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Global Offshore Wind Update

Asia Offshore Wind Day, Taipei

18 Sep. 2018

C0 Members

C1, C2 and C3 Members

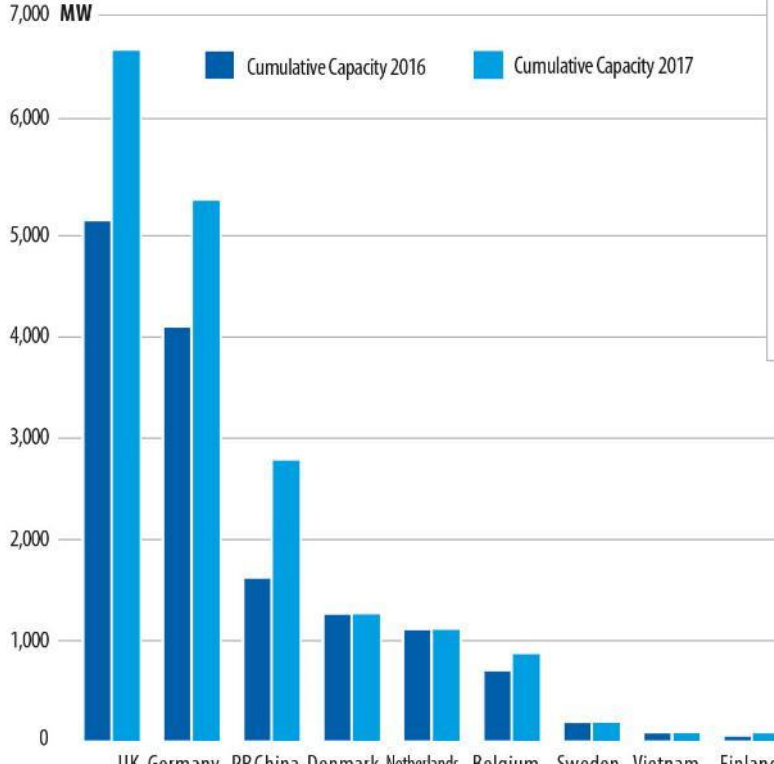
Associations

Contents

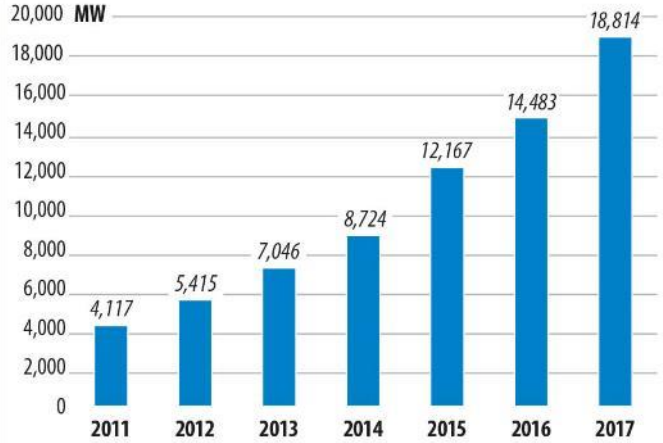
- Global Offshore Wind Development Overview
- Offshore Development in Europe
- Non European markets
- GWEC's Offshore Taskforce
- Looking ahead/Conclusions

Thanks to BNEF, BVG Associates CWEA, DNV-GL,IRENA, JWPA, and WindEurope for source material

GLOBAL CUMULATIVE OFFSHORE WIND CAPACITY IN 2017



ANNUAL CUMULATIVE CAPACITY (2011-2017)

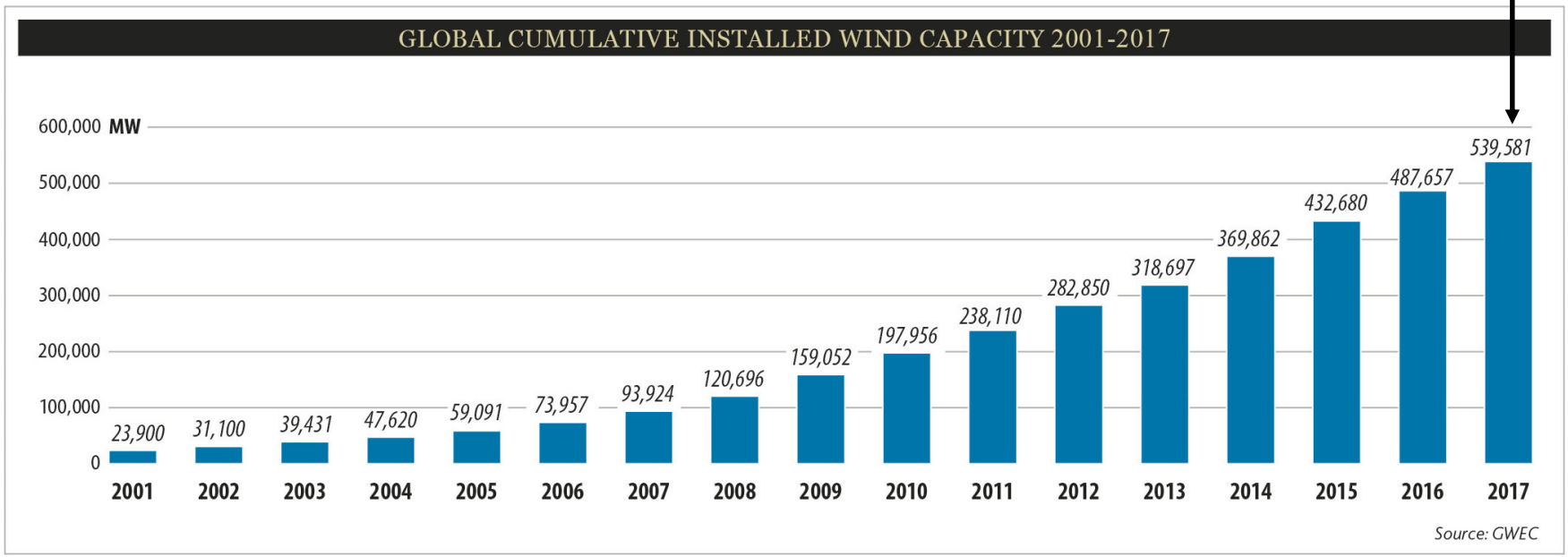


	UK	Germany	PR China	Denmark	Netherlands	Belgium	Sweden	Vietnam	Finland	Japan	S Korea	US	Ireland	Taiwan	Spain	Norway	France	Total
Total 2016	5,156	4,108	1,627	1,271	1,118	712	202	99	32	60	35	30	25	0	5	2	0	**14,483**
New 2017	1,680	1,247	1,161	0	0	165	0	0	60	5	3	0	0	8	0	0	2	**4,331**
Total 2017	6,836	5,355	2,788	1,271	1,118	877	202	99	92	65	38	30	25	8	5	2	2	**18,814**

