Offshore Wind
GE Renewable Energy

Haliade 150-6MW installation at First US Offshore Wind Farm; picture courtesy Deepwater Wind

Focusing portfolio for growth & shareholder value creation

GE GOING FORWARD

AVIATION
$30.6B

POWER
$27.3B

RENEWABLE ENERGY
$15B

Digital, Additive, and financing expertise of GE Capital

- ✓ Leading franchises solving tough problems with advanced technology
- ✓ Technology is the DNA of the company
- ✓ Valuable installed base with track record of increasing asset productivity & improving margins

$ Revenue from 2018 Annual Report

UNLOCKING VALUE

TRANSPORTATION
$3.9B

- ✓ Merging with Wabtec to create global leader for rail equipment, services and software
- ✓ Positioned to grow … diversified transportation business with large installed base

HEALTHCARE
$19.8B

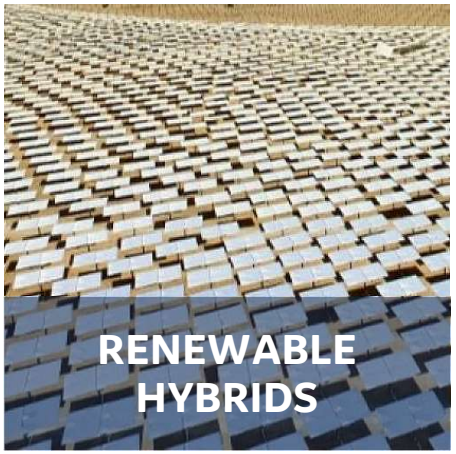
- ✓ Leading healthcare solutions provider
- ✓ Enabling precision health with leadership in diagnostics, therapeutics and monitoring

BAKER HUGHES
$22.9B

- ✓ Full-stream oil & gas company for land and offshore solutions
- ✓ Supported by digital solutions backbone

GE Renewable Energy

$15B revenue • 40,000 employees



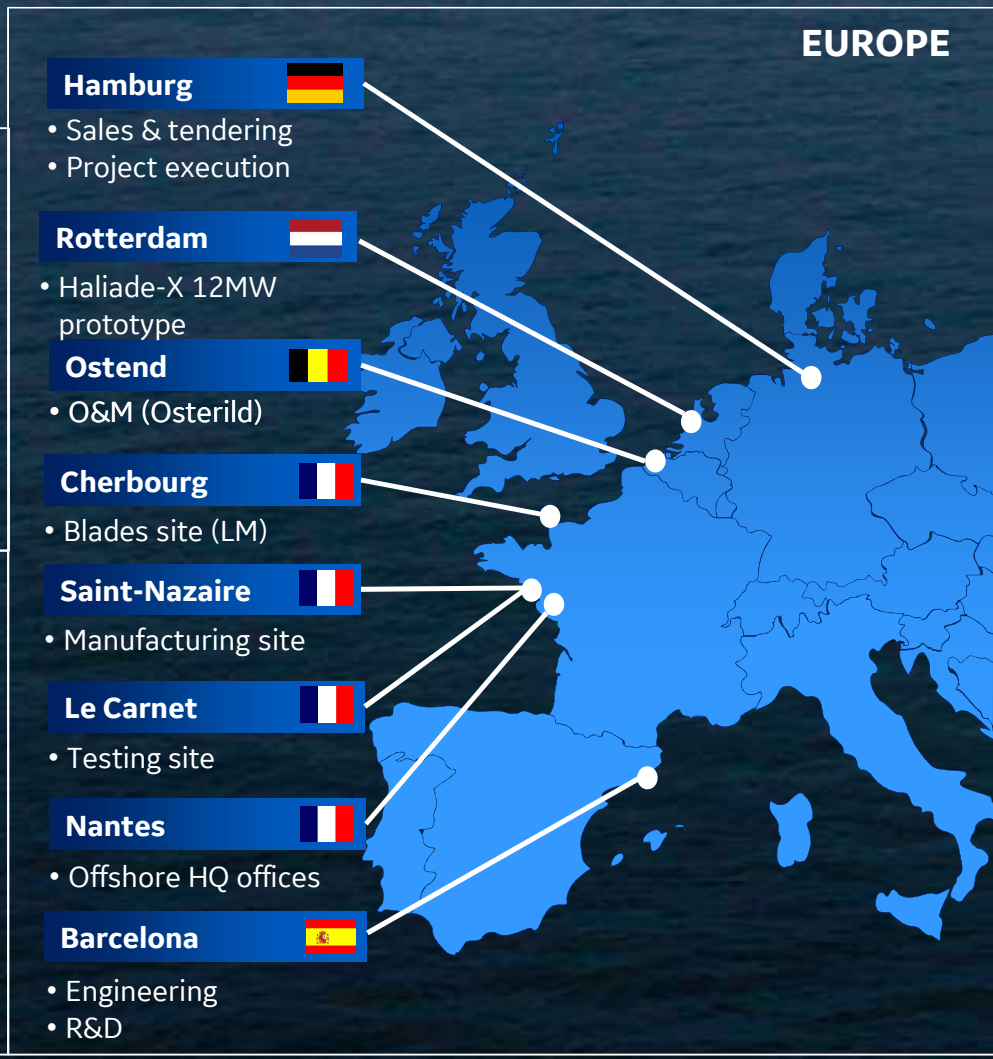
Broadest portfolio in the industry; gives us scale, scope and capability to fulfill our mission

