



Grid Development and Integration of RE in China

State Grid Corporation of China

Frankfurt

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Overview SGCC

2

Development of Renewable Energy in China

3

Integration of Renewable Energy

4

Global Energy Interconnection



■ Geographic Coverage

88% of China's territory

■ Customers

Serving over 1.1 billion customers

■ Employees

1.8 million

■ Key Figures (2016)

Assets: **€464Bn** Revenue **€285Bn**

■ Core business

Power grid construction and operation, R&D

■ Overseas Business

Runs overseas business in the Philippines, Portugal, Brazil, Australia, Italy, etc.

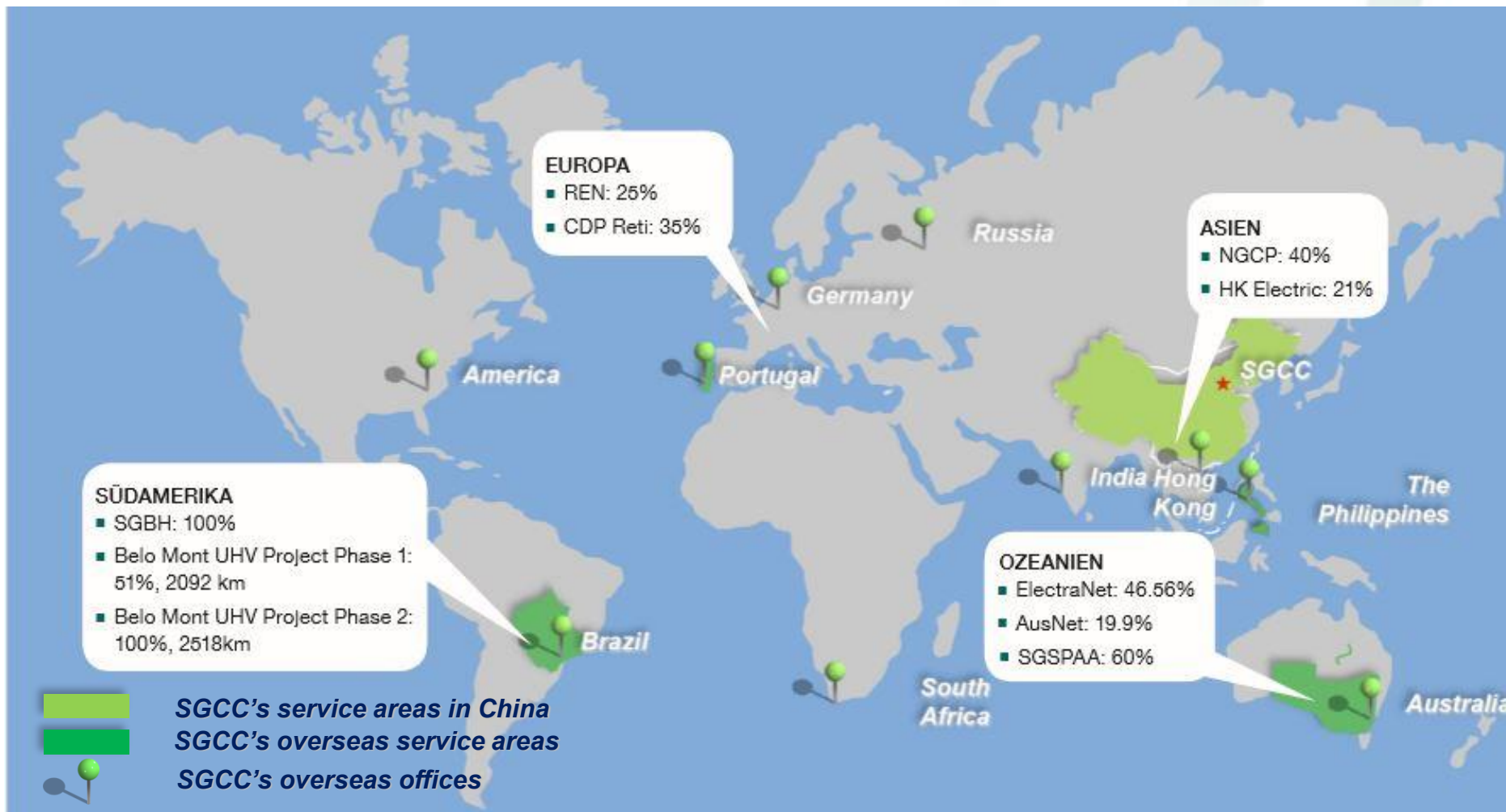
■ R&D

4 Research institutes

24,000 Researchers & Developers

■ Ranked 2nd Fortune Global 500

Distribution of overseas assets and offices





Global Energy Interconnection Research Institute Europe GEIRI Europe, Berlin





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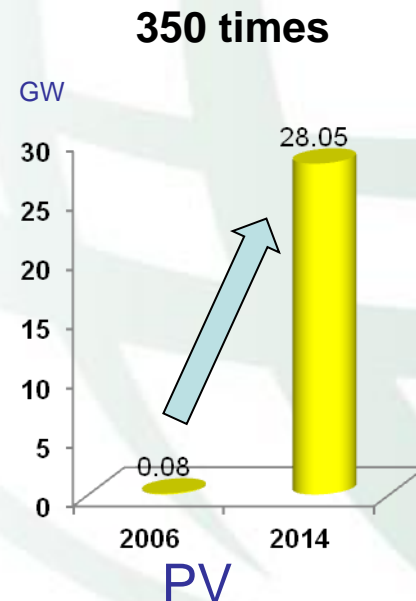
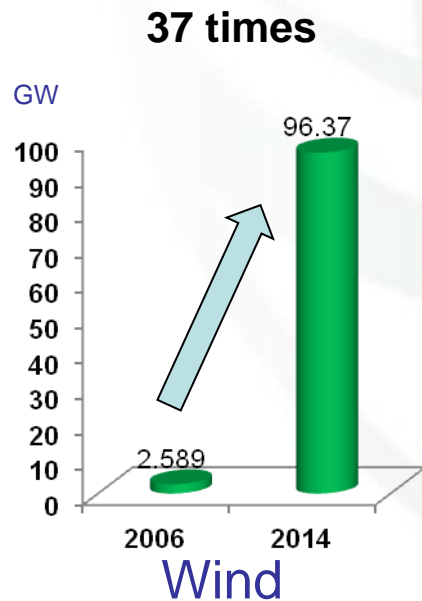
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Global Energy Interconnection

