Industrializing Offshore Wind: Getting to 1,000 units

Offshore Direct Drive

25 January 2018

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Agenda

1 **Siemens Gamesa Renewable Energy**

2 Our presence in Asia Pacific

3 Industrializing offshore wind with the Direct Drive technology

Three business units strongly positioned in the market

Onshore

+70 GW installed in 70 countries since 1980

The technological partner of choice for Onshore wind power projects.

Offshore

11 GW installed worldwide since 1991

Most experienced offshore wind company with the most reliable product portfolio in the market.

Service

+53 GW maintained

Commitment beyond the supply of the wind turbine to reach the profitability objectives of each project.

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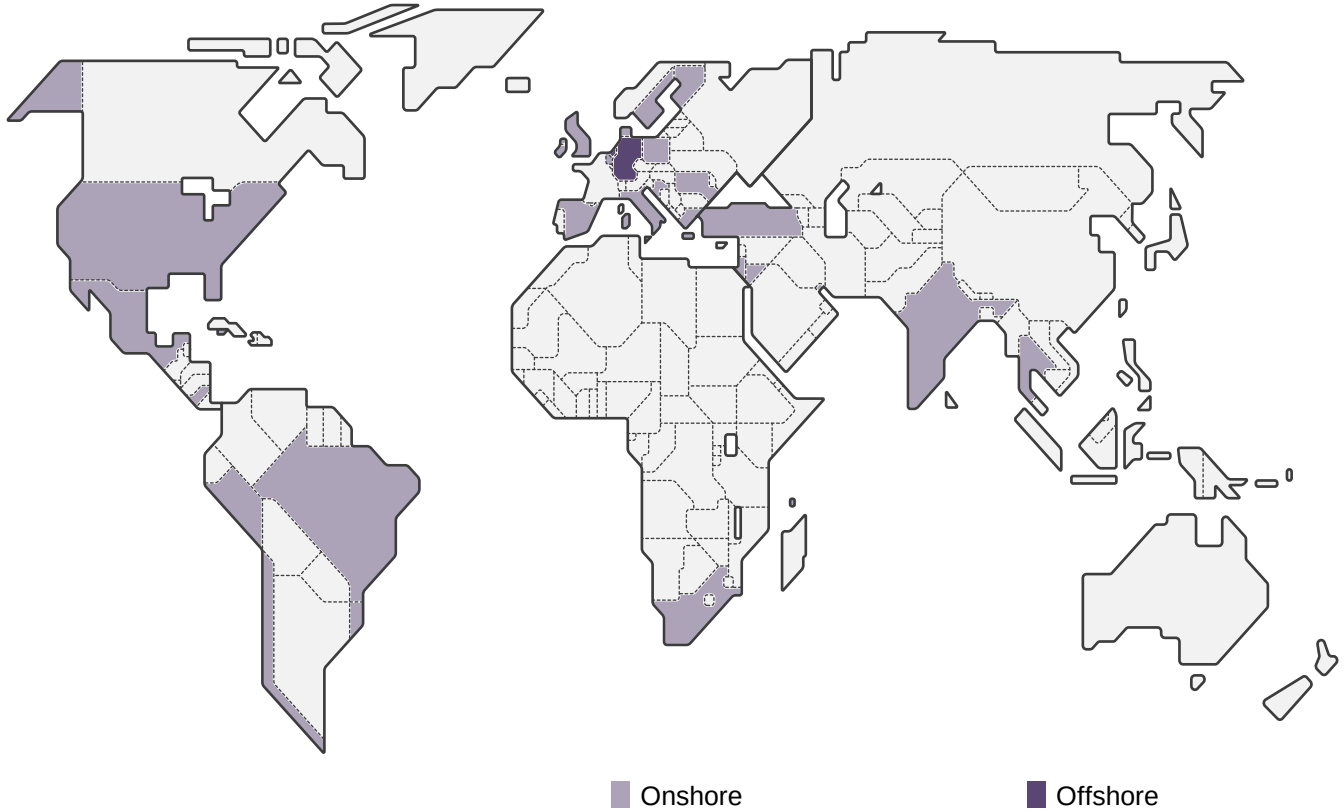
A leading provider of wind power solutions to customers around the globe

