Korea Wind Power Industry Status

2019. 10. 16 (Wed)

Korea Wind Energy
Industry Association

I Korea Wind Power Status

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Korea Wind Power Status

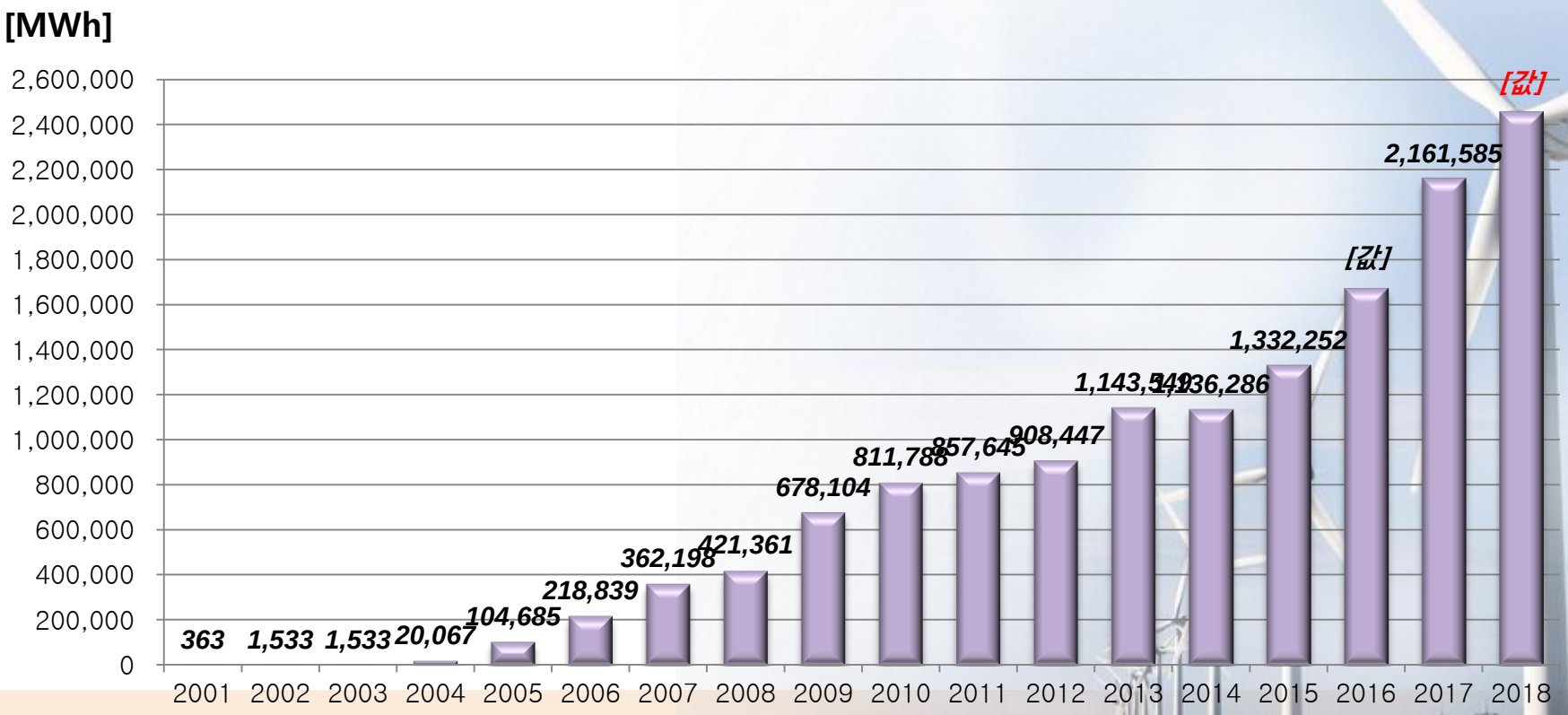
Energy Mix of Korea

- As of the end of 2018, a total 118,970MW of power plants was built in Korea
- Renewable energy is equivalent to 13,292MW, accounting for 11.17% of all power plants
- Wind power is a total 1,299.09MW, 1.09% out of total power generation, 9.77% out of renewable energy

	Capacity(MW)	Share ratio(%)
Non-renewable energy	105,678	88.83
Fuel cell	344	0.29
IGCC	346	0.29
Solar Energy	7,130	5.99
Wind Power	1,299	1.09
Hydropower	1,790	1.50
Marine	255	0.21
Bio	538	0.45
Waste	1,590	1.34
Total	**118,970**	**100**