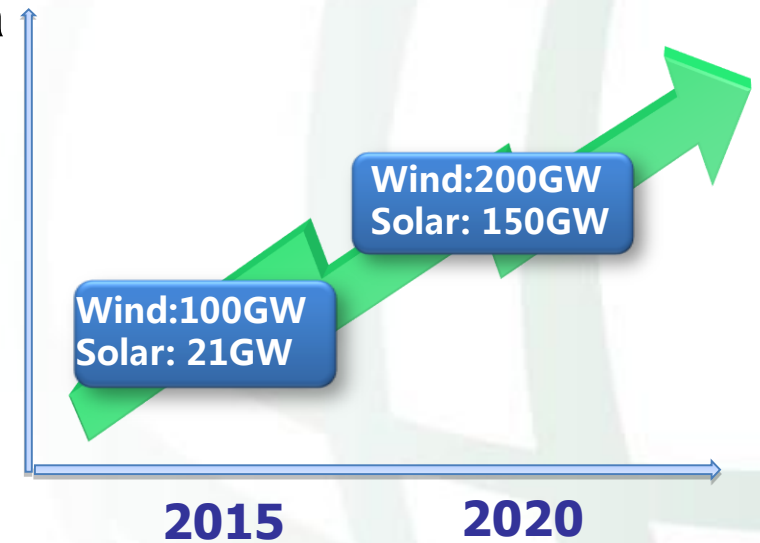
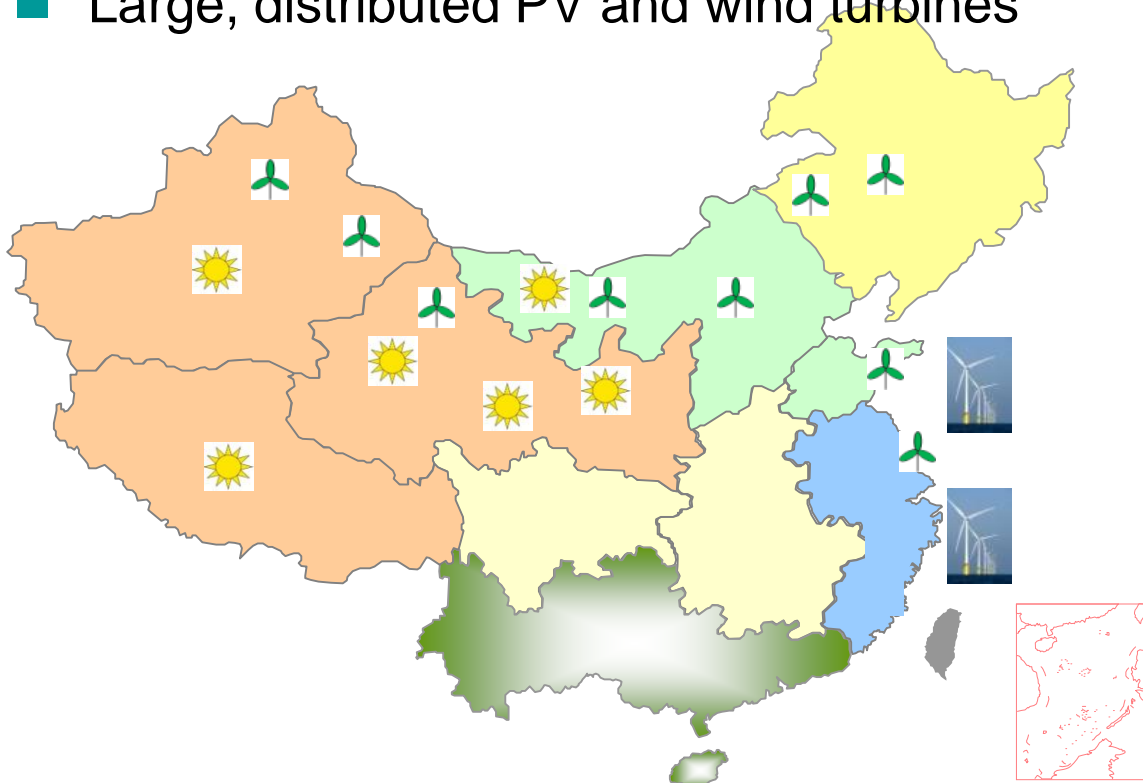
- **Hydro power** : 330 GW, ranking **No.1** in the world;
- **Wind power** : 169 GW, ranking **No.1** in the world;
- **PV power** : 78 GW, ranking **No.1** in the world;
- **Wind power** has been **the third largest** power source in China.



Wind and PV power capacity growth from 2006 to 2014

Development of Renewable Energy

- 9 large-scale wind power bases are in planning or under construction, each of them with a capacity of more than 10GW.
- Large-scale of Offshore wind-farms
- Large, distributed PV and wind turbines