Offshore
- #1 in global Offshore market

Onshore
- #4 in global Onshore market
- #1 in India and LATAM

Service
- #2 in service backlog
- #2 in serviced fleet size

Top 3 market share* position in several main countries



* Based on MW installations

Source: MAKE Global Wind Turbine OEM 2016 Market Share

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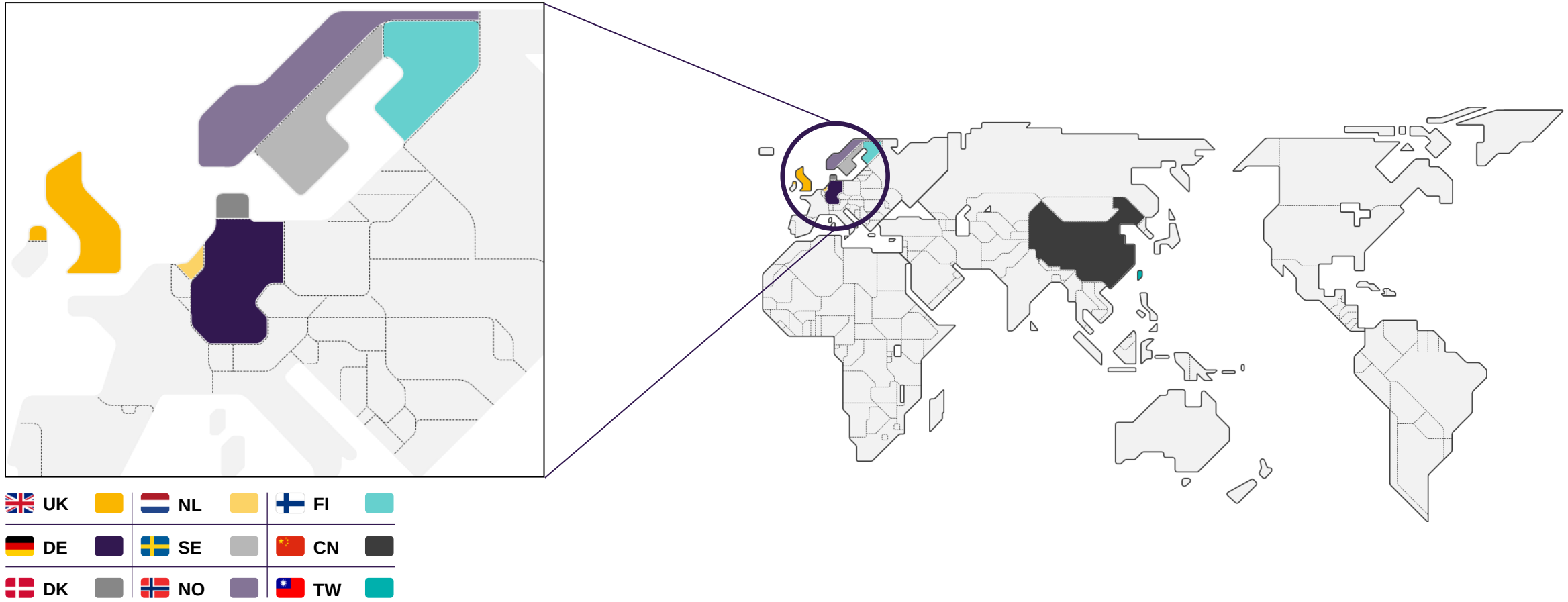
Market leader within offshore wind power: ~ 11 GW installed[1)]



1) Installed by November 2017

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Offshore wind is gaining momentum in Taiwan and rest of the region

Siemens Gamesa – Early Market Engagement

Formosa Offshore Wind Farm I Phase 1

- **First project** in Taiwan, developed by Swancor / FOWI
- Siemens Gamesa – Supply and installation wind turbines
- **2 x 4 MW** wind turbines
- **2016 – Erection of the two turbines announcing market take-off**

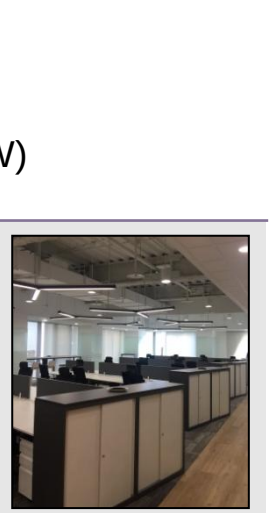
Official national targets (in cumulative capacity)