Source: GWEC

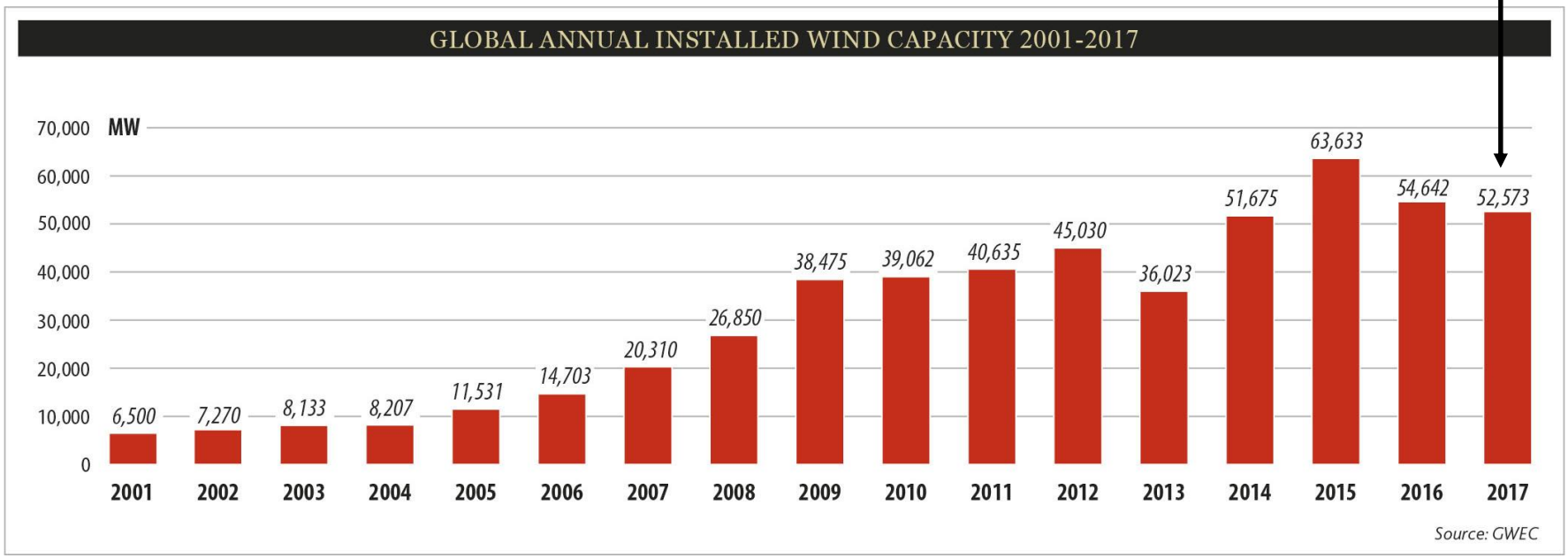
Cumulative Markets

3.5% Offshore

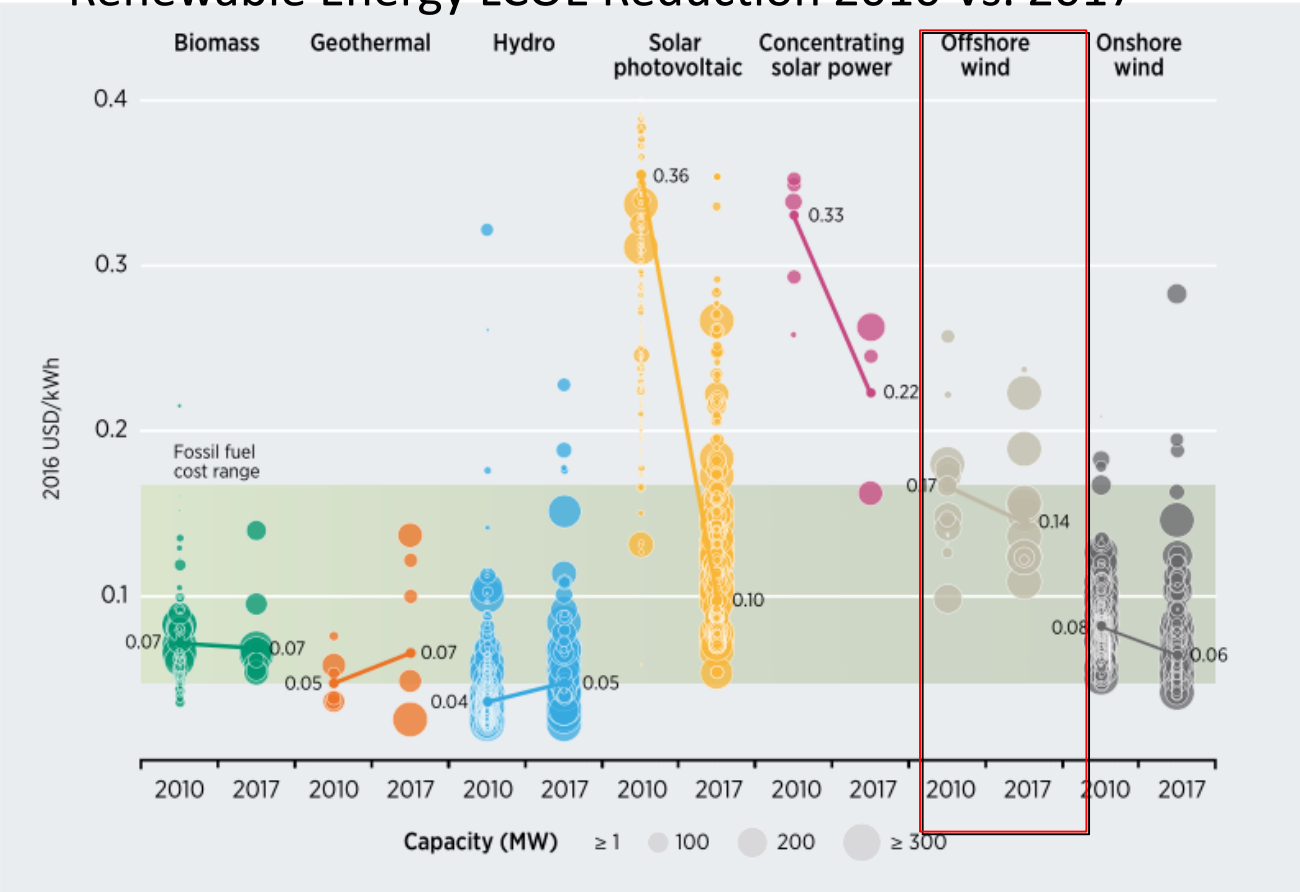


Annual Markets

8.2% Offshore,
20% from EU



Renewable Energy LCOE Reduction 2010 Vs. 2017



- Offshore LCOE reduction: 2017 $0.14/kWh, 17% reduction from 2010 level of $0.17/kWh;
- Onshore LCOE reduction: 25%

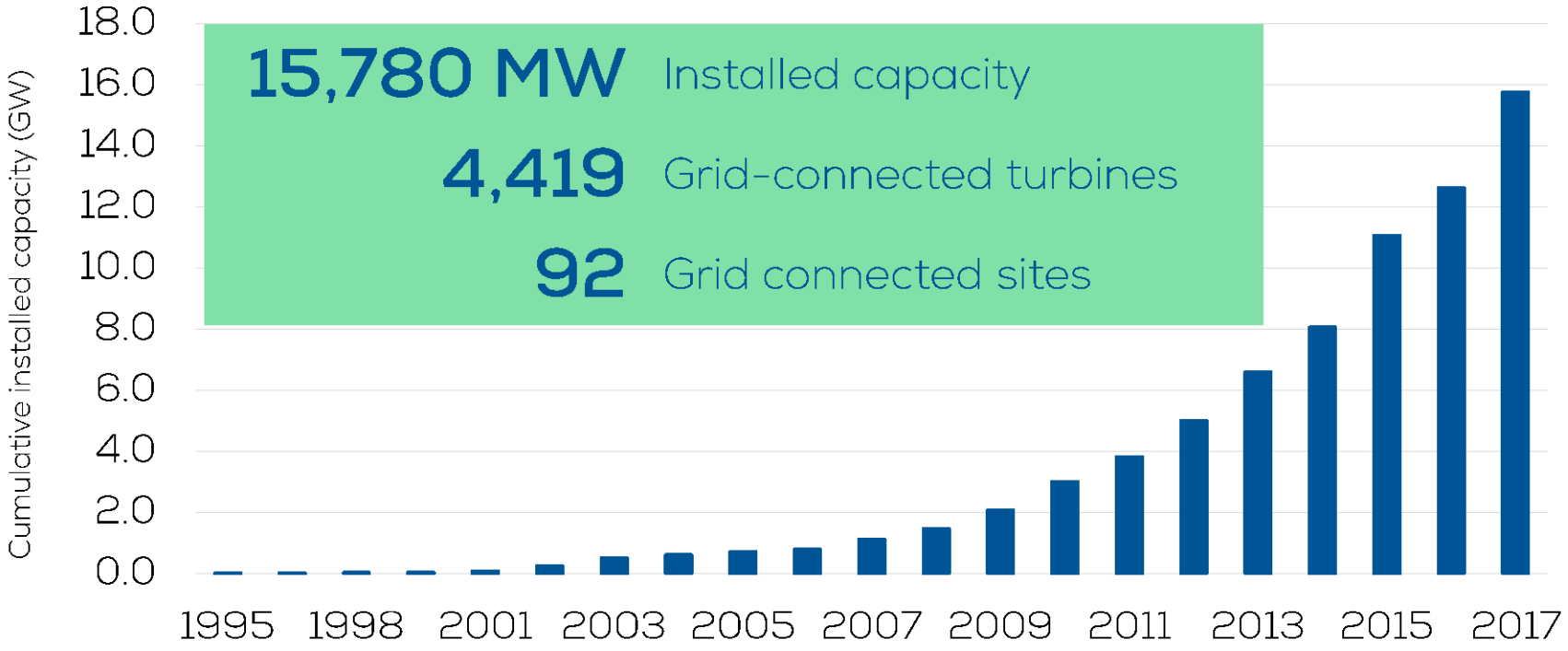
Source: IRENA Renewable Cost Database.