Wind, Solar, Storage Pilot Project

Wind: 600MW
Solar: 60MW
Storage: 50MW



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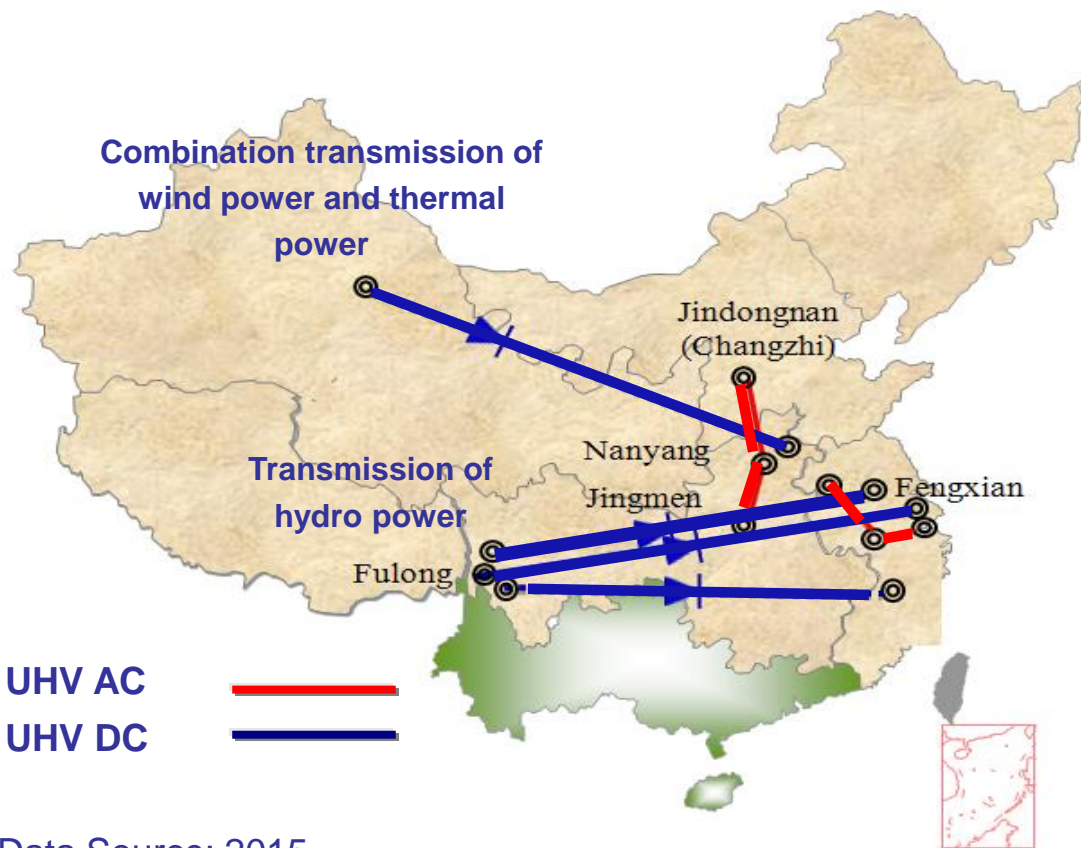
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Global Energy Interconnection



◆ UHV operation & construction:

- 13 UHV (6 AC and 7 DC) Projects in Operation
- 9 UHV (2 AC and 7 DC) Projects under Constr.



