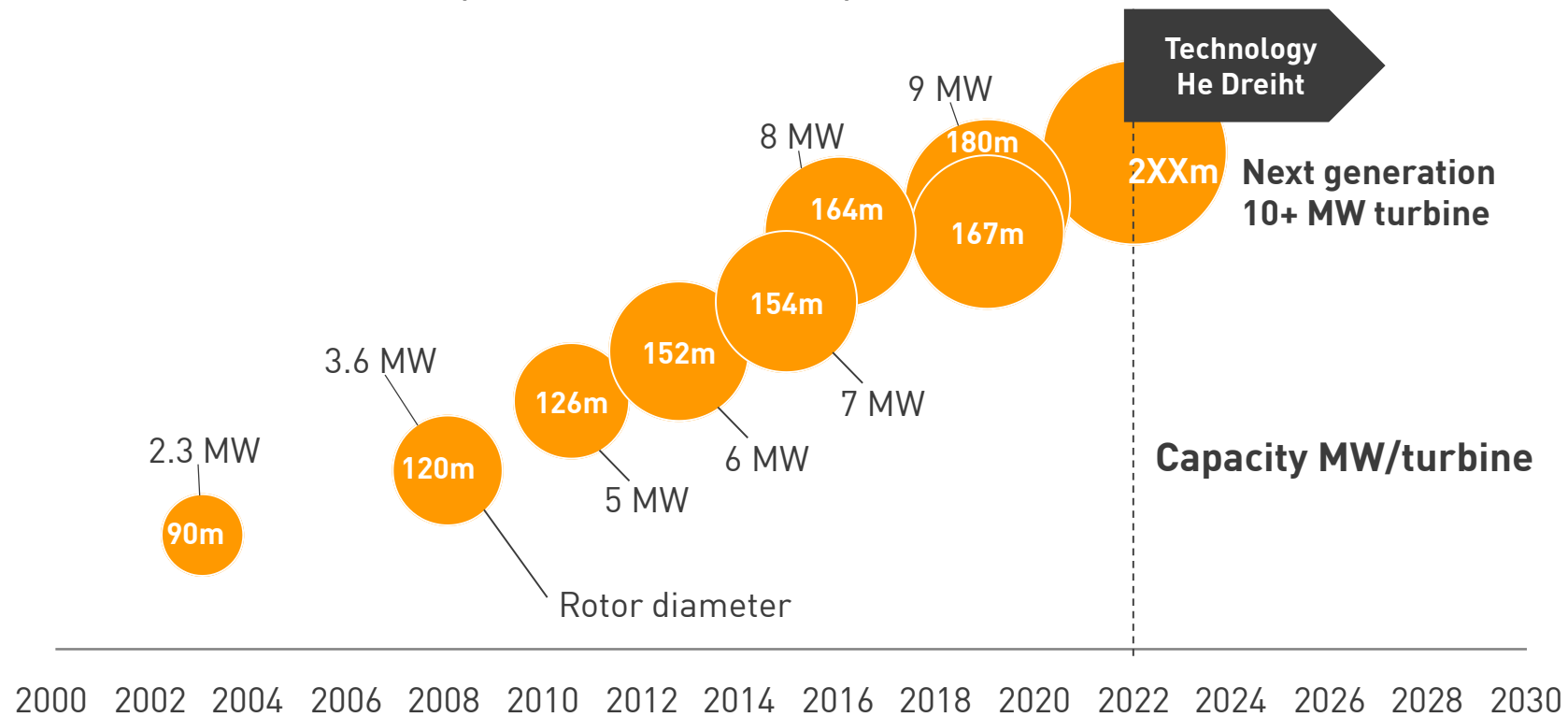




# EnBW He Dreiht: Major milestones since 2017 (2/2)

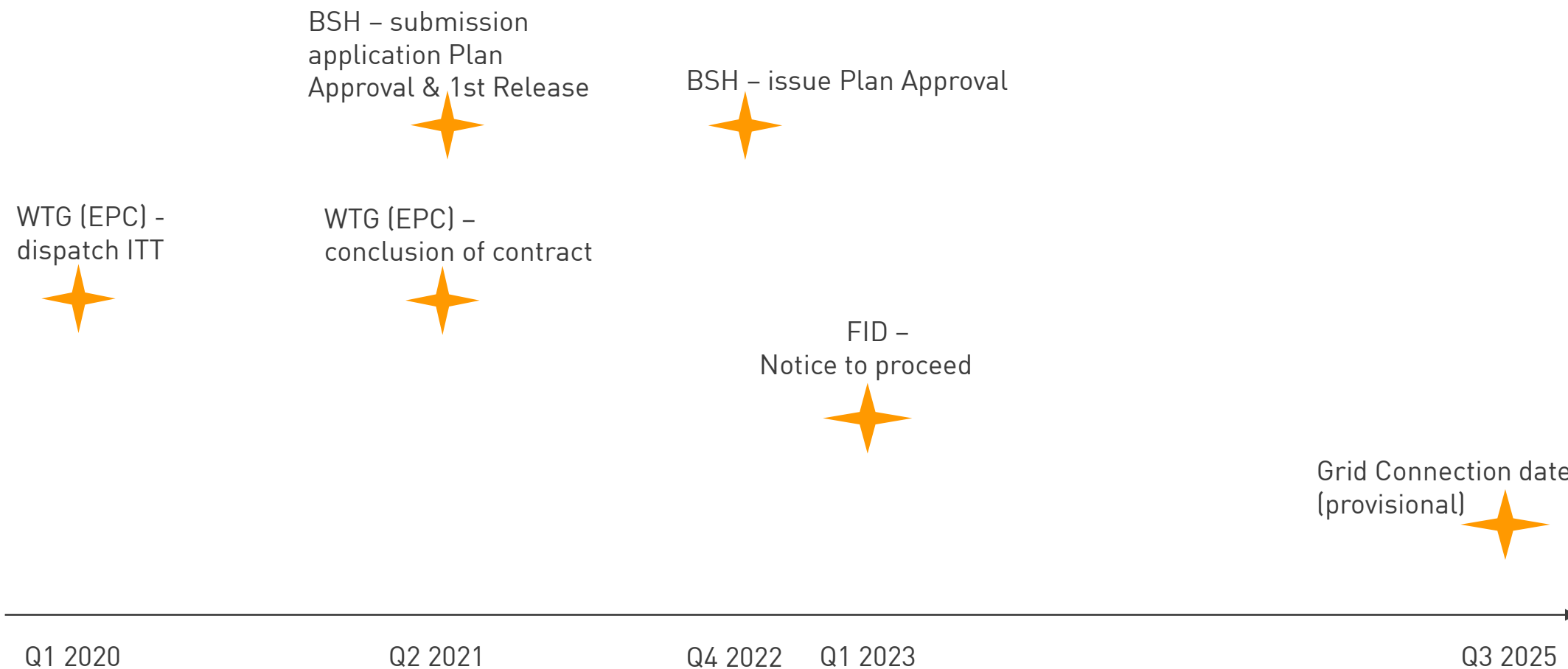
## Closely monitor wind turbine development, 2017 predictions confirmed!

- > GE announced 12 MW-220 turbine, type certificated expected in 2020
- > Other OEMs follow, new platforms in development





# Next steps EnBW He Dreiht





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**Offshore wind: Floating offshore technology outlook**



# From bottom-fixed to floating foundations

## Bottom Fixed

Suitable water depths

<40 m (monopiles) and <60 m (jackets) resp.

## Floating

Suitable water depths

>40 m (spar buoy: >100 m)



Illustration by NREL



## Offshore Wind resource in >60 m waters<sup>1</sup>:

- > 80% of Europe's offshore wind resources (~4000 GW)
- > 60% of US' offshore wind resources (~2400 GW)

## LCOE<sup>2</sup>:

- > Pre-commercial projects (today): €230/MWh
- > First commercial projects (2026 onwards): €100/MWh
- > Maturing industry (2030 onwards, 4 GW deployed): ~€60/MWh