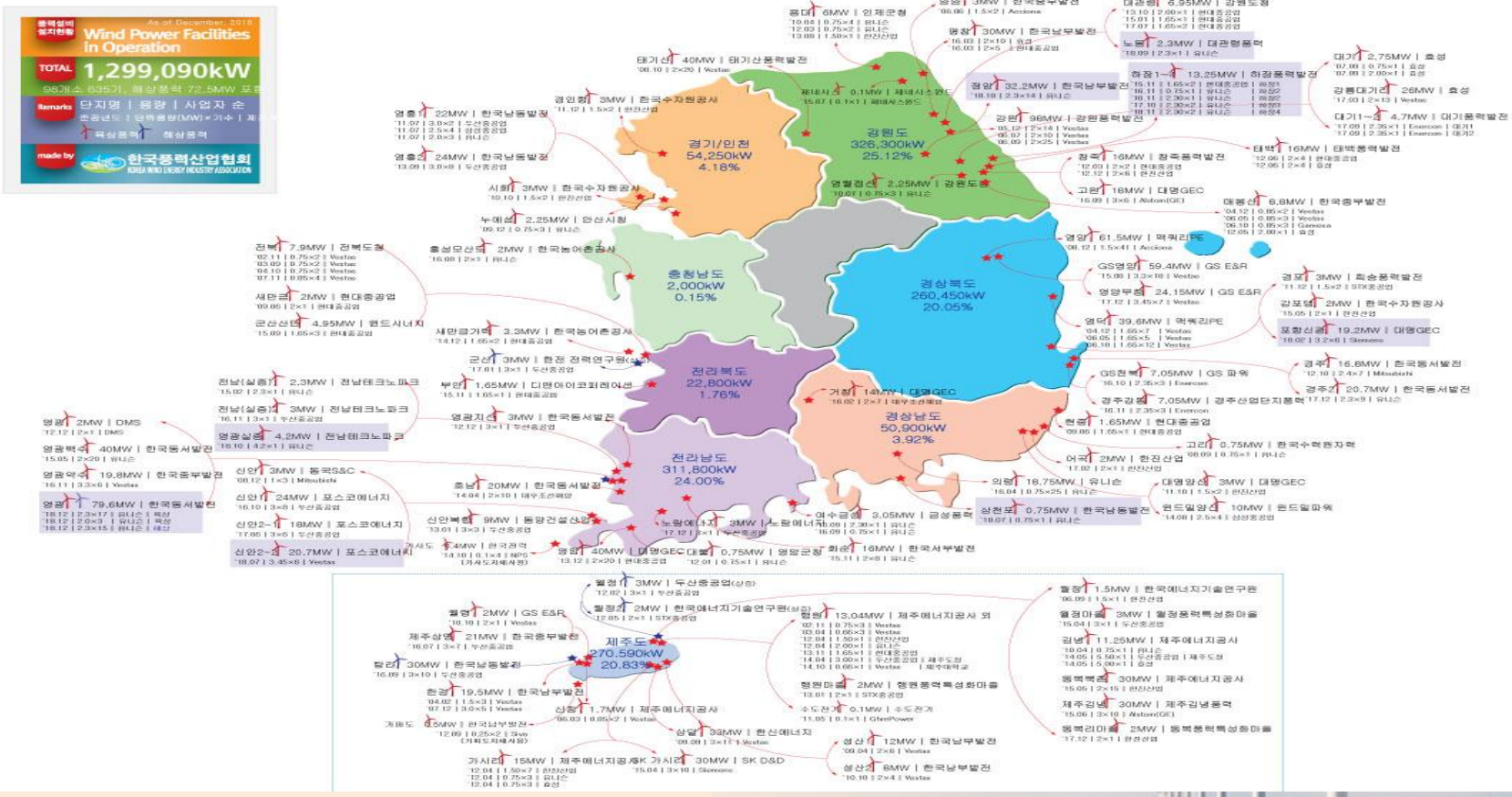
Energy Mix of Korea

- The power generation of wind power is increasing every year
- As of the end of 2018, Wind power generation is a total 2,456GWh, 0.46% out of total power generation, 9.59% out of renewable energy