Note: The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted average LCOE value for plants commissioned in each year. Real weighted average cost of capital is 7.5% for OECD countries and China and 10% for the rest of the world. The band represents the fossil fuel-fired power generation cost range.

European Markets

- Overall Installation
- Cost Reduction
- Outlook of the Development

Cumulative Installed Offshore Wind Capacity in Europe (MW)



WindEurope

European Wind New Installation H1 2018

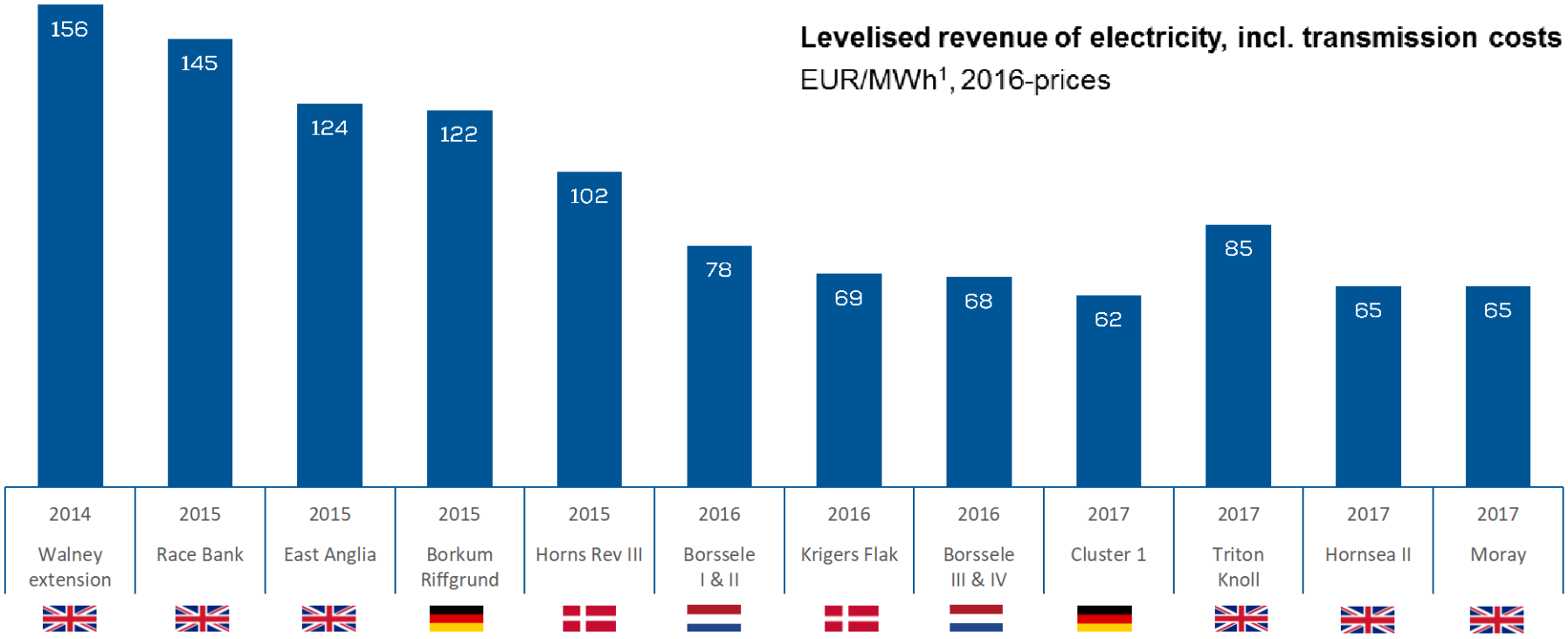
Offshore	MW
UK	911
Belgium	175
Denmark	28
Spain	5
France	1

Total onshore:
3,333 MW

Total offshore:
1,120 MW

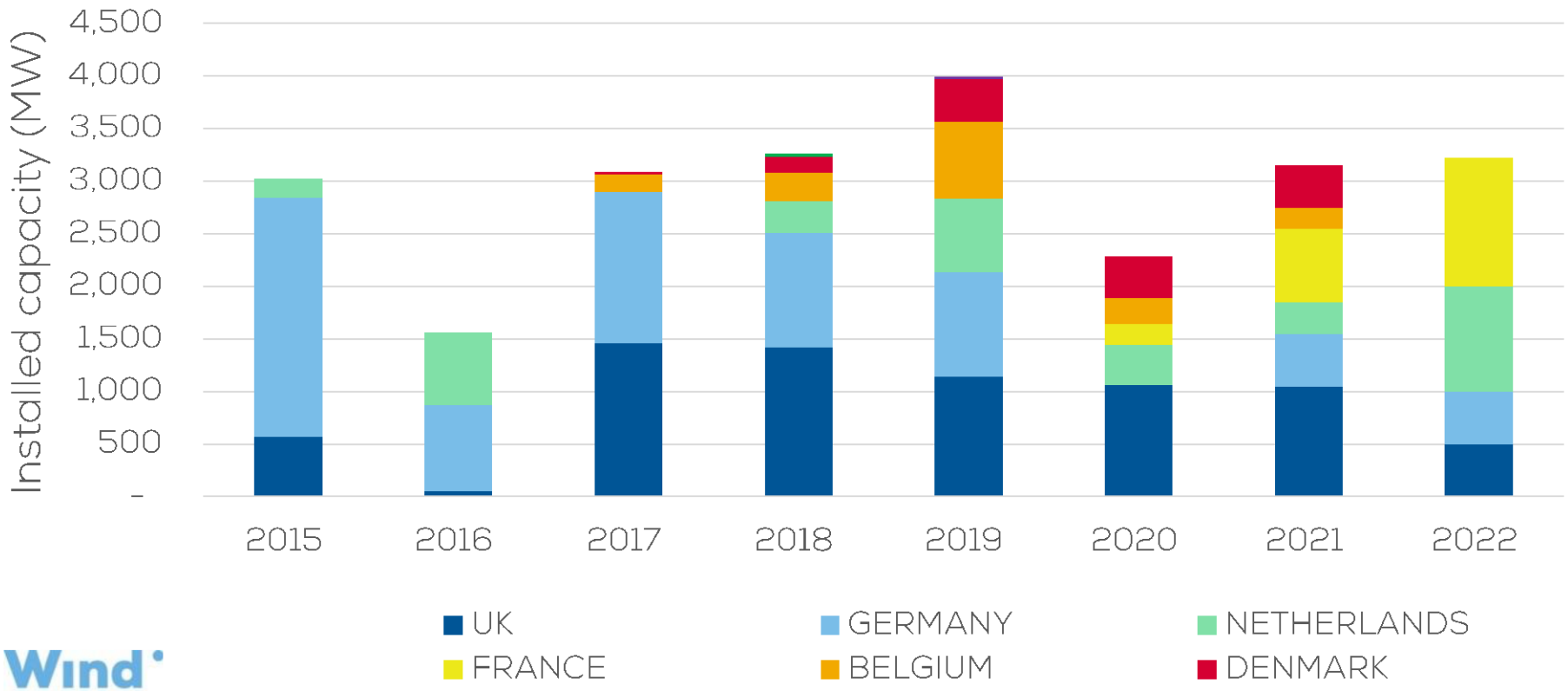
- 2018 H1 newly added 1,120MW, spread in five countries;
- Cumulative capacity of 16,880 MW
- 98 wind farms across 11 countries