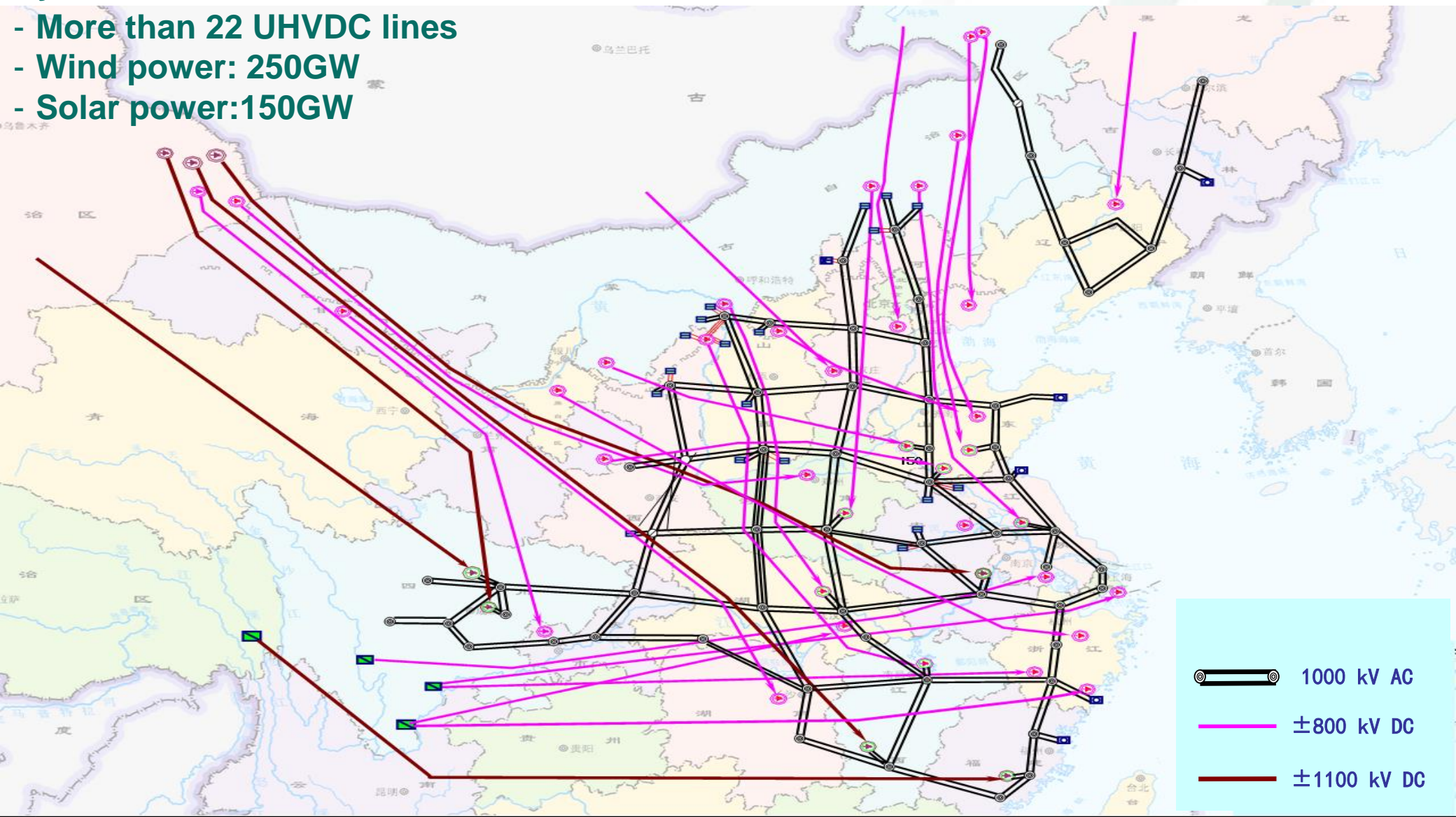
Commissioned UHV projects

Projects	Length of line	Conversion capacity	Annual CO2 emission reduction
1000kV Jindongnan--Jimen	640km	18GVA	--
±800kV Xiangjiaba-Shanghai	1,907km	12.8GW	26.0 million tons
±800kV Jinping-Sunan	2,059km	14.4GW	32.4 million tons
1000kV Huainan-Zhebei-Shanghai	2×649km	21GVA	--
±800kV Haminan-Zhengzhou	2,210km	16GW	40 million tons
±800kV Xiluodu-Zhexi	1,669km	16GW	34.0 million tons
Total	9,782km	98.20G	132.4 million tons



By 2020:

- More than 22 UHVDC lines
- Wind power: 250GW
- Solar power: 150GW



World Record 1: Multi-Terminal HVDC



Launch of operation	4 th July 2014
Rated capacity	400/300/100/100/100 MW
Rated DC voltage	±200 kV