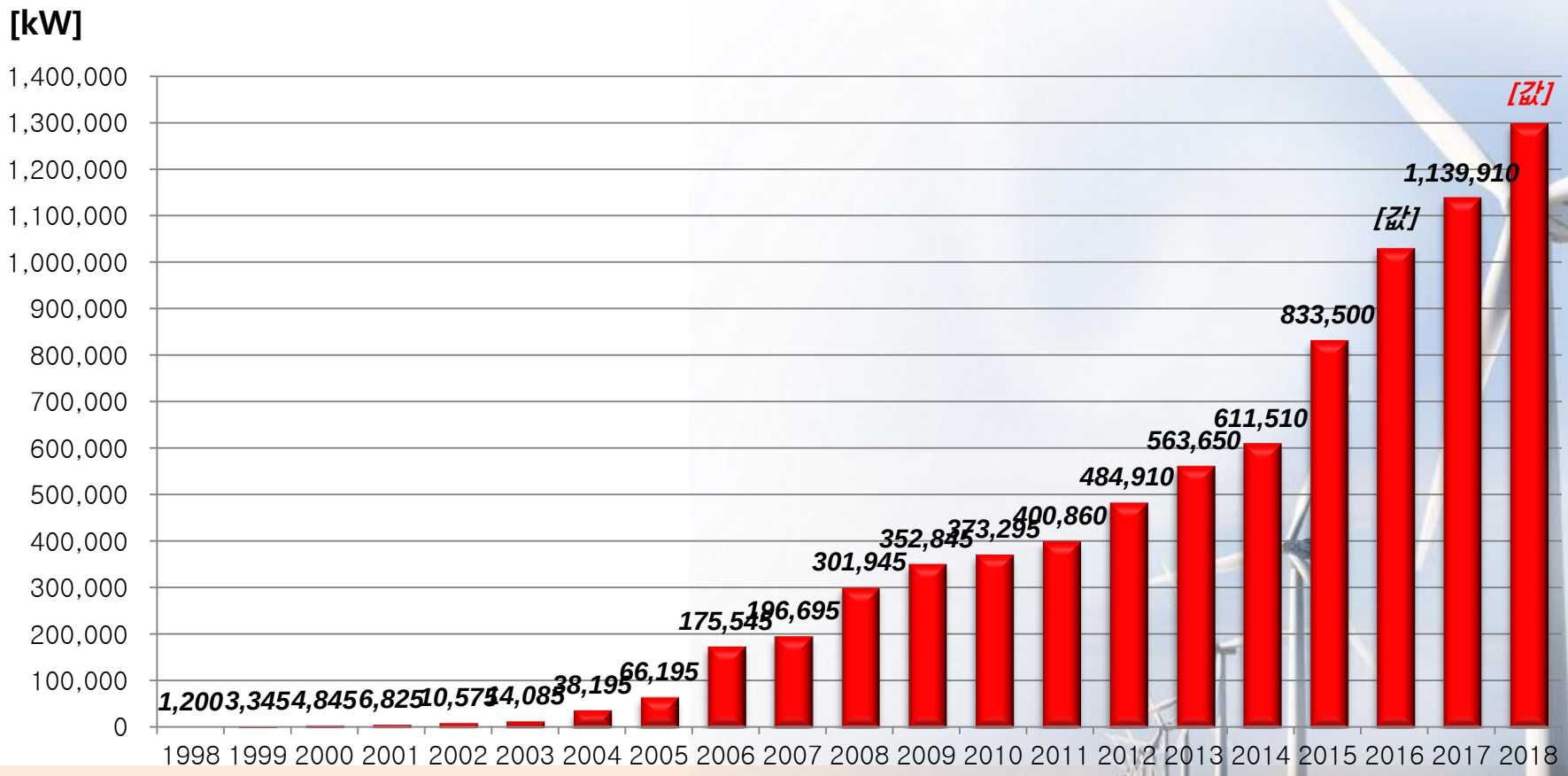
Overview

- As of the end of 2018, the total amount of wind power in Korea was 1,299.09 MW, up 14.1% from 2017

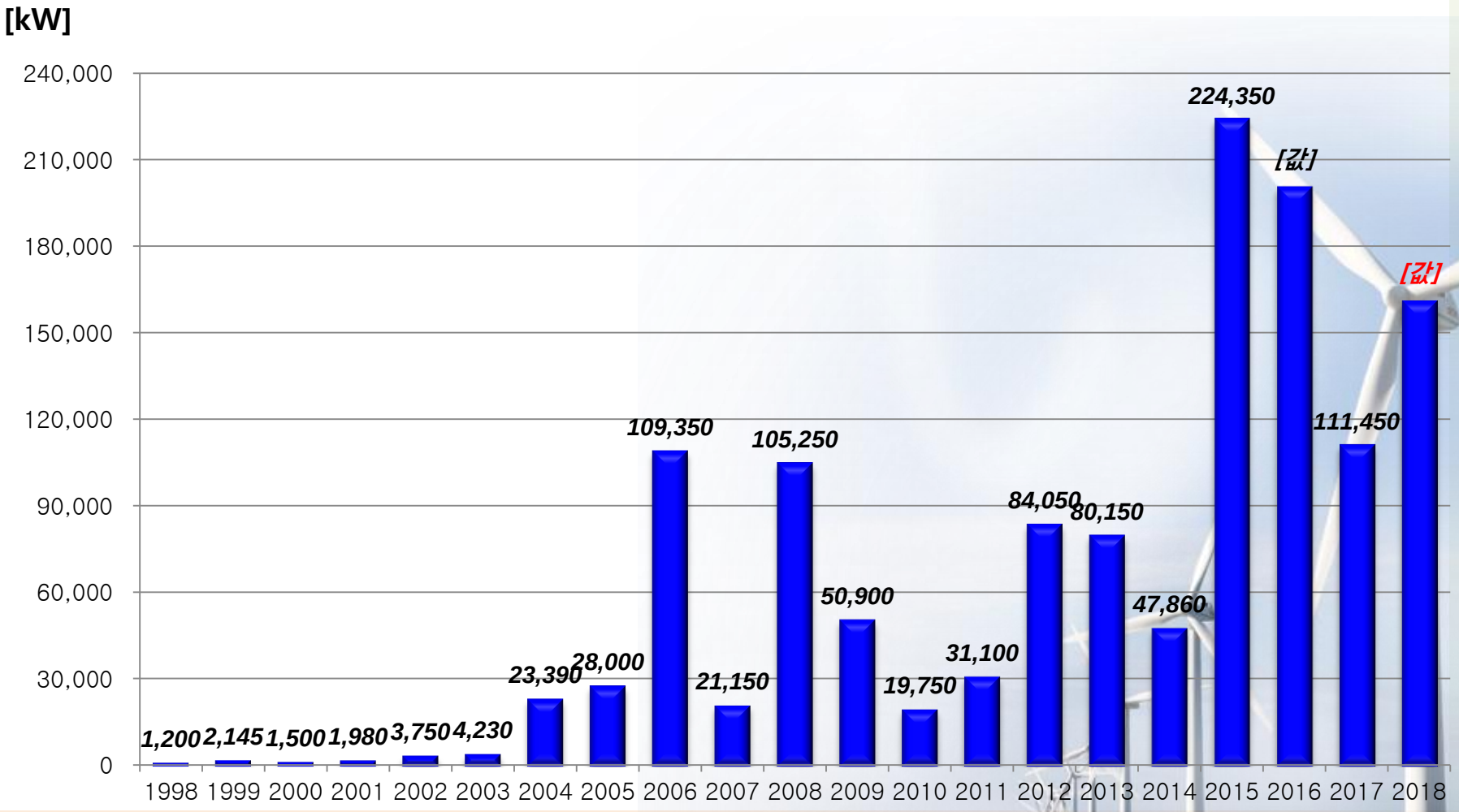


Cumulative Capacity(Dec 2018)

- The cumulative capacity of wind power in Korea has increased by average amount of 16.03% over the last 10 years