Price reduction: Offshore wind



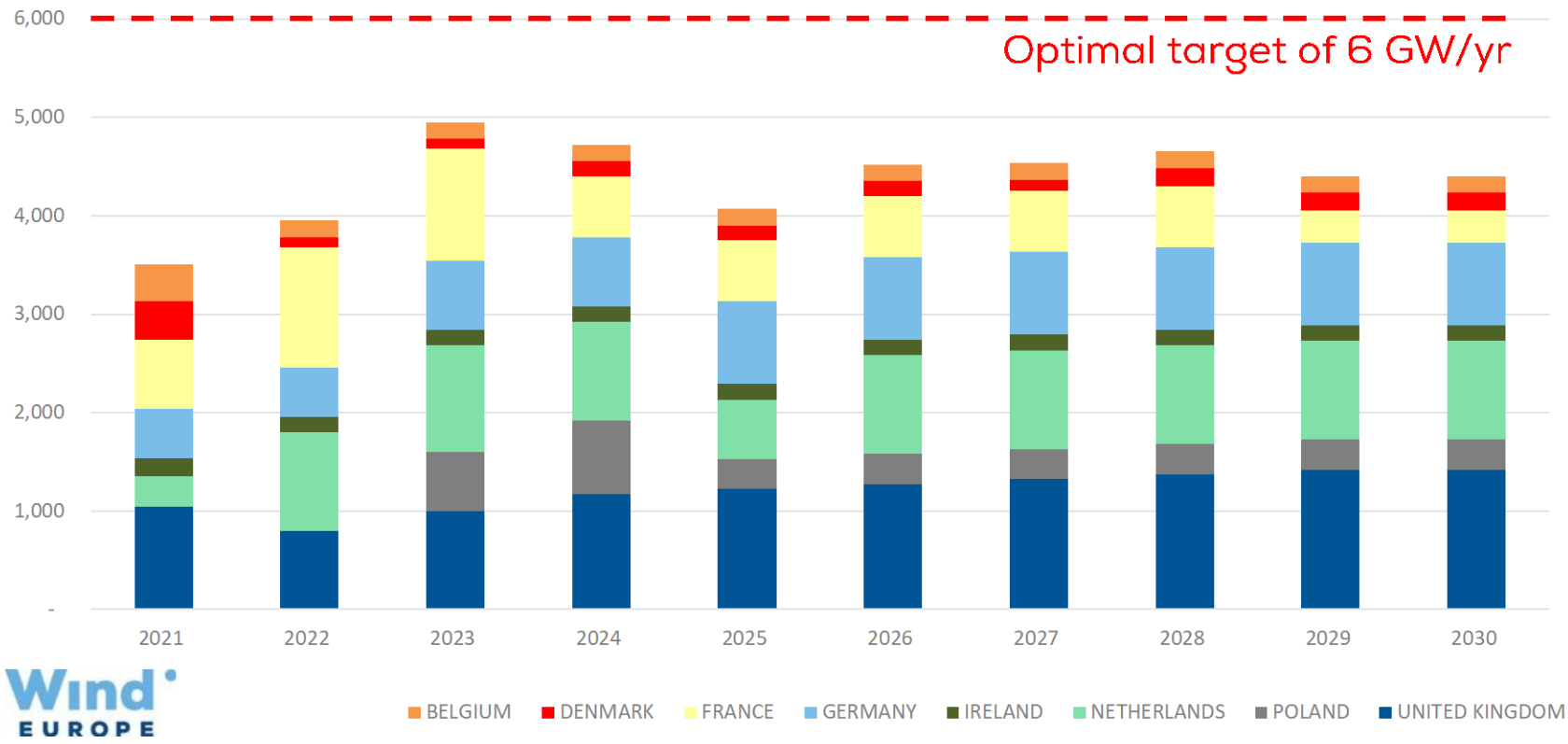
Wind EUROPE

2022 outlook



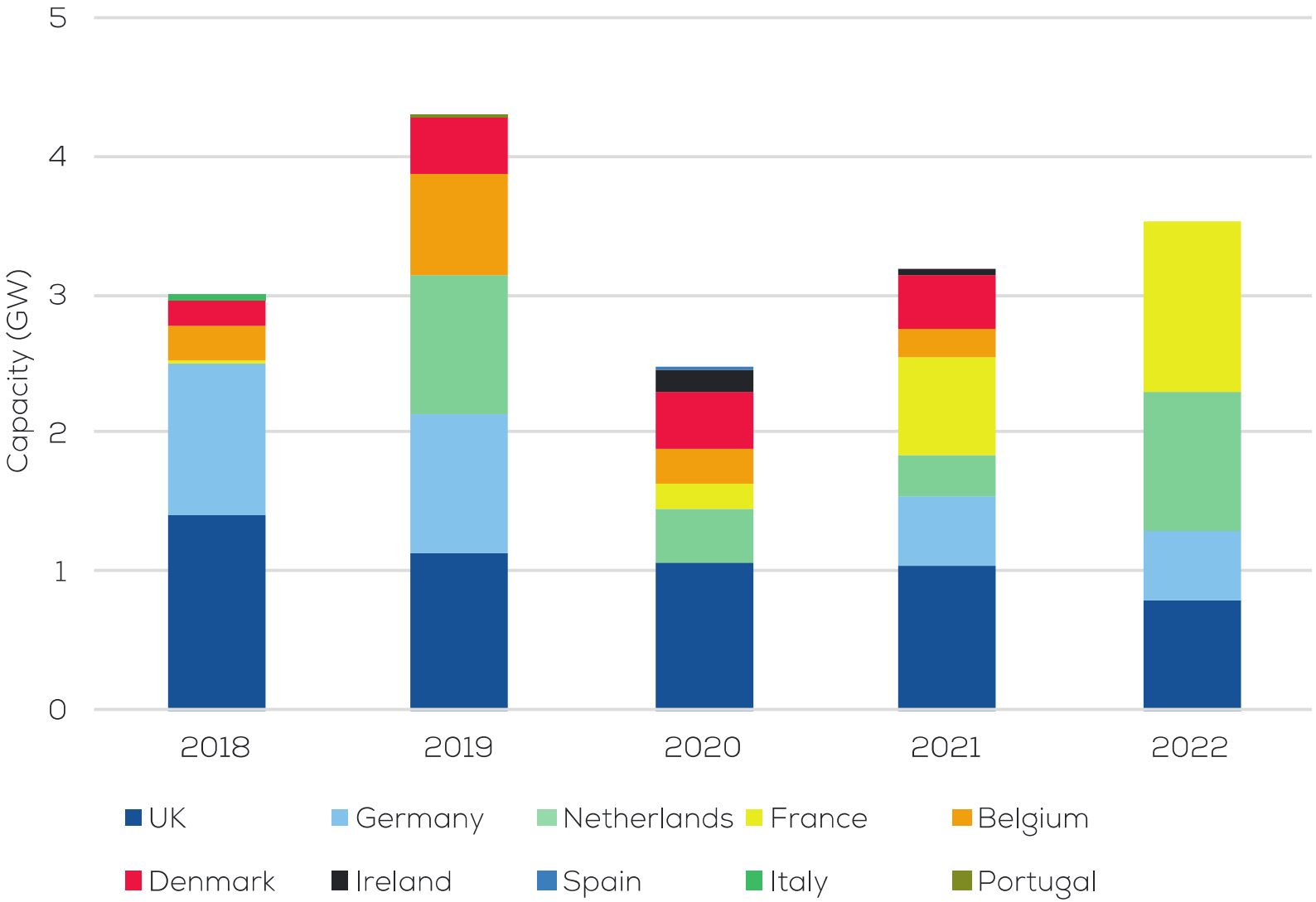
Wind EUROPE

2030 outlook



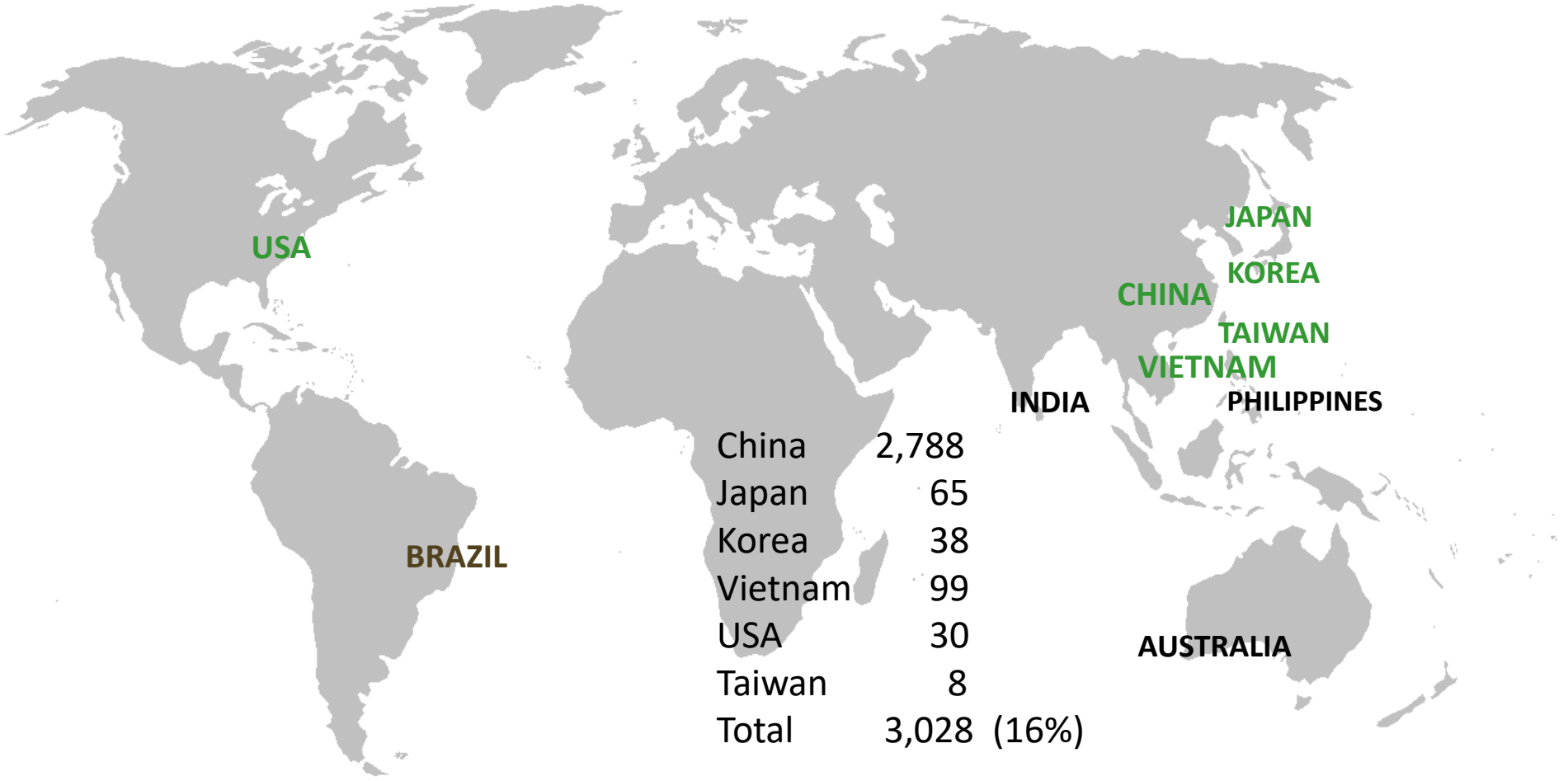
Wind EUROPE