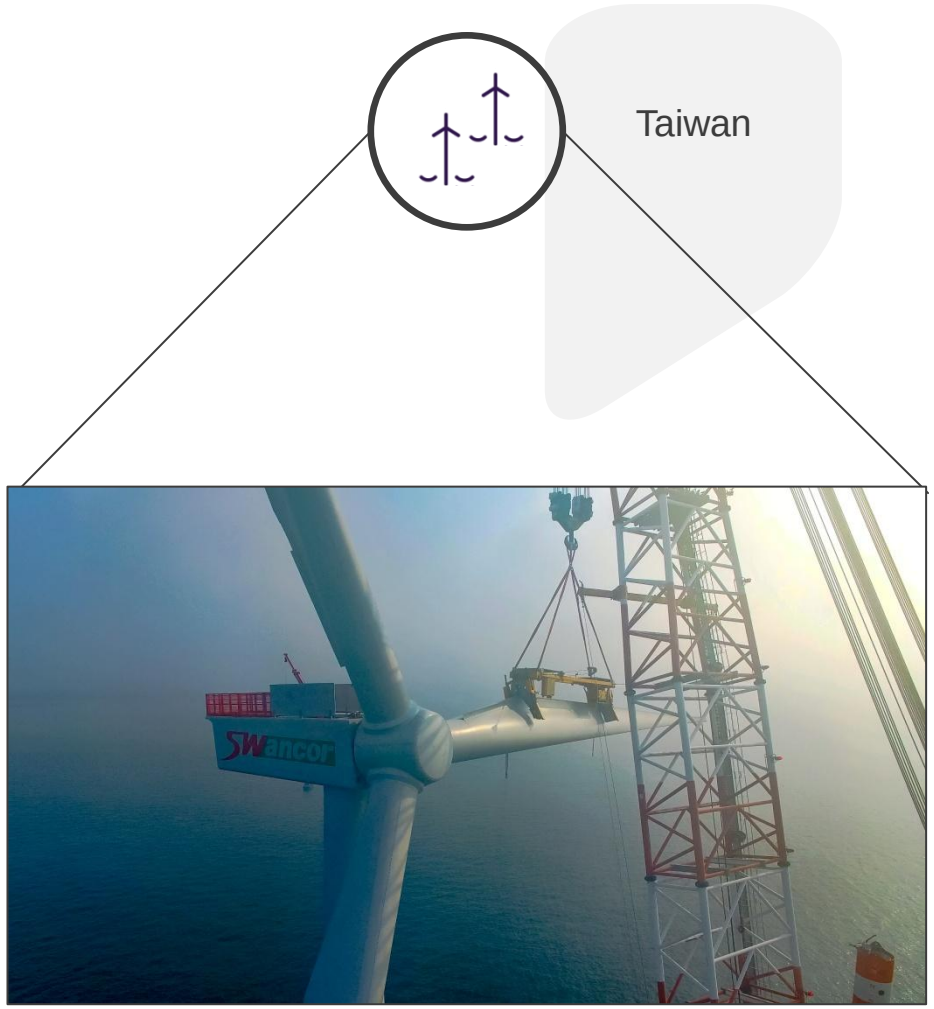
- 2020: **520 MW**
- 2025: Under review (Expected **between 5-6 GW**[1], prev. 3 GW)