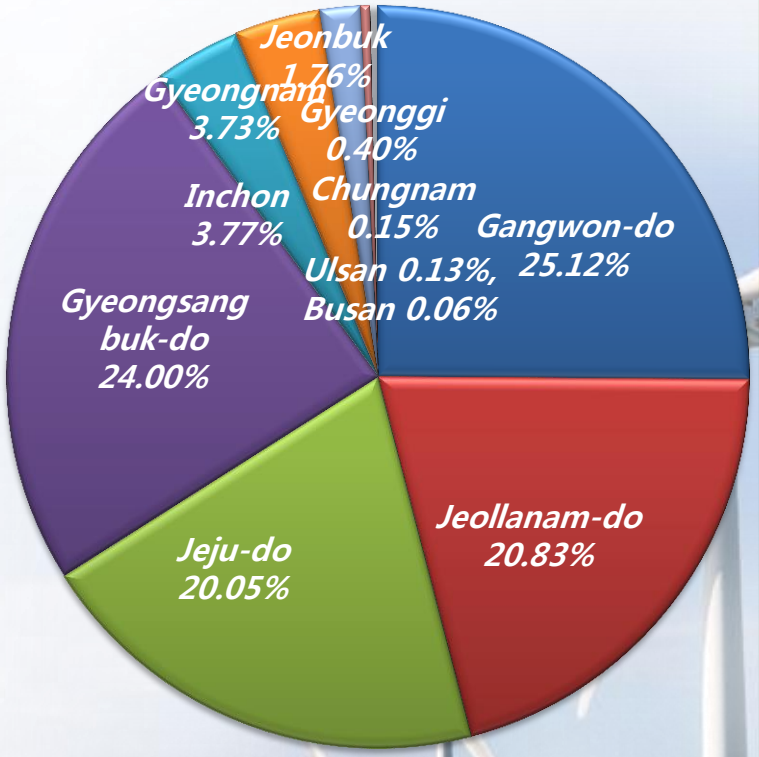


New Installed Capacity(Dec 2018)



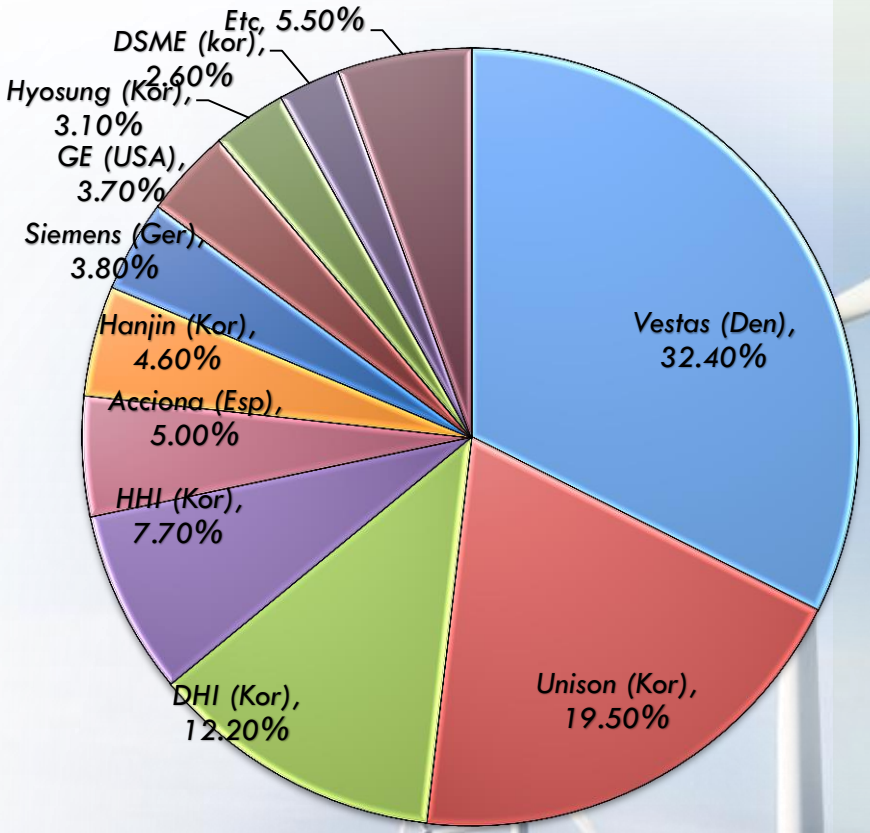
Installed Capacity(Region/Dec 2018)

	Number of units	Capacity (kW)	Share ratio (%)
Gangwon-do	171	326,300	25.12%
Jeollanam-do	120	270,590	20.83%
Jeju-do	121	260,450	20.05%
Gyeongsangbuk-do	138	311,800	24.00%
Inchon City	19	49,000	3.77%
Gyeongsangnam-do	40	48,500	3.73%
Jeollabuk-do	18	22,800	1.76%
Gyonggi-do	5	5,250	0.40%
Chungchongnam-do	1	2,000	0.15%
Ulsan City	1	1,650	0.13%
Busan City	1	750	0.06%
Total	**635**	**1,299,090**	**100%**



Installed Capacity(Manufacturer/Dec 2018)

	Number of units	Capacity (kW)	Share ratio (%)
Vestas (Den)	197	420,890	32.4%
Unison (Kor)	145	253,300	19.5%
DHI (Kor)	52	158,500	12.2%
HHI (Kor)	52	99,450	7.7%
Acciona (Esp)	43	64,500	5.0%
Hanjin (Kor)	34	60,000	4.6%
Siemens (Ger)	16	49,200	3.8%
GE (USA)	16	48,000	3.7%
Hyosung (Kor)	21	40,000	3.1%
DSME (kor)	17	34,000	2.6%
Etc	42	71250	5.5%
Total	**635**	**1,299,090**	**100%**