Annual gross offshore installations per country – WindEurope's Central Scenario



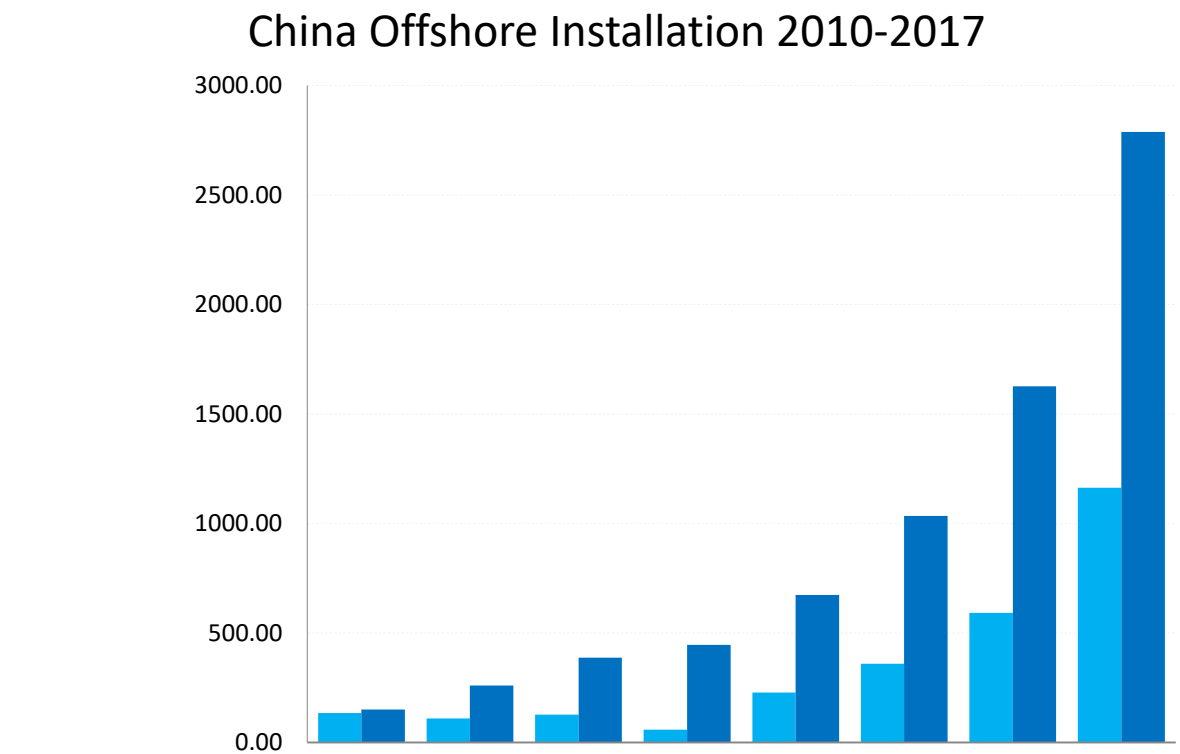
Source: WindEurope

Non European Offshore Markets today



China	2,788	
Japan	65	
Korea	38	
Vietnam	99	
USA	30	
Taiwan	8	
Total	3,028	(16%)