Blade production: LM Wind Power

- In operation since 1978
- Produced: +215,000 blades
- Corresponding to ~ 102 GW capacity
- Saving > 212 MM tons of CO_2/year
- 14,000+ employees
- 15 manufacturing facilities in 8 countries
- Supplier to 30 turbine OEMs

Vertical integration to accelerate LCOE ↓

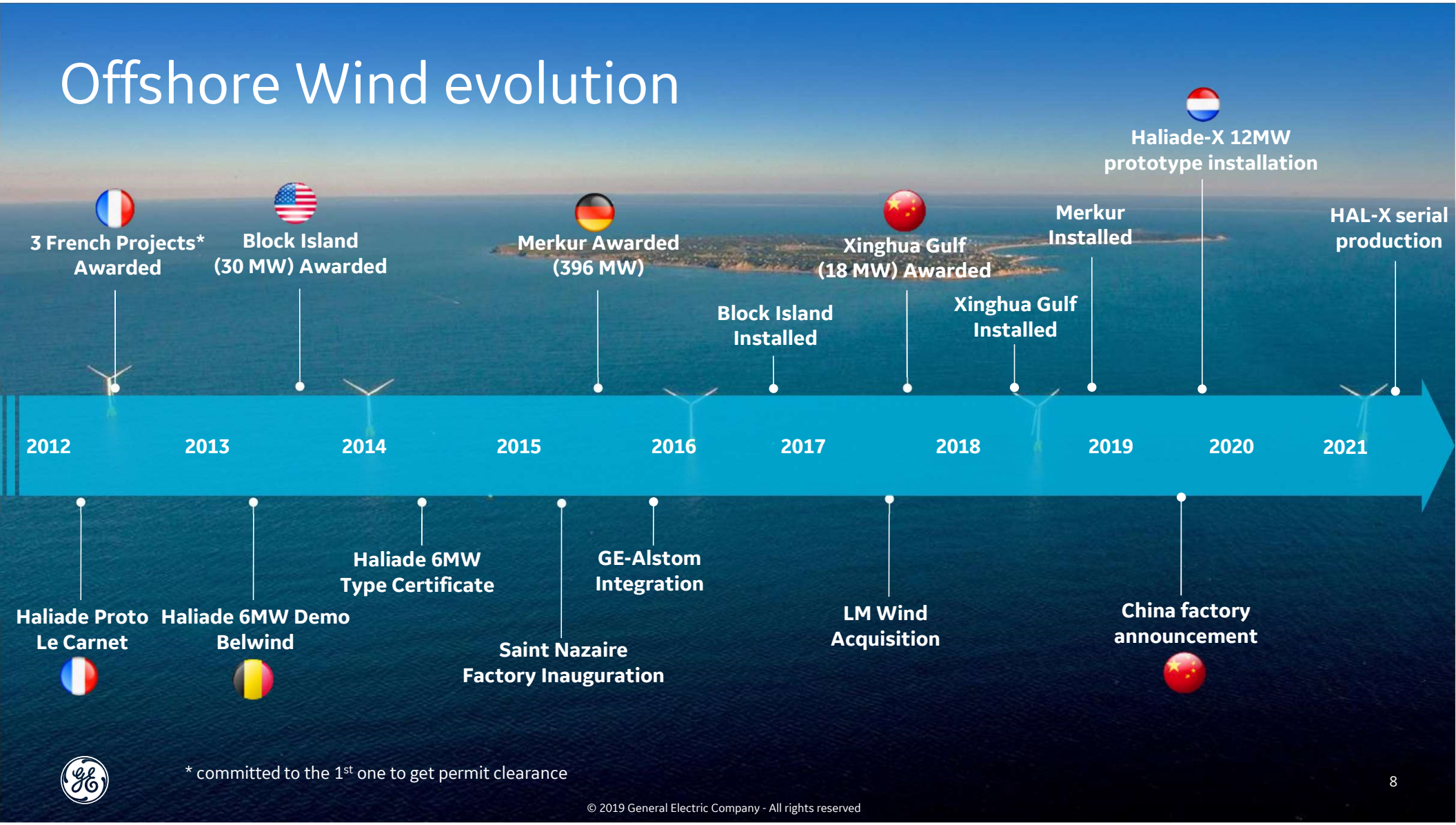
Our Offshore Footprint



Saint-Nazaire (manufacturing facilities)

- Components: Generators and nacelles
- Capacity: 100 turbines/year (6 & 12 MW units)
- Area: 13 hectares
- Constructed area: 19,000 sqm.
- Opened December 2014
- 120+ workers
- Dynamic production line
- Quality processes designed by manufacturing experts from the automotive and aircraft industries
- First European factory HEQ certified

Offshore Wind evolution



* committed to the 1st one to get permit clearance

Our Projects

Block Island (30 MW)
5 x Haliade 150-6MW

Xinghua Gulf (18 MW)
3 x Haliade 150-6MW

Merkur (396 MW)
66 x Haliade 150-6MW

Osterild (6 MW)
1 x Haliade 150-6MW

Rotterdam (12 MW)*
1 x Haliade-X 12MW

Osterild (6 MW)
1 x Haliade 150-6MW

Le Carnet (6 MW)
1 x Haliade 150-6MW

St. Nazaire (480 MW)**
80 x Haliade 150-6MW

We are the only offshore wind turbine OEM with installations in 3 continents

** in process*
*** order backlog*

Haliade-X 12 MW, Netherlands

The world's first 12 MW wind turbine

Developer: Future Wind (JV - Pondera and SiF Holding)
Demo Project: 1 Haliade-X 12 MW
Location: Maasvlakte-Rotterdam (NL)
Site: on-shore for easy access during test activities
Scope: 5-years testing & 15-years full service O&M

Tower in Rotterdam

107-meter long blade in Cherbourg

1st Haliade-X rolling-out of the factory

HALIADE-X 12 MW

GE Renewable Energy is developing **Haliade-X 12 MW**, the most powerful offshore wind turbine in the world, with **220-meter rotor**, **107-meter blade**, leading capacity factor **(63%)**, and **digital capabilities**, that will help our customers find success in an increasingly competitive environment.