2017 – New office in Taipei

Regional hub for APAC

- Sales, Service, Development and Project Managment





1) Per communications of the Bureau of Energy

Copyright: Swancor / FOWI

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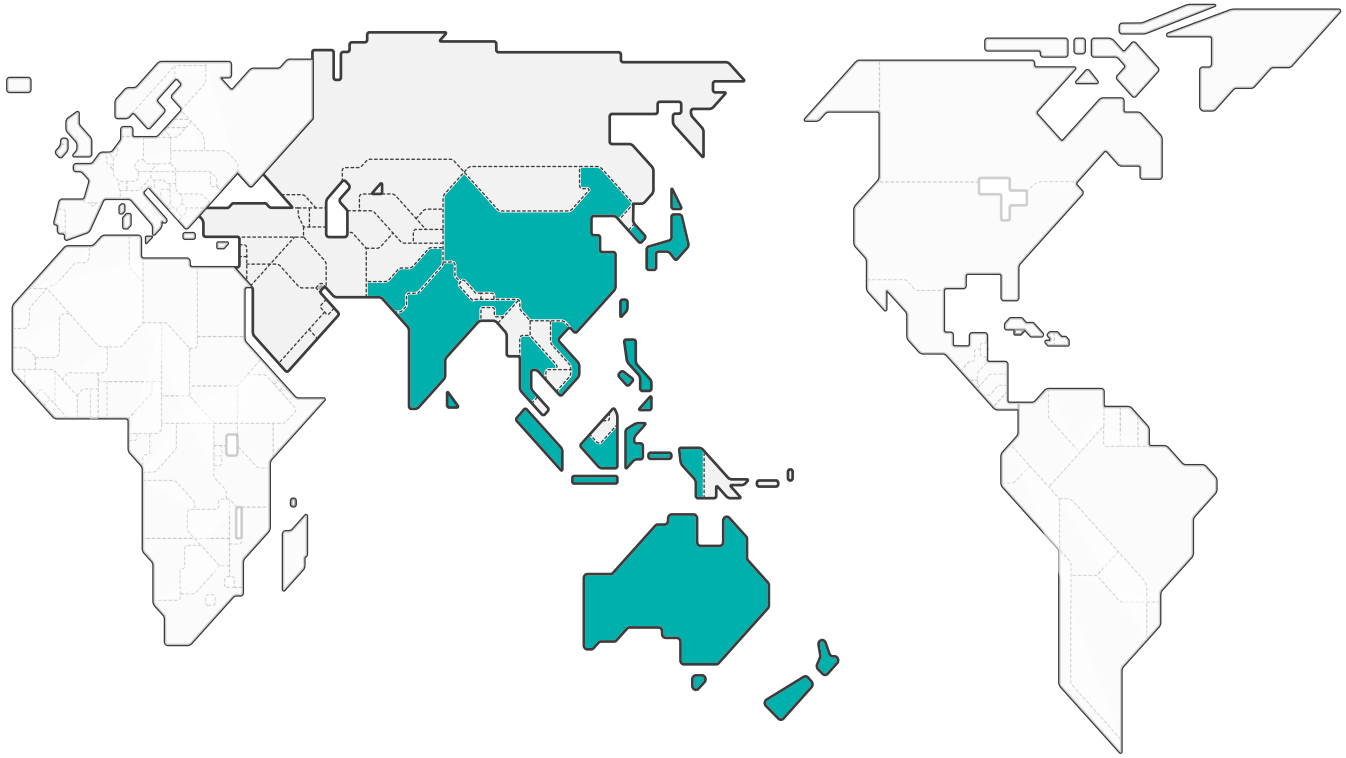
Extended presence in APAC in both Onshore and Offshore wind businesses

	Installed and upcoming
Australia	✓
China, P.R.C.	✓
India	✓
Indonesia	✓
Japan	✓
Korea, R.O.K.	✓
New Zealand	✓
Pakistan	✓
Philippines	✓
Sri-Lanka	✓
Taiwan, R.O.C.	✓
Thailand	✓
Vietnam	✓



Offshore[1)]

+1GW of Siemens Gamesa turbines installed in China, P.R.C. and Taiwan, R.O.C. **since 2011**

1) Installed by November 2017

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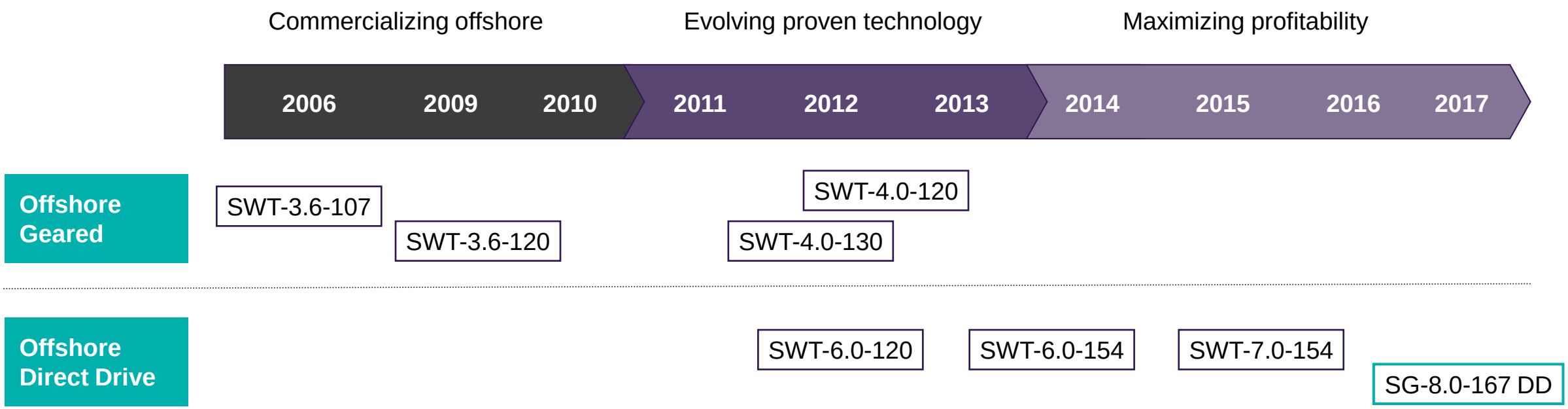
Continuously evolving Product Portfolio to match market and customer needs