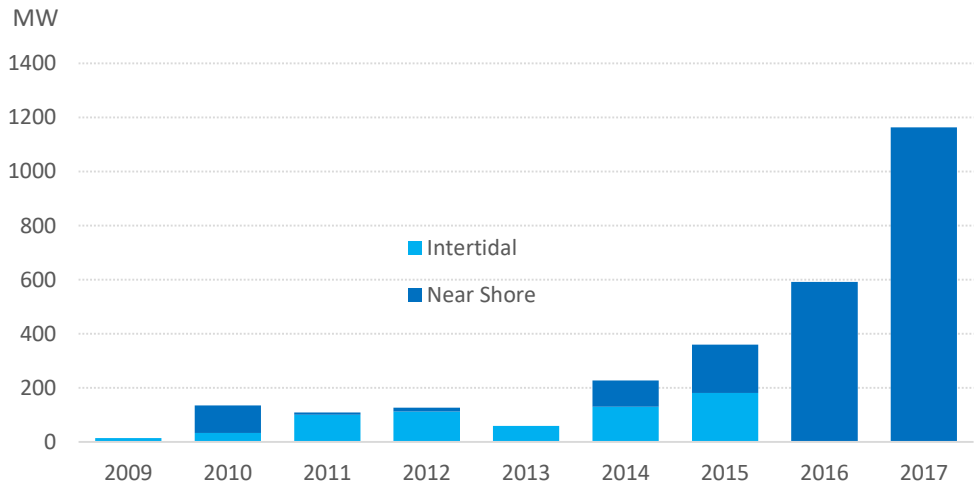
China Offshore



	2010	2011	2012	2013	2014	2015	2016	2017
NEW INSTALLATION/MW	135.50	109.58	127.00	59.00	227.60	360.50	592.20	1163.80
CUMULATIVE /MW	151.00	260.58	387.58	446.58	674.18	1034.68	1626.88	2787.68

Source: CWEA

Intertidal Vs. Near Shore in Annual Installation (2009-2017)



- Intertidal projects' share is drastically coming down, 23% of the total cumulative installation by end of 2017.

- Average water depth: 8.57m;
- Average distance from the shore: 17.32km

Source: CWEA

Offshore Installation By Province(2017) (MW)

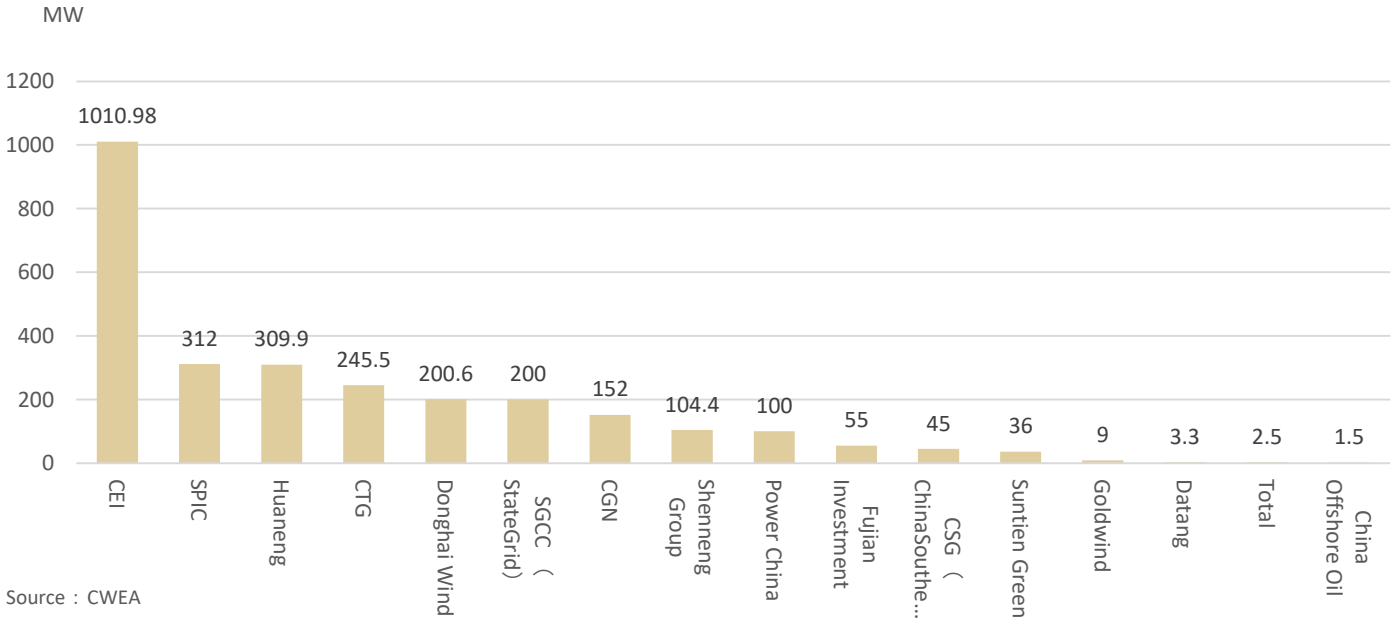
Provincial 2020 targets

- Jiangsu 3500 MW
- Guangdong 2000 MW
- Fujian 2000 MW
- Zhejiang 3000 MW

China Offshore

- OEM Market share: Shanghai Electric(SGRE licenced) 50%; Goldwind 18%; Envision 17%; CSIC 9%
- Developers are all Chinese SOE and Chinese utilities

China Offshore Developers Market Share in Cumulative Offshore Installation （2017）



Source：CWEA

China Offshore

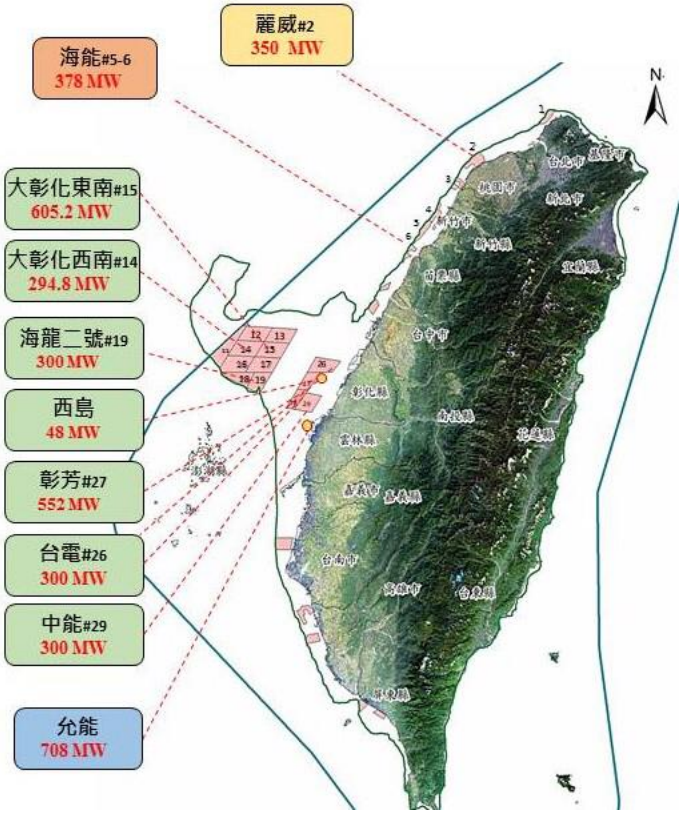
- 2014 FIT introduced:
  - Near shore tariff 0.85RMB/kWh ($0.12/kWh)
  - Intertidal project tariff 0.75RMB/kWh ($0.11/kWh)

- May 2018, New projects will start tender process to determine the investors and the project tariff, apply to both onshore and offshore.
  - New opportunities for international offshore developers, with pressure to drive down the cost dramatically in a very short time?
  - Tender rules being set up will be crucial for the entering of the international developers;

Taiwan Offshore

Success story of the Taiwan Government on setting up the offshore industry:

- Clear, ambitious and doable target of 5.5GW offshore wind by 2025;
- Initial high FIT attracted interested parties;
- Partnership of local industry and renowned international developers and supply chain;



- April 2018 3,836MW of grid connection capacity awarded, with FIT;

- A further 1,664MW was awarded to 4 projects in June 2018; bid price ranged from TWD 2,224.5/MWh to TWD 2,548/MWh (EUR 63.03/MWh to EUR 72.24/MWh)