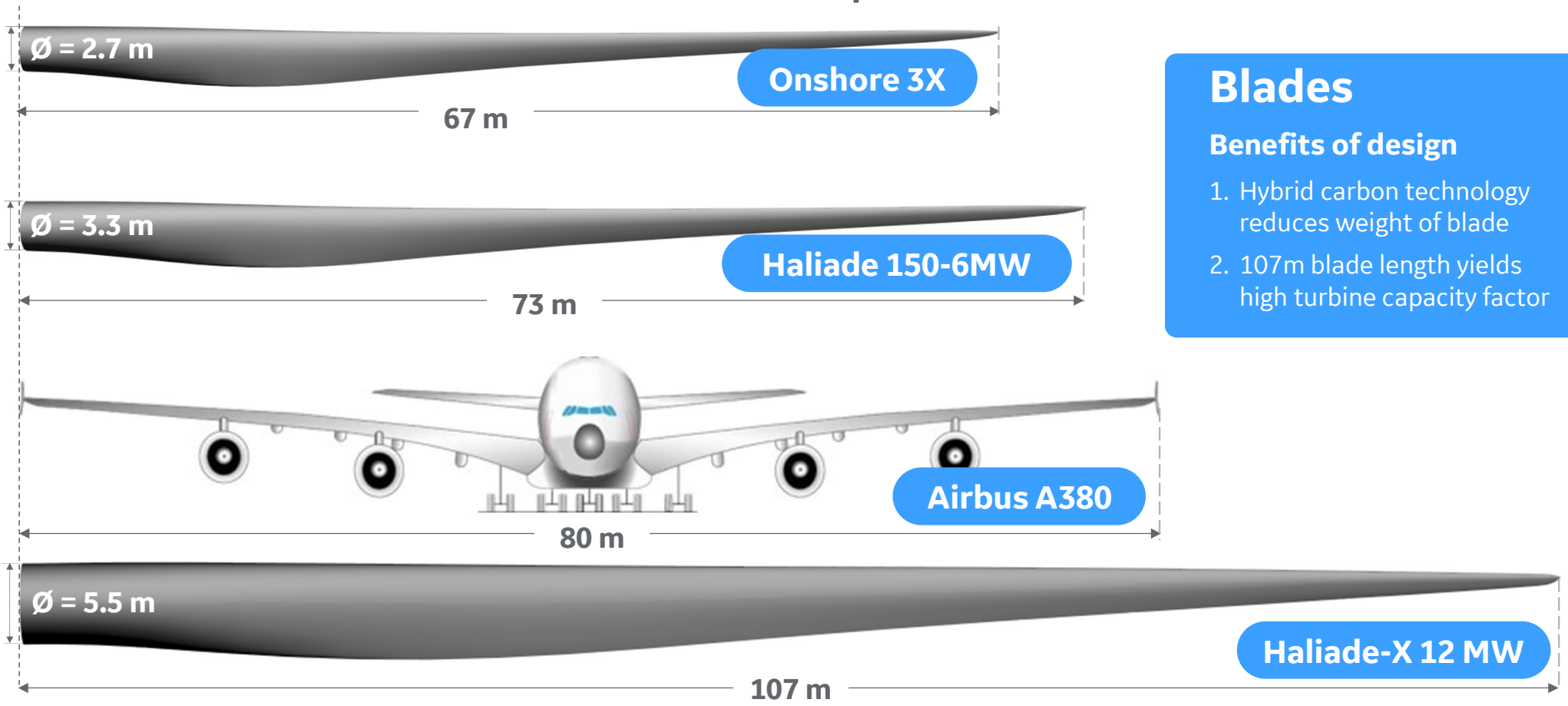
- **12 MW** capacity
- **220**-meter rotor
- **107**-meter long blades
- **260** meters high
- **67 GWh** gross AEP
- **63%** capacity factor
- **38,000** m^2 swept area
- **Wind Class IEC: IB**

Generates **double the energy as previous GE Haliade model**

Generates almost **45% more energy** than most powerful wind turbine available on the market today