Installed Capacity of Offshore

- Korea`s offshore wind power is the initial stage of business development,
- 2016.09 the first Tamna offshore(30MW) wind power in Korea, commenced commercial operations

[Proto Type 5MW]

DHI 3MW, STX 2MW

Jacket Type(Jeju Woljeong)

[Commercial 30MW]

DHI 3MW x 10units

Jacket Type(Jeju Tamna)

Installed Capacity of Offshore

- 2018.12 the Yeonggwang offshore(34.5MW) wind power in Korea, commenced commercial operations. It's onshore&offshore complex farm.(Total 79.6MW)

[Proto Type 3MW]

DHI 3MW

Suction bucket Type

(Jeonbuk Gunsan)

[Commercial 34.5MW]

Unison 2.3MW x 15units

(Jeonnam Yeonggwang)

onshore&offshore complex

System Supplier

- Global Shipbuilders/heavy industries continue to make an investment for R&D to develop bigger WTG`s and to improve LCOE
  * Up to 4.2MW WTG, proven & certified for both onshore and offshore application
  * 5.5MW WTG, proven & certified for offshore application
  * 8MW size of offshore application : either about developed or being developed

[DHI]

3MW class in operation at onshore&offshore / 5.5MW class under production (offshore) / 8MW class under develop(offshore)

[Hyosung]

2MW class in operation at onshore / 5.5MW class under commissioning (offshore)

[Unison]

0.75, 2, 2.3MW class in operation at onshore / 4.2MW class under production (onshore&offshore)

[Hanjin Ind]

1.5, 2MW class in operation at onshore / 4MW class under develop(onshore)

Components Supplier

- Korea's wind power industry is dominated by forging products, and many companies supply products to manufacturers of overseas systems
- Major outsourcing partners for global WTG OEM`s are;

[Tower]

[CS Wind Corp]

[Dongkuk S&C]

[Win&P]

[Bearing, Shaft]

[Taewoong] [Hyunjin Material] [Shilla Corporation]

Construction Forecast

- **Onshore : Total 8,940.2MW(189 Projects)**
- **Offshore : Total 2,058MW(21 Projects)**

No.	Name	Capacity(MW)	Location	Company
1	West South Sea 1	60.0	Buan-gun, Jeollabuk-do	KOWP
2	Yeonggwangduuri	99.1	Yeonggwang-gun, Jeollanam-do	Jaewon energy
3	Sinanjeungdo	33.0	Sinan-gun, Jeollanam-do	Winwindpower
4	Tongyeongsocho	9.9	Tongyeong-si, Gyeongsangnam-do	yeongdongbaljeon
5	Apae2	20.0	Sinan-gun, Jeollanam-do	Apaewindpower
6	Haegicheongsapo	40.0	Haeundae-gu, Busan-si	G-windsky
7	Jeonnamsinan	300.0	Sinan-gun, Jeollanam-do	Posco Energy
8	Jeonnam 1	96.0	Sinan-gun, Jeollanam-do	SK E&S
9	Yeomsan	38.4	Yeonggwang-gun, Jeollanam-do	DaemyeongGEC
10	Wind Power System Evaluation Center	12.3	Yeonggwang-gun, Jeollanam-do	JNTP