Japan Offshore

Offshore Wind Power Experience in Japan (2017)

Type	Location		Distance (km)	Depth (m)	Rated (MW)	No. of WTG	Total (MW)	Start operation
Fixed	Hokkaido	Setana Port	0.7	13	0.6	2	1.2	Dec.2003
	Akita	Akita Port	0.1	-	3.0	1	3.0	Feb.2015
	Yamagata	Sakata port	0.05	4	2.0	5	10.0	Jan.2004
	Ibaraki	Kamisu	0.04	4	2.0	7	14.0	Feb.2010
		Kamisu	~0.05	4	2.0	8	16.0	Feb.2013
	Chiba	Choshi*	3.1	12	2.4	1	2.4	Mar.2013
	Fukuoka	KitaKyushu*	1.4	14	2.0	1	2.0	Jun.2013
Floating	Nagasaki	Fukuejima	5.0	-	2.0	1	2.0	Mar.2016
	Fukushima	Iwaki city	20	120	2.0	1	2.0	Nob.2013
		Naraha*			7.0	1	7.0	Apr.2016
					5.0	1	5.0	Apr.2017
		Total				29	64.6	

*National projects

South Korea Offshore: Yes, No, Maybe?

2012 – 2 turbines off JeJu (5MW)
Targets: 900 MW by 2016,
1,500 MW by 2019
Offshore development zones identified; nothing has happened yet

2017 – 30 MW added, Tamra nearshore (<1km) project, also off Jeju

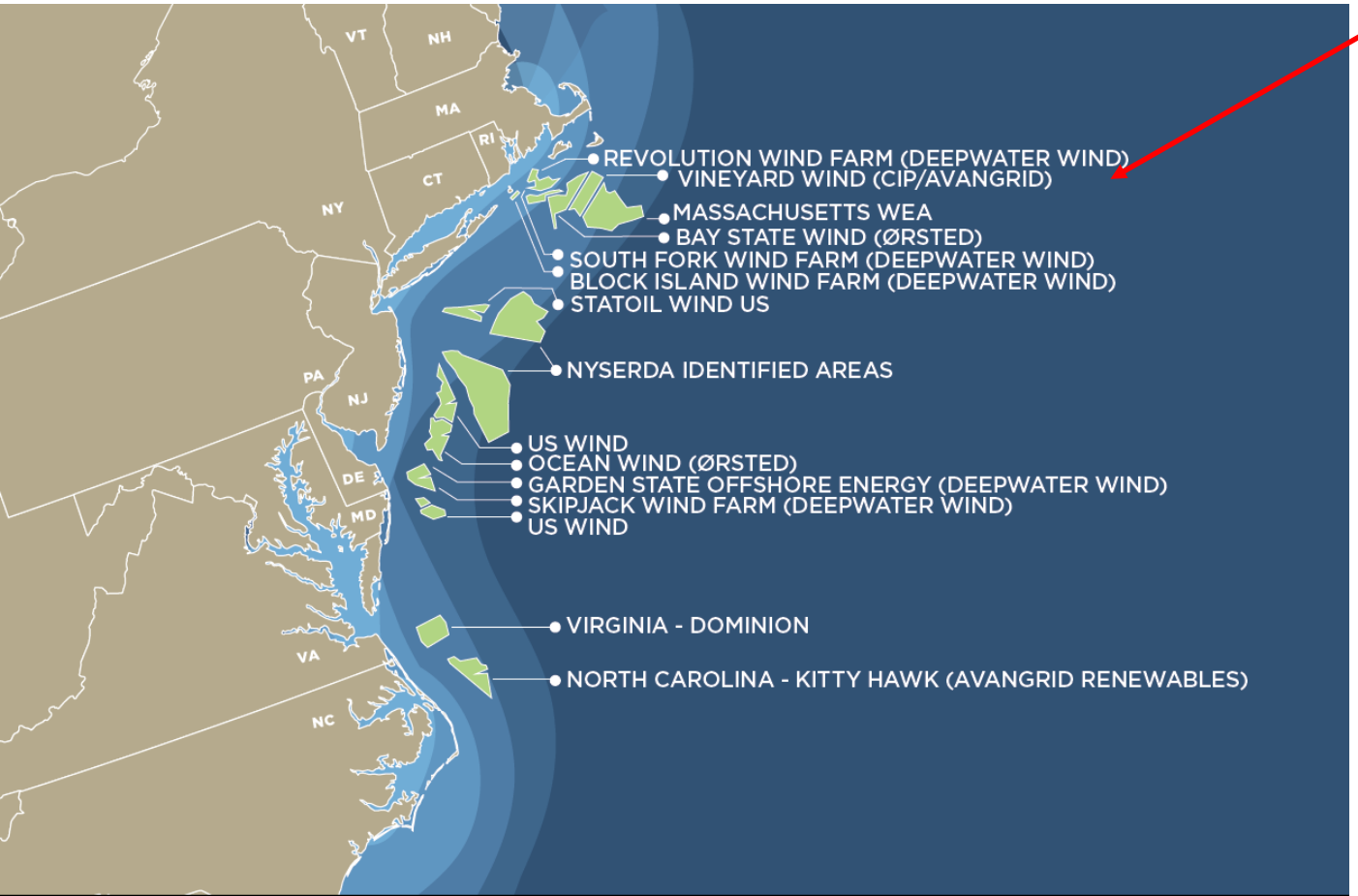
Will be expanded by 60-80 MW by 2019; then by 400 MW by 2022; part of 2.5 GW project, no indication on remaining 2 GW.

India – next on the list?

- Four year EU funded study Facilitating Offshore Wind In India (FOWIND)
  - Focus on Tamil Nadu and Gujarat
  - All studies including Roadmap to 2030 and Feasibility studies available at: http://gwec.net/publications/topical-report/#
  - LiDAR deployment(s) in Gujarat, one coming soon in Tamil Nadu
  - Current plan
    - Test field in Tamil Nadu (Dhanushkodi)
    - RFP for 500-1000 MW in Gujarat Zone A (Autumn 2018)
    - RFP for 500-1000 MW in Tamil Nadu Zone A (Autumn 2019)
    - Tenders to follow
- Indian government government（MNRE）announced ambitious offshore plan:
  - 5GW by 2022; 30GW by 2030
  - EOI attracted leading European developers and also solicited the target set up by the gov.
  - Ambitious? Lack of proper regulation framework(clarification on remuneration level), infrastructure, supply chain…we'll see.