Will generate enough clean power for up to **16,000** European households per turbine, and up to **1 million** European households in a 750 MW configuration windfarm

Haliade-X 12 MW blade comparison

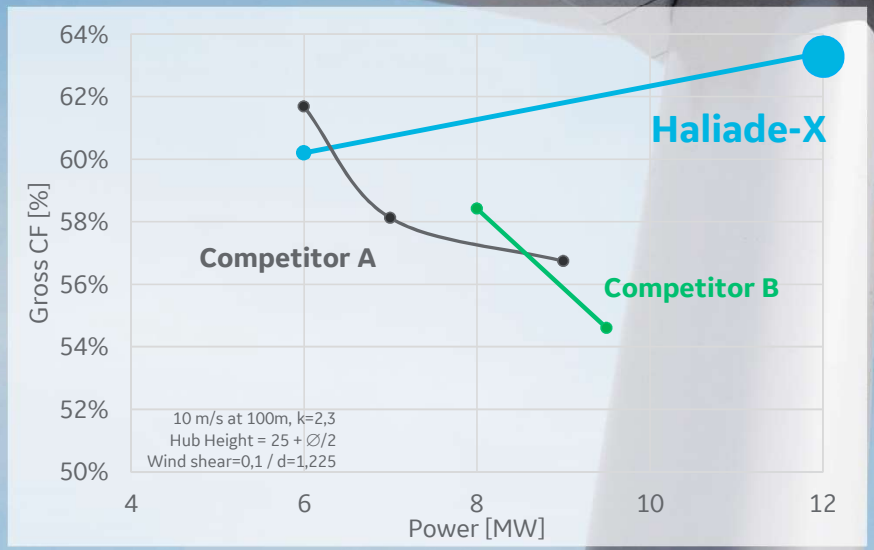


Blades

Benefits of design

1. Hybrid carbon technology reduces weight of blade
2. 107m blade length yields high turbine capacity factor

Haliade-X … the World's first 60 GWh wind turbine



Capacity factor leadership … +7M$/pp/100MW value

- Energy efficiency ↑
- Sensitivity to y-o-y wind variation ↓
- Future proof for merchant developments

12MW generator rating … - 50% units*

- Balance of Plant cost ↓ … -230k$/MW*
- Wind farm installation cycle time ↓ … -20 days/100MW*
- OPEX cost ↓ … -5 $/MWh*

The Intelligent windfarm … time @ sea ↓, revenue ↑

- Asset performance management … enhanced remote diagnostics
- Operations optimization with offshore app's
- OPEX optimization … merchant ready with weather and electricity price forecasting