## 6.9 - 13.7 GW of Floating Wind by 2030<sup>3</sup> Cumulative installed capacity by year to 2030

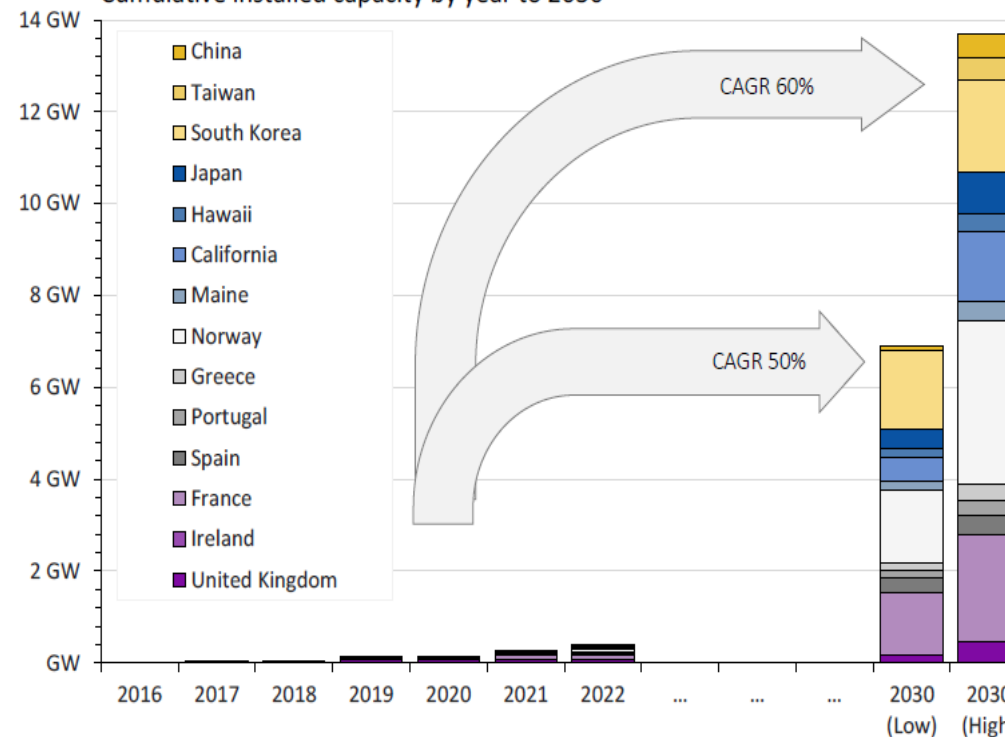


Figure 5. Estimated cumulative installed floating capacity - low & high scenarios - to end-2030, including compound annual growth rates (CAGR)