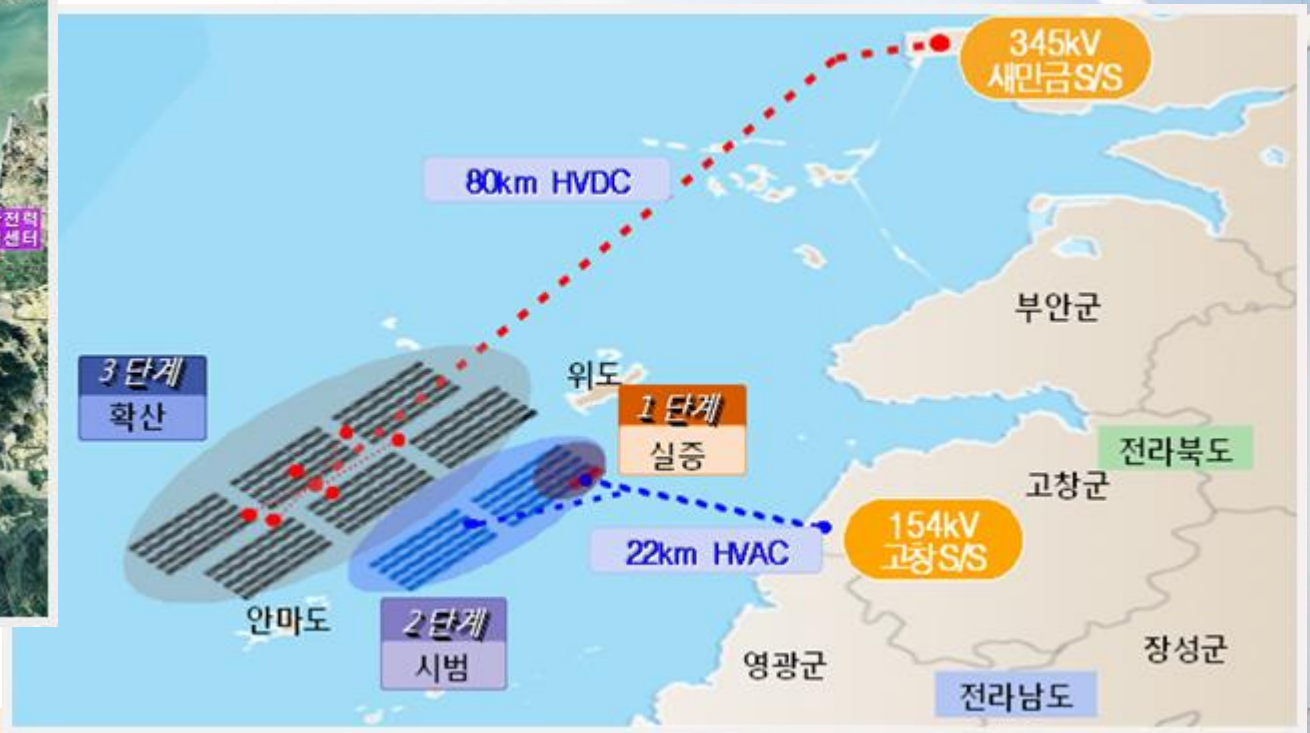
Construction Forecast

- **Onshore : Total 8,940.2MW(189 Projects)**
- **Offshore : Total 2,058MW(21 Projects)**

No.	Name	Capacity(MW)	Location	Company
11	Dongnamhaean	136.0	Buk-gu, Ulsan City	SK E&C
12	Yeonggwangyawol	49.8	Yeonggwang-gun, Jeollanam-do	Daehangreenenergy
13	Chilsan	151.2	Yeonggwang-gun, Jeollanam-do	CW&RE
14	Wando	148.5	Wando-gun, Jeollanam-do	Wandohaesangpungnyeok
15	Wandogeumil	200.0	Wando-gun, Jeollanam-do	KOEN
16	Saemangeum	98.8	Gunsan-si, Jeollabuk-do	Saemangeum Offshore
17	Jeju Daejeong	100.0	Seogwipo-si, Jeju-do	KOSPO
18	Jeju Hanlim	100.0	Jeju-si, Jeju-do	KEPCO, KEPCO-Enc
19	Jeju Pyungdae-Handong	105.0	Jeju-si, Jeju-do	Jeju Energy Corporation
20	Jeju Woljeong-Haengwon	125.0	Jeju-si, Jeju-do	Jeju Energy Corporation
21	Jeju Pyosun-Sehwa	135.0	Jeju-si, Jeju-do	Jeju Energy Corporation

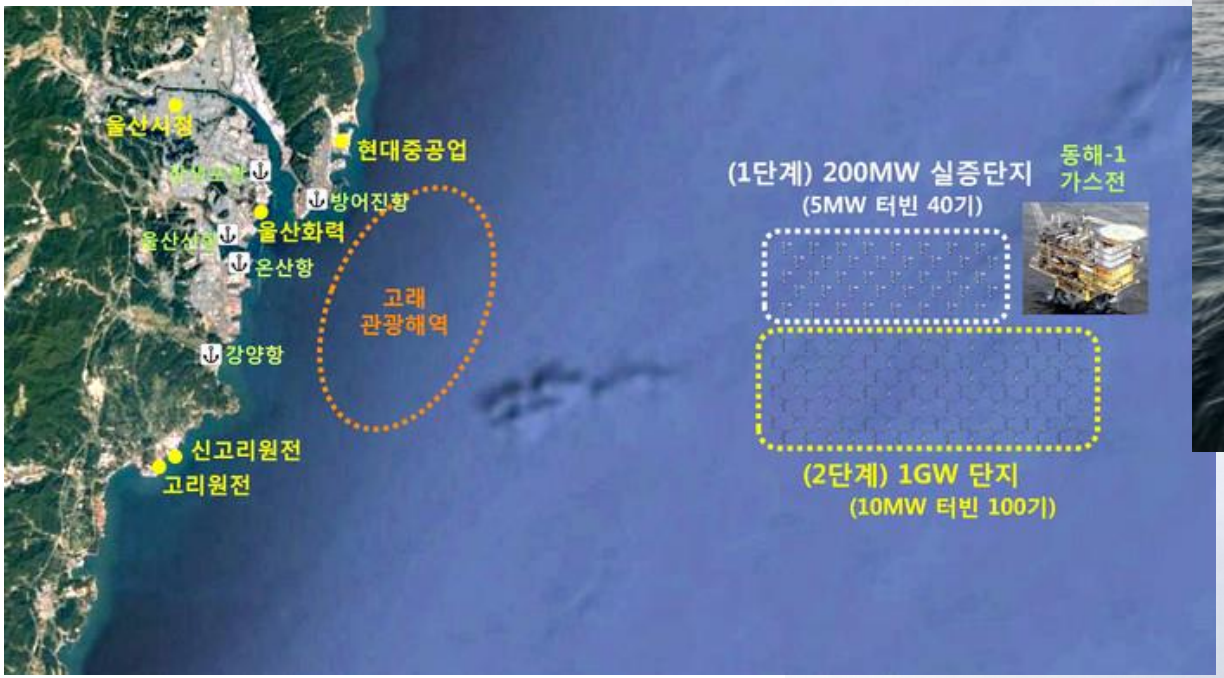
Construction Forecast

- Southwest Offshore Wind Power Project(KOWP)