* Vs state of the art 6MW turbine

Haliade-X 12 MW

12MW-220

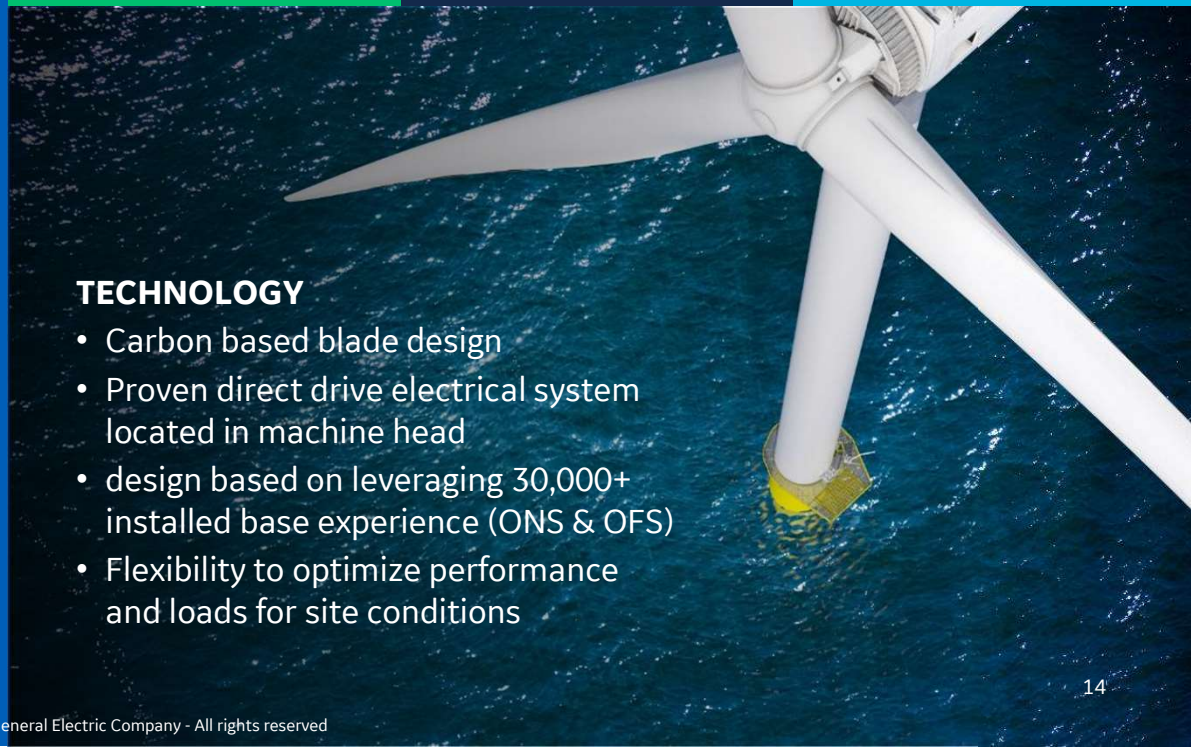
Specs	9.5 m/s	10.0 m/s
AEP* (gross)	~64GWh	~67GWh
Capacity Factor* (gross)	60.3%	63.5%
Wind Class	IEC Class IB	
Design Life	25 years	
DECS Cert. (IEC)	Target 1Q-2019	
Type Cert. (IEC)	Target 2Q-2020	
Frequency	50Hz & 60Hz	
Hub Height	138m	
Shipment	4Q 2020 for 50Hz	
Key Technology	• Direct Drive Train Technology with PMG • Uptower electrical system • Electrical Output: 33kV or 66 kV • Fault Tolerant Design • WindSCADA & WindCONTROL • Digital Wind Farm with GE's Predix Platform	