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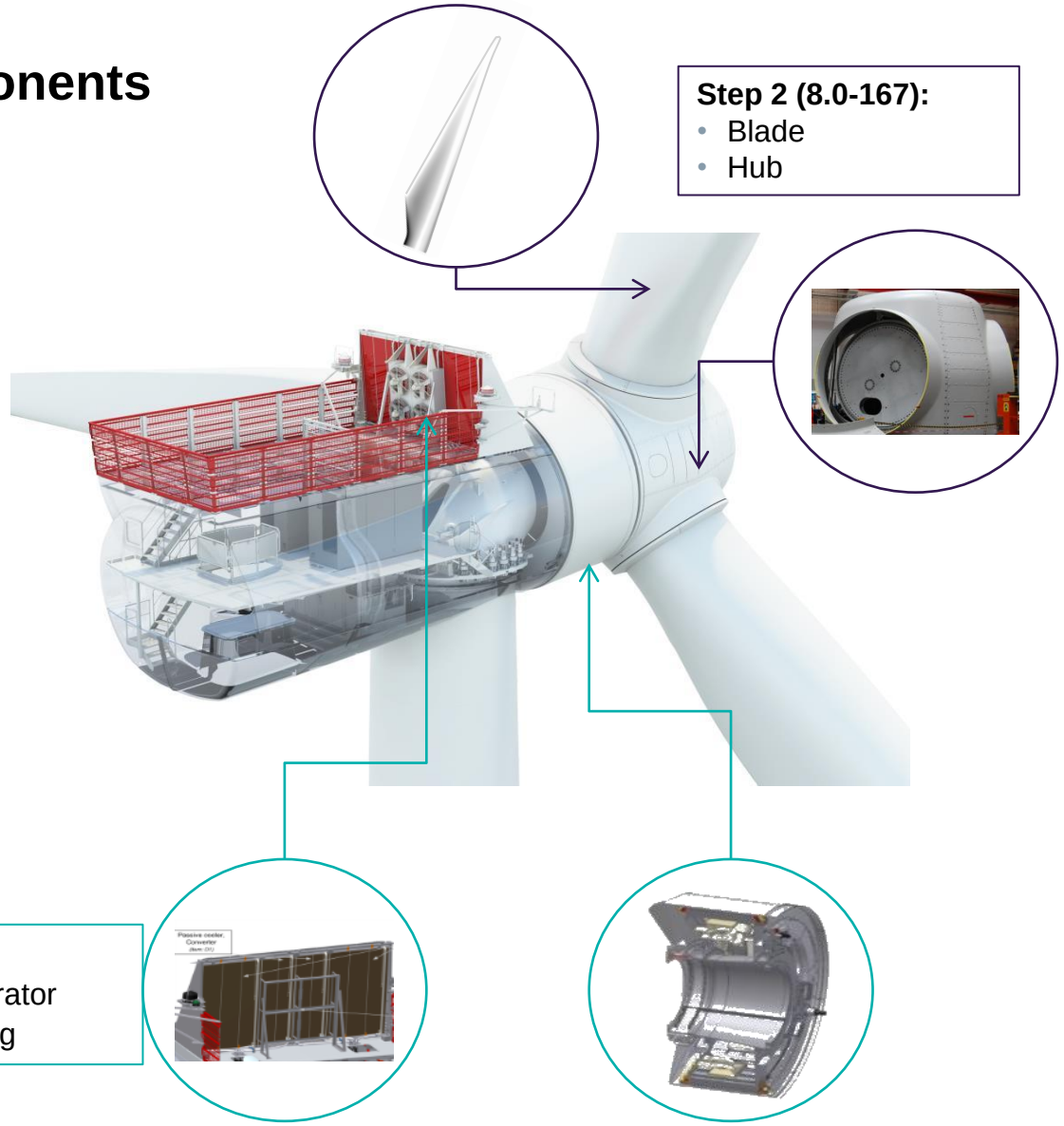
Industrializing offshore wind