<sup>1</sup> Source: Carbon Trust, 2015

<sup>2</sup> Source: WindEurope, 2018

<sup>3</sup> Source: 4COffshore, 2019



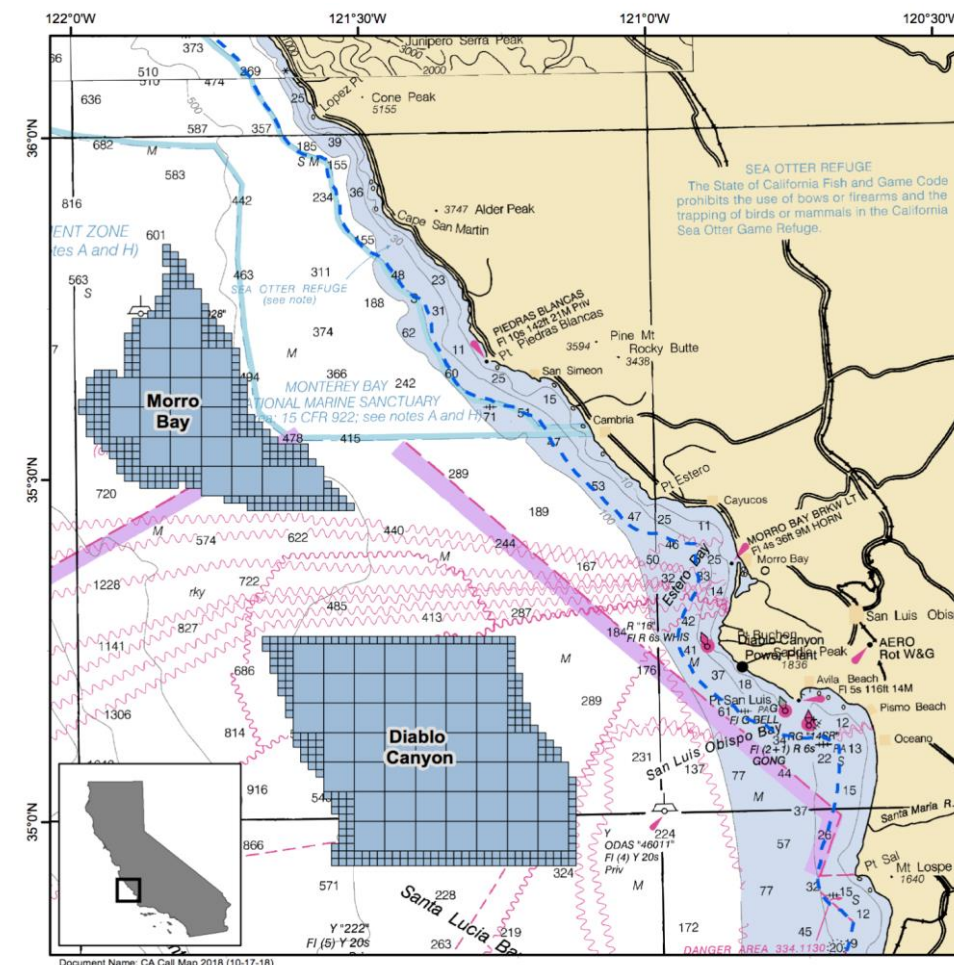
# Project Castle Wind



## Development of a commercial floating Offshore Wind Project in USA

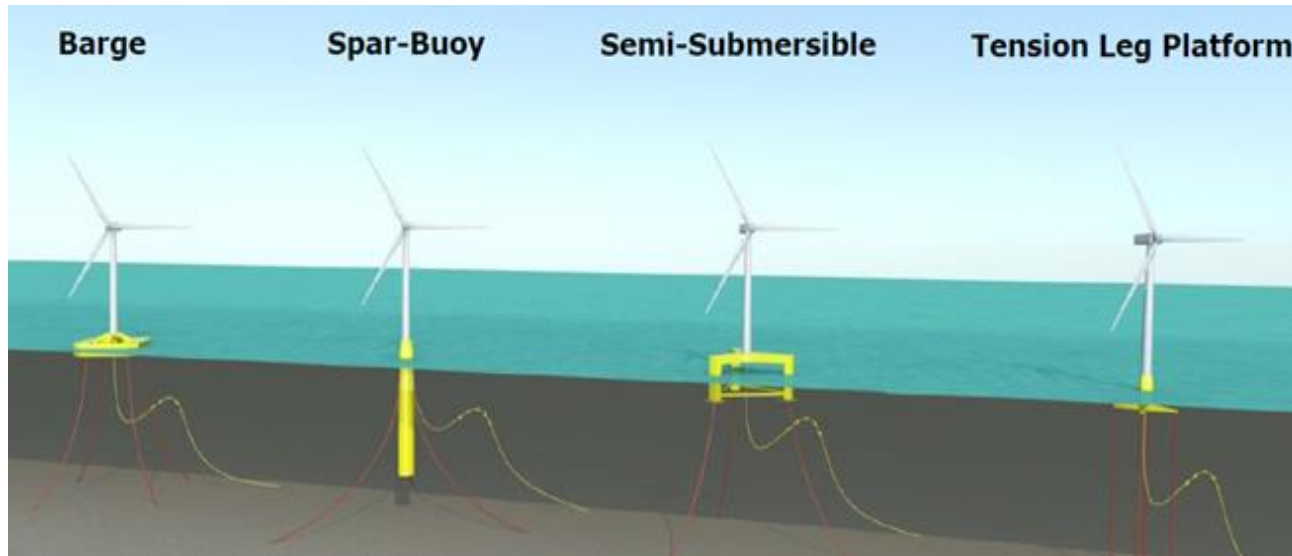
<b>Capacity</b>	up to 1,000 MW
<b>WTG</b>	10+ MW
<b>Location</b>	Morro Bay (County of San Luis Obispo)
<b>Water depth</b>	~800-1,000 m (Floating FOU)
<b>Wind speed</b>	~8.5 m/s
<b>Distance to shore</b>	~48 km
<b>Grid connection</b>	~560 MW (from shut down gas power plant)
<b>Timeline</b>	COD 2027-2030

- In 2017 EnBW decided to expand its long-term offshore wind presence in prospective international markets, including the US and Taiwan
- California gives EnBW the opportunity to enter the well advancing floating offshore wind market in an early development stage





# Technology Development



## EnBW's activities

- > Participation in the Joint Industry Project Floating
  - > Currently, projects on topics like turbine scaling, heavy lift offshore operations, export cable development, monitoring & inspections
- > Several internal studies, e.g. on dynamic cables
- > Investigation of potential participation in pilot projects (currently two MoUs in negotiation)



*Focus on commercial scale floating wind farms*

*Design basis:  
500 MW wind farm  
(50 x 10 MW units)*





# Questions & Answers







## Important note



Unless indicated otherwise, all data contained hereinafter refers to the EnBW group and is calculated according to IFRS.

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