*5% TI, k factor 2.3, 0.1 wind shear, 1.225kg/m³ air density

GE's Largest, High Efficiency Offshore Turbine

Innovative Blade Design by LM Wind Power

Ideal for High to Medium Wind Speeds



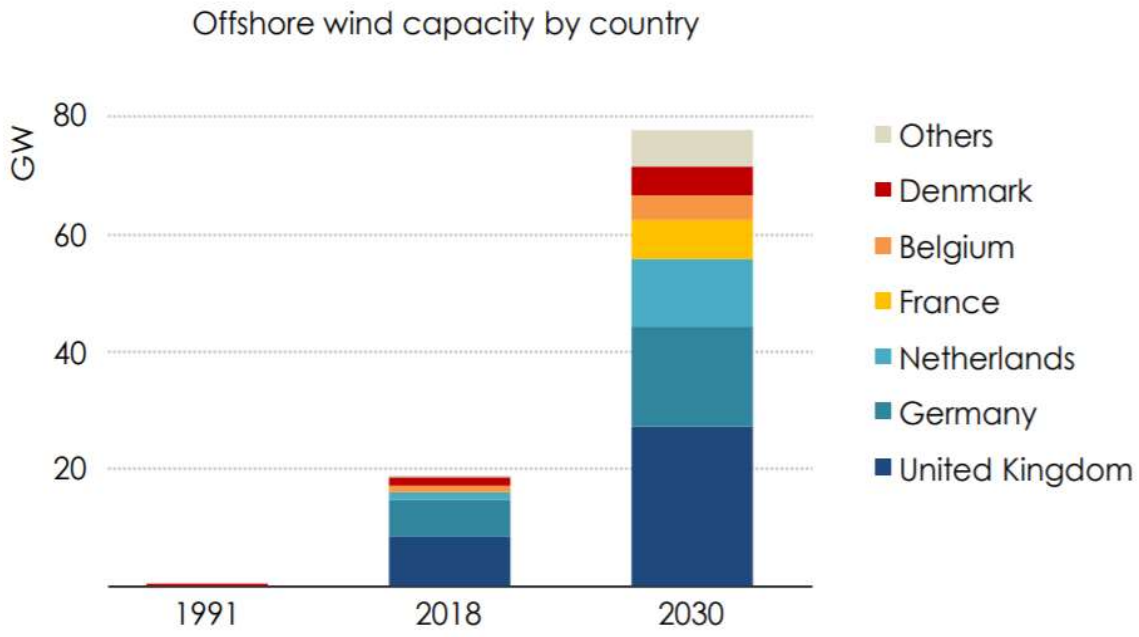
TECHNOLOGY

- Carbon based blade design
- Proven direct drive electrical system located in machine head
- design based on leveraging 30,000+ installed base experience (ONS & OFS)