	SWT-6.0-154	SWT-7.0-154	SG 8.0-167 DD
			
Annual Energy Production		Increased up to 10%	Increased up to 20%
Time-to-market		Serial installation in 2018	Serial installation in 2020
Industrialization		>400 units on OF DD platform by 2018	>1,000 units on OF DD platform by 2020
Supply chain		Re-use technology and supply chain	Re-use technology and supply chain
Balance of plant		Minimal impact	Minimal impact

SG 8.0-167 DD: New rotor, re-use all other components

Minimal upgrade; maximal benefit

- **Annual energy production (AEP): +20%***
- **New technology**
  - More powerful magnet grade
  - Blade material and structure
  - Load optimized pitch control (sensors in blade root)
- **WTG upgrades on current technology**
  - Hub structure
  - More powerful cooling
  - Blade aerodynamics and structure



* At ”North Sea” wind conditions, compared to SWT-7.0-154

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OF DD platform project footprint

No. of turbines	Type of turbine	Project name	Country
2014			
35	SWT-6.0-154	Westermost Rough	UK
2015/16			
97	SWT-6.0-154	Gode Wind I+II	D
2017			
67	SWT-6.0-154	Veja Mate	D
67	SWT-6.0-154	Dudgeon	UK
91	SWT-6.0-154	Race Bank	UK
56	SWT-6.0-154	Galloper	UK
5	SWT-6.0-154	Hywind Scotland	UK
4	SWT-7.0-154	Nissum Bredning*	DK
2018			
60	SWT-6.0-154	Arkona Becken	D
47	SWT-7.0-154	Walney ext. East	UK
84	SWT-7.0-154	Beatrice	UK
42	SWT-7.0-154	Rentel	BE
71	SWT-7.0-154	Hohe See	D
2019			
174	SWT-7.0-154	Hornsea ONE	UK
102	SWT-7.0-154	East Anglia I*	UK
16	SWT-7.0-154	Albatros	D
2020/21			
94	SG 8.0-167 DD	Borssele I+II*	NL
41	SG 8.0-167 DD	Vesterhav N/S*	DK
72	SG 8.0-167 DD	Kriegers Flak	DK

More than 1,000 DD turbines will be installed offshore prior to the SG 8.0-167 DD introduction

* 66kV projects

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Proven technology tailored for APAC market conditions

We are working to deliver our latest offshore wind solution on a global scale

Design adaptations ensuring a perfect market fit

- Designed to withstand typhoon conditions as defined by IEC 61400-1 Ed. 4
- Optimized thermal performance for improved operation in high temperatures
- Designed to comply with local codes and standards, incl. 50/60Hz grid

Market introduction

- First utility scale project in APeC* is expected ~2021

Note: * APeC = Asia Pacific excluding China

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Thank you!

Niels Steenberg
Executive General Manager for offshore wind in Asia Pacific

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Market leader within Offshore Wind Power: ~ 11 GW installed[1)]

United Kingdom

Project	Year
Burbo Bank: 25x SWT-3.6-107	2007
Dudgeon: 57x SWT-6.0-154	2017
Greater Gabbard: 140x SWT-3.6-107	2012
Gunfleet Sands I & II: 48x SWT-3.6-107	2009
Gunfleet Sands III: 2x SWT-6.0-120	2013
Gwynt Y Mor: 160x SWT-3.6-107	2015
Hywind: 5x SWT-6.0-154	2017
London Array: 175x SWT-3.6-120	2013
Lincs: 75x SWT-3.6-120	2013
Lynn/Inner Dowsing: 54x SWT-3.6-107	2008
Rhyl Flats: 25x SWT-3.6-107	2009
Sheringham Shoal: 88x SWT-3.6-107	2012
Teesside: 27x SWT-2.3-93	2013
Walney I: 51x SWT-3.6-107	2011
Walney II: 51x SWT-3.6-120	2012
Westermost Rough: 35x SWT-6.0-154	2015