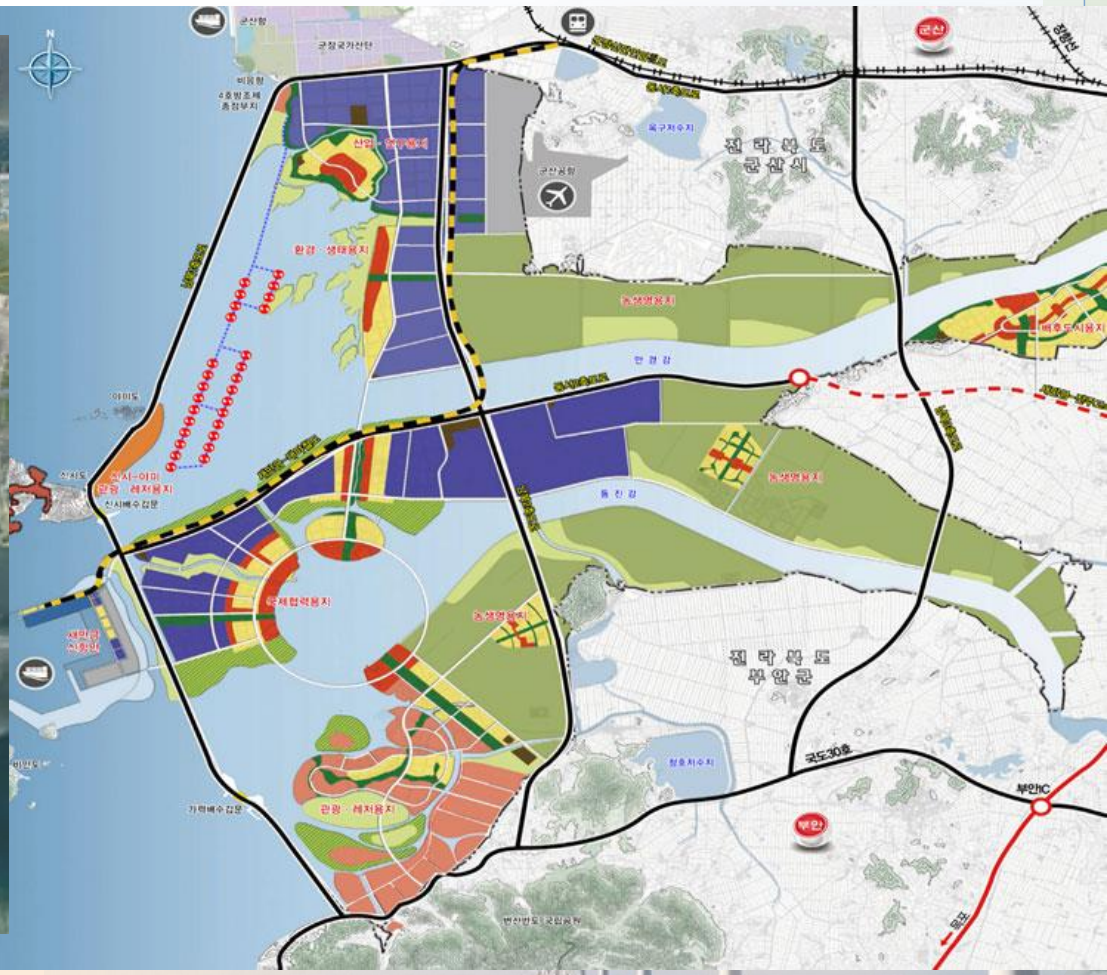
Construction Forecast

- Ulsan Floating Offshore Wind Farm



Construction Forecast

- Saemangeum Offshore Wind Farm Project



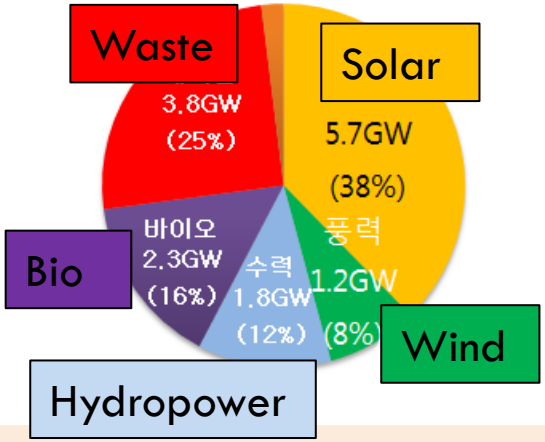
Supply objective

- The government 20% of Korea's total generation by 2030 to replace renewable energy goals that the announcement

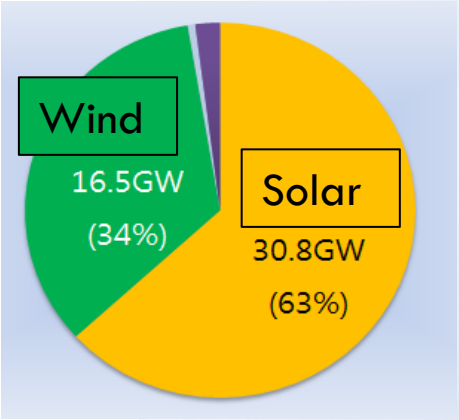
(Supply objective : wind Power Onshore 4.5GW, Offshore 12GW)

- 20% of power generation by 2030 : More than 95% of new capacity is PV&Wind

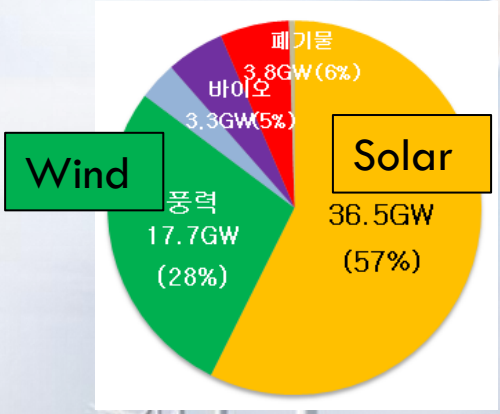
'17년 : 총 15.1GW



NEW('18~'30) : 48.7GW



'30년 : 총 63.8GW



Policy Directions of Korea Government

RPS

- RPS (Renewable Energy Portfolio Standard) introduced in 2012
- 21 Power Companies, which have generation capacity of over 500MW are obliged to produce a certain portion of their electricity from NRE
- Costs for Implementing RPS will be Added to Electricity Bill
- Annual RPS Targets