- Flexibility to optimize performance and loads for site conditions

Worldwide installed base

Overall, there are now 18,814MW of installed offshore wind capacity in 17 markets around the world (2017).

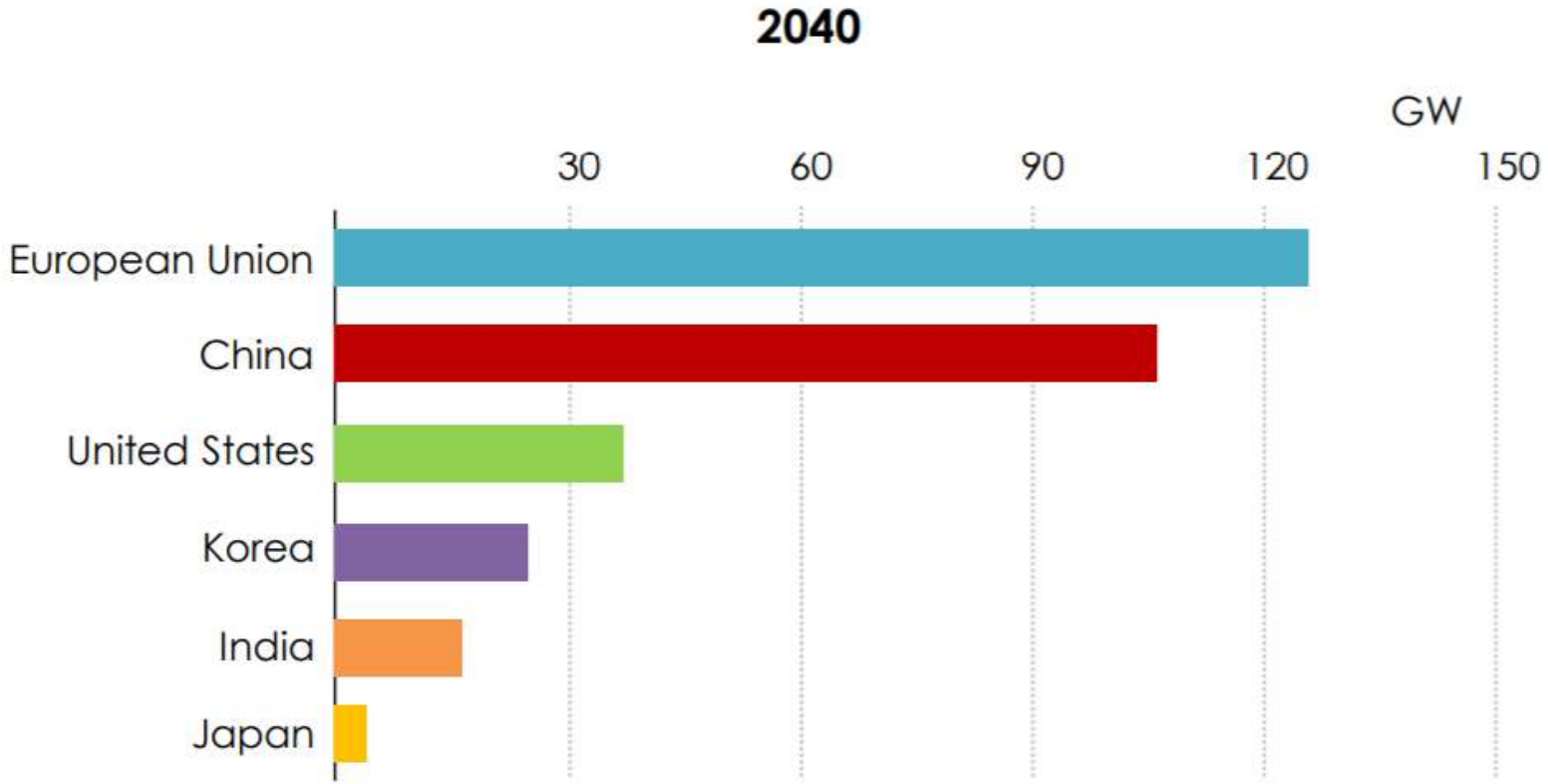
- 84% (15,780) MW - Europe
- UK 36%
- Germany 28.5%.
- China 15%.
- Denmark 6.8%,
- Netherlands 5.9%,
- Belgium 4.7%
- Sweden 1.1%.
- Vietnam, Finland, Japan, South Korea, US, Ireland, Taiwan, Spain, Norway and France