US Offshore Wind – prospects improving

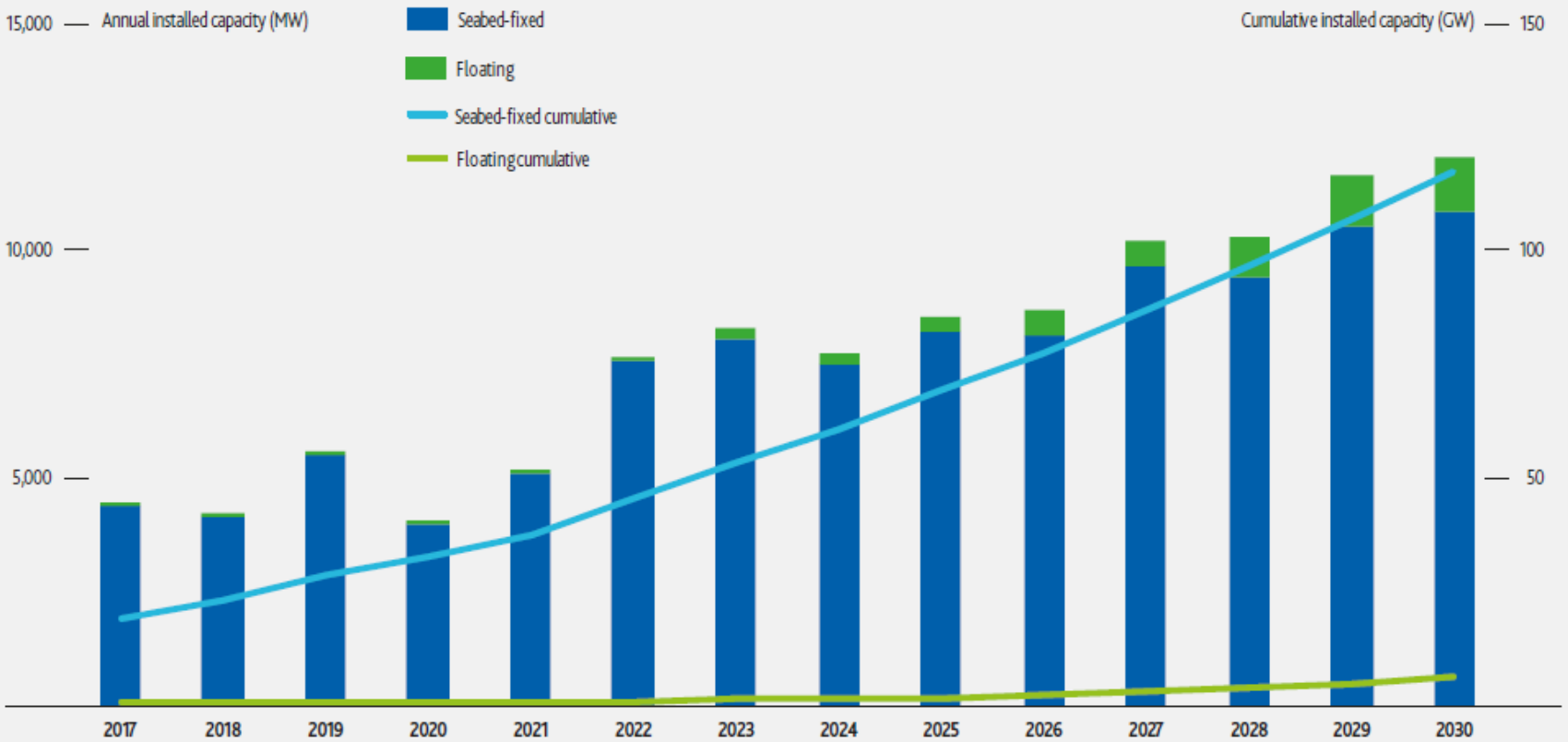
Vineyard Wind comes in at $US 0.065/kWh!



NY, MA, NJ, MD& RI committed to 5.5 GW. MA and RI awarded 1.2 GW in April

Federal leases already conducted should yield about 15 GW

PROJECTIONS FOR OFFSHORE WIND DEVELOPMENT GLOBALLY OUT TO 2030



Source: BVG Associates

Global Wind Energy Council's Offshore Wind Taskforce

Using a programmatic approach to tackle the offshore issue; Offshore Wind Taskforce to create a coalition of industry, as well as national and international organizations, to the make the technology deployed faster and wider.

- Advising governments on regulatory frameworks and tendering systems for offshore wind, including creating an Offshore Wind Policy Toolkit
- Measuring and highlighting the economic and social benefits of offshore wind deployment and the creation of local supply chains
- Fostering technology innovation and the testing of new turbines, installation techniques and O&M strategies, including promoting the benefits of digitalisation
- Spreading best practices and the transfer of knowledge from Europe and other established markets to new and developing markets
- Creating appropriate forums to promote the growth of the global offshore industry, including seminars, technical workshops, conferences and exhibitions.

- Utilising knowledge management techniques:
  - To provide a structured approach to market creation
  - To identify where countries, and regions, are in maturing elements of the market
  - To focus on specific topics for improvement
- To be applied in-country with governments, developers and supply chain
- The approach is proven in many applications in other sectors

Offshore Wind Market Readiness Assessment

To assess the readiness and attractiveness of new and emerging offshore wind markets wind markets for offshore wind deployment and to identify where improvements would be best focused.

	Topic	Level	Objective	Gap	Target Date
1	Policy	2	4	2	
2	Stakeholders	2	3	1	
3	Legal	3	4	1	
4	Health and Safety	1	3	2	
5	Consenting	2	5	3	
6	Grid	3	4	1	
7	Offtake	2	4	2	
8	Projects	4	4	0	
9	Manufacturing	2	3	1	
10	Finance	2	4	2	
11	Construction	1	3	2	
12	Operation and Commissioning	1	2	1	

Assessment Dates		to	
Planned Review Date			

Subsequent sheets explain the separate topic rankings and how they have been derived in this assessment.

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- Every topic has:
  - 5 levels of readiness, from Foundation to World Class
  - Each has approx 6 descriptors
  - Ranking is through a facilitated process, either workshop or interviews, with people in the field
  - Higher level rankings require supporting evidence
- Objective setting creates a simple gap analysis, which underpins an improvement plan
- Readiness can be regularly reviewed

Offshore Wind Market Readiness Assessment

1. Policy

Context

Policy is closely linked with political aspiration for renewable energy deployment and aspiration can be measured in terms of capacity targets and financial support. Many supportive policy measures can be readily put in place by government, but they can also be rescinded. As such stability of offshore wind policy is important and provides security to underpin investment. Long term legislated positions have greater weight than policy alone. Support regime must reflect maturity of the market, new and or isolated markets need greater support.

Level	Description
1 World Class	1. Policy exists for **offshore wind** deployment forward for **15 years or more** 2. The policy is supported by **all major** political parties 3. **Established** financial support regime is **clear** including grants, feed-in tariffs, power price premiums (or equivalents) 4. Demand for **offshore wind** is explicit in policy, either as GW, TWh or quantity of financial support 5. Financial support is sufficient for the country/region exceeding **4GWpa** of offshore wind 6. Local content rules **do not obstruct** deployment
2 Excellent	1. Policy exists for **wind power** deployment forward for **10 years or more** 2. The policy is supported by **most major** political parties 3. **New** financial support regime is **clear** including grants, feed-in tariffs, power price premiums (or equivalents) 4. Demand for **wind power** is explicit in policy, either as GW, TWh or quantity of financial support 5. Financial support is sufficient for the country/region exceeding **2GWpa** of wind power 6. Local content rules **increase levelised cost of energy**
3 Good	1. Policy exists for **renewable power** deployment forward for **5 years or more** 2. The policy is supported by the **two main** political parties (in majority) 3. Financial **support regime is expected in next 2 years** including grants, feed-in tariffs, power price premiums (or equivalents) 4. Demand for **renewable power** is explicit in policy, either as GW, TWh, g/kWh or quantity of financial support 5. Financial support is sufficient for the country/region exceeding **1GWpa** of renewable power 6. Local content rules are **challenging** from lack of supply chain
4 Fair	1. Policy exists for **low carbon** power deployment forward for **less than 5 years** 2. **Majority** government support to policy 3. Financial support is **insufficient** to invest in low carbon projects 4. Demand for **low carbon power is not quantified** in policy 5. Financial support is sufficient for the country/region exceeding **0.5GWpa** of low carbon power 6. Local content rules are **restrictive** e.g. requiring supply chain commitments
5 Foundation	1. **Limited** low carbon energy policy 2. **Minority** government support to policy 3. Financial support is **unpredictable** for investment in low carbon projects 4. **No clear expression** of demand for low carbon power generation 5. **Expectation of improved low carbon policy** to be in place within 2 years 6. **Obstructive** local content rules

Evidence of level 3 to 5

Policy documents, political party manifestos/policy statements, financial support regime documentations, legislated or policy bound targets.

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Conclusions

- New markets are deploying fast and *can* learn from the European experience, cutting down the learning curve and cost curve dramatically;
- Tremendous business opportunity, and major contribution to a clean energy economy; Offshore as a sector can be the single most game changer to ensure the energy transition really happens, due to its size, high yield and huge deployment opportunities
- BUT, it needs a long term vision, a willingness to invest, strong public-private partnerships and cooperation and patience.

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Thank you!

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