Year	`16	`17	`18	`19	`20	`21	`22	`23(after)
%	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0

* Annual compulsory RE generation = Total generation(excl. RE) × Compulsory rate(%)

RPS

- RPS Weight Factors for Eligible New and Renewable Energy Sources

Weight Factors	Eligible NRE Sources
0.7~1.5	Solar
0.25	IGCC, byproduct gas, Waste, Bio-SRF
0.5	Landfill gas, Wood pellet, Wood chip
1.0	Hydropower, Onshore wind, bio-energy, tidal power, etc
1.0~2.5	Geothermal energy, tidal power(without Seawall)
1.5	Hydrothermal energy, etc
2.0	Fuel cell, etc
2.0	Offshore wind (less than 5km from land)
2.5	Offshore wind (more than 5km, less than 10km from land)
3.0	Offshore wind (more than 10km, less than 15km from land)
3.5	Offshore wind (more than 15km from land)
4.0~5.0	ESS(be connected with Solar or Wind)

R&D

- R&D Supports for development of offshore wind technologies and localization of core components

- Focus on R&D to reduce cost of energy with offshore wind power
  * Support technical development of a project in the south-west sea
  * Unit-cost reduction, Sites investigation, Resources utilization, etc.

- Advanced technologies in major components of wind industry
  * Upgrade designation skills, processes and reliabilities of technology
  * Develop main bearing and upgrade reliabilities of drive-train

- Strengthen basic technologies
  * Develop long-term planned technologies and Secure scientific skills
  * Advanced research on tech. such as superconductivity generator, etc

Test bed

- Current status of test bed

  * Seonamahae(South-west)offshore wind farm project(1-step 60MW)

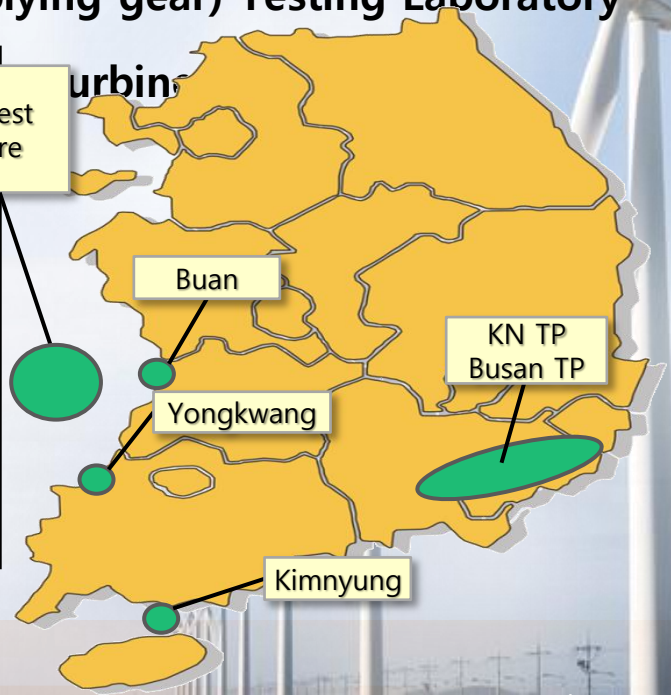
  * Youngkwang, Jeonnam : Test bed for turbine system(20MW)

  * Kimnyung, Jeju : Demonstration(now on 10MW -→ expand to 14MW)

  * Buan, Jeonbuk : Critical equipment(blade, multiplying gear) Testing Laboratory

<Demonstration Site in Kimnyung>

<Blade test>



Testing Laboratory

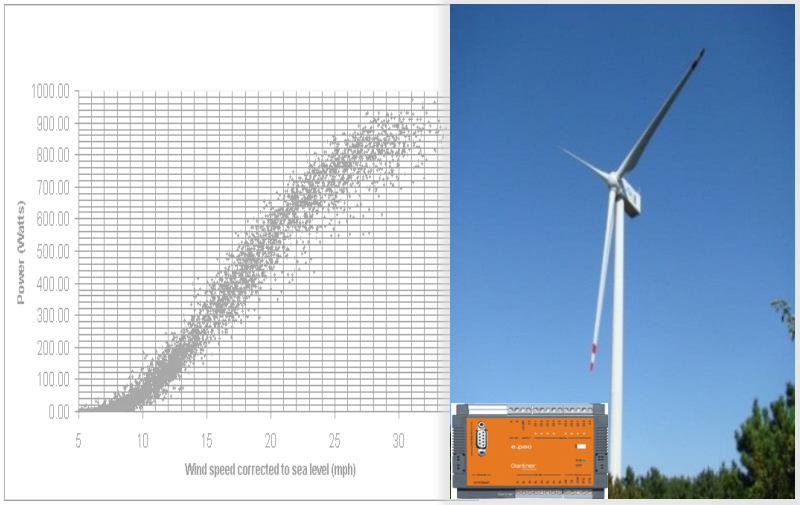
- Enhancement of Testing Laboratory for Wind turbine system & component

  * Testing Infra structure for 5~7MW Scale Wind Turbine

- New project for advanced performance evaluation institute

  * Arrange performance evaluation system for large-scale wind turbine certification

  * Establish infra for component performance evaluation, 5~7MW class certification



<Test Equipments for System>

<Test Equipments for components>

THANK YOU

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