Predicted - 10GW/year going forward – resilient market

Source IEA

Future predicted installed base



Source IEA

Offshore wind installed capacities (GW)

Source IRENA

United States

- Current U.S. offshore wind pipeline : 29 GW
  - 30 MW of installed capacity
  - 6,398 MW of capacity with site control and offtake awarded
  - 19,151 MW of potential capacity where developers have exclusive site control over a defined lease area
  - 8-10 GW of Additional potential capacity in unleased wind energy areas in NY, SC
  - 2,350 MW of potential capacity in unsolicited project applications (Pacific region)

➔ State-level policies continue to drive the U.S. market.

State policies

Maryland, Massachusetts, New Jersey, New York, Rhode Island, and others are vital drivers

June 2019, the sum of official **state offshore wind targets** increased to :

- 11,468 MW to be operating in 2030 and
- 19,968 MW to be operating by 2035. (New York State mandating 9,000 MW by 2035, & NJ 7,500 MW)

➔ With stable policies in place, the Department of Energy found the U.S. could develop a total of 86 GW of offshore wind projects by 2050

Since 2000, the US has reduced its GHG emissions by 8%


Vineyard Wind
Bay State Wind
Equinor Wind US
National Grid
Deepwater Wind
Mayflower Wind Energy
Fairways North Call Area
Equinor Wind US
Vineyard Wind
Fairways South Call Area
Atlantic Shores Offshore Wind
Hudson North Call Area
Hudson South Call Area
Ocean Wind
GSOE I
Skipjack
US Wind
Dominion
Commonwealth of Virginia
Avangrid Renewables
Wilmington West WEA
Wilmington East WEA
Grand Strand Call Area
Cape Romain Call Area
Winyah Call Area
Charleston Call Area

Energy price

Offshore

- Benchmark prices $78/MWh for the second half of 2019, driven by cheaper equipment costs
- **The lowest U.S. offshore wind contract price … Vineyard Wind's $64/MWh Massachusetts deal, August 2018**

Onshore

- Wind and solar prices have dropped 6% and 11% since the first half of 2019,
- Globally: $47/MWh and $51/MWh – (even lower in Alberta, and Saskatchewan)

Battery storage prices down 35% in 2019, global average of $186/MWh.