Holland

Project	Year
Gemini: 150x SWT-4.0-130	2016
Westermeerwind: 48x SWT-3.0-108	2016

Germany

Project	Year
Alpha Ventus: 6x AD5-116	2015
Amrumbank West: 80x SWT-3.6-120	2015
Baltic I: 21x SWT-2.3-93	2010
Baltic II: 80x SWT-3.6-120	2015
BHV Airport: 1x AD8-180	2017
Borkum Riffgrund I: 78x SWT-4.0-120	2015
Butendiek: 80x SWT-3.6-120	2015
DanTysk, 80x SWT-3.6-120	2015
Global Tech: 80x AD5-116	2015
Gode Wind I & II: 55x SWT-6.0-154 + 42 x SWT-6.0-154	2016 2017
Lehe 1, 2 & 3: 2x AD5-116 + 1x AD5-135	2008 2013
Meerwind Süd Ost: 80x SWT-3.6-120	2014
Riffgat: 30x SWT-3.6-120	2014
Sandbank: 72x SWT-4.0-130	2017
Speckenbüttel 1 & 2: 2x AD5-116	2004
Trianel Borkum: 40x AD5-116	2015
Veja Mate: 67x SWT-6.0-154	2017
Wikinger: 65x AD5-135	2017

Taiwan

Project	Year
Formosa: 2x SWT-4.0-120	2017

Denmark

Project	Year
Anholt: 111x SWT-3.6-120	2013
Frederikshavn: 1x SWT-2.3-82	2003
Horns Rev II: 91x SWT-2.3-93	2009
Middelgrunden: 20x SWT-2.0-76	2000
Rødsand/Nysted: 72x SWT-2.3-82	2003
Rødsand II: 90x SWT-2.3-93	2010
Rønland: 4x SWT-2.3-93	2002
Samsø: 10x SWT-2.3-82	2002
Vindeby: 11x 0.45 MW -37	1991

Finland

Project	Year
Pori: 1x SWT-2.3-101	2010

Norway

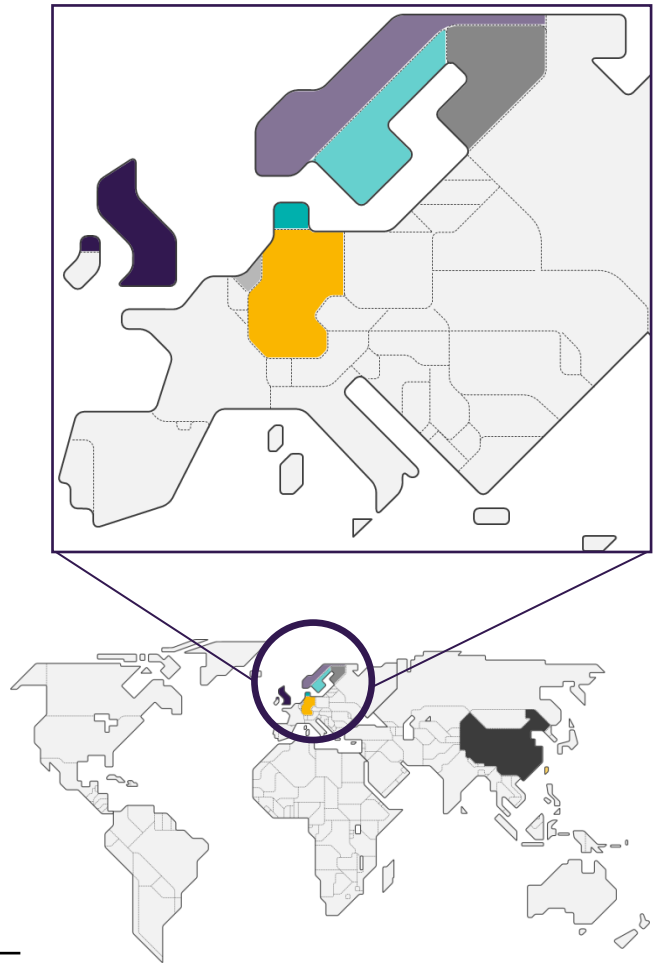
Project	Year
Hywind: 1x SWT-2.3-82	2009

Sweden

Project	Year
Lillgrund: 48x SWT-2.3-93	2007

China

Project	Year
Rudong Intertidal: 21x SWT-2.3-101	2011



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