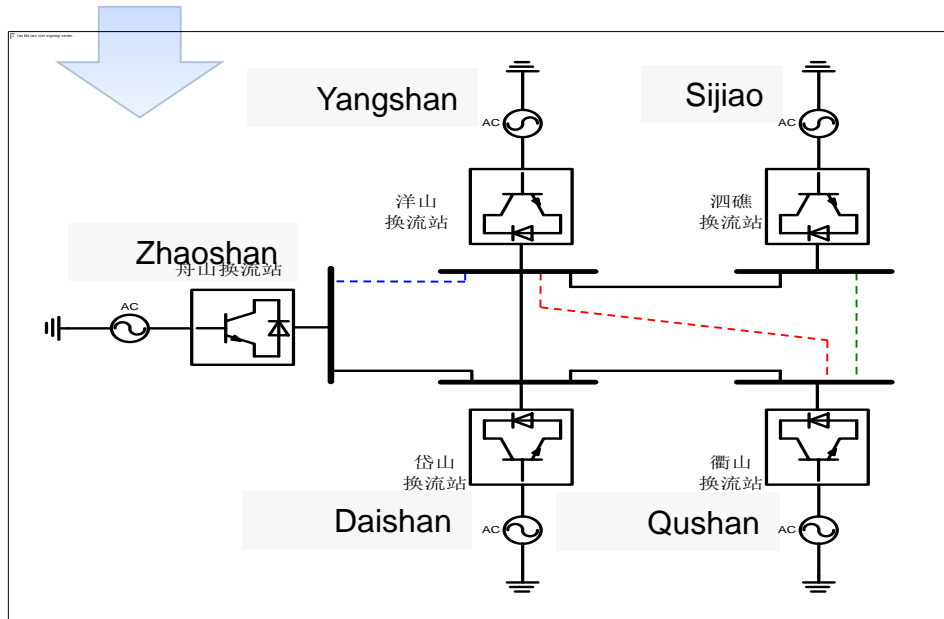
Current status

- Power supply to islands
- Wind power integration

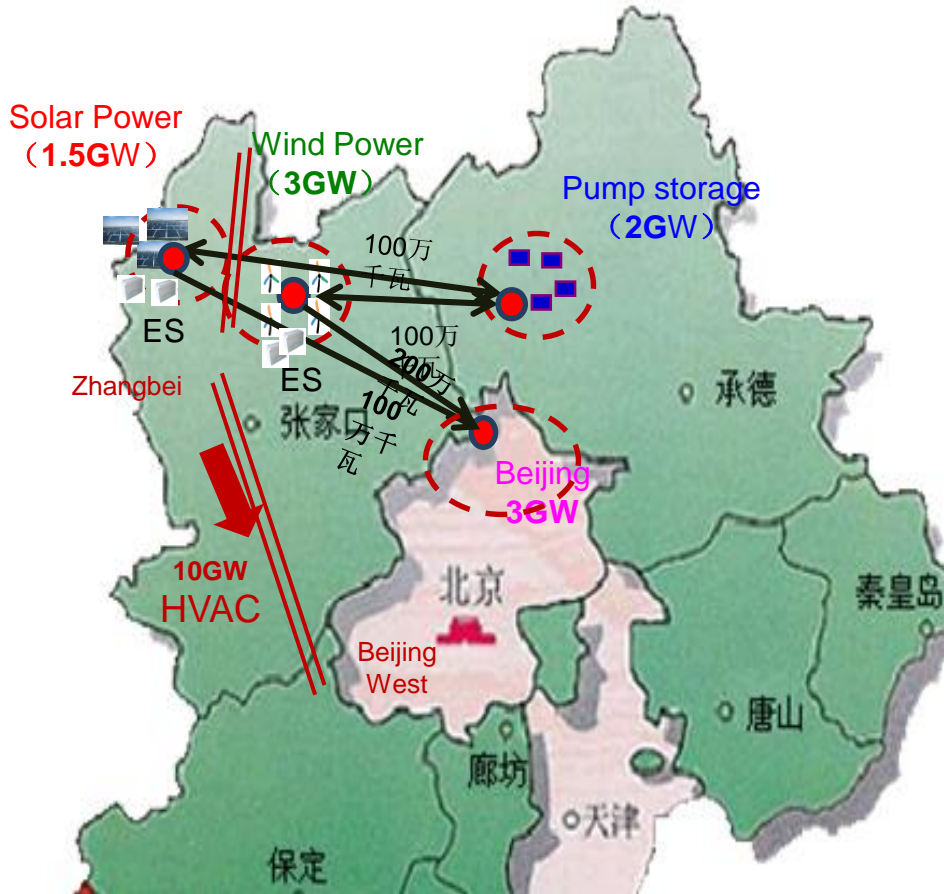


Upgrade plan

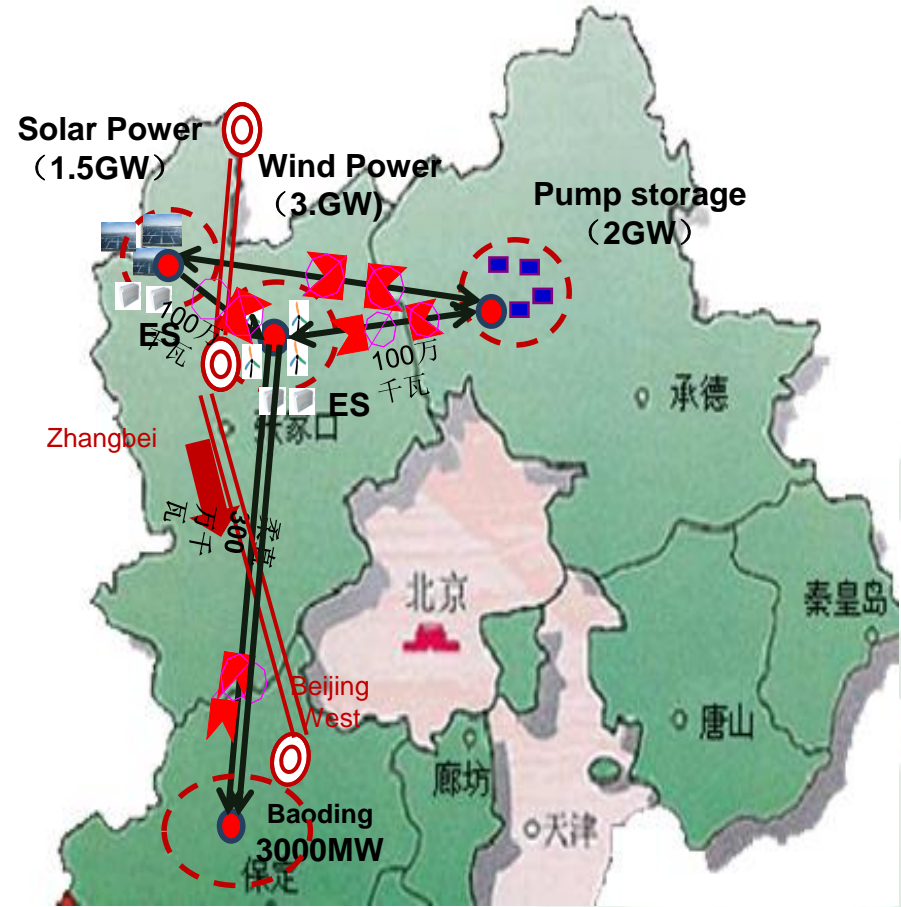
- Transform to HVDC grid
- Solution 1 – dashed blue line
- Solution 2 – dashed red line
- Solution 3 – dashed green line
- Redundancy
- Grid reliability and security
- **DC CBs** → DC side fault clearance



Winter Olympic 2020 – DC Grid Demo Project



Proposal 1



Proposal 2



Phase I: 100MW Wind, 40MW PV, 20MW storage

Phase II: 400MW Wind, 60MW PV, 50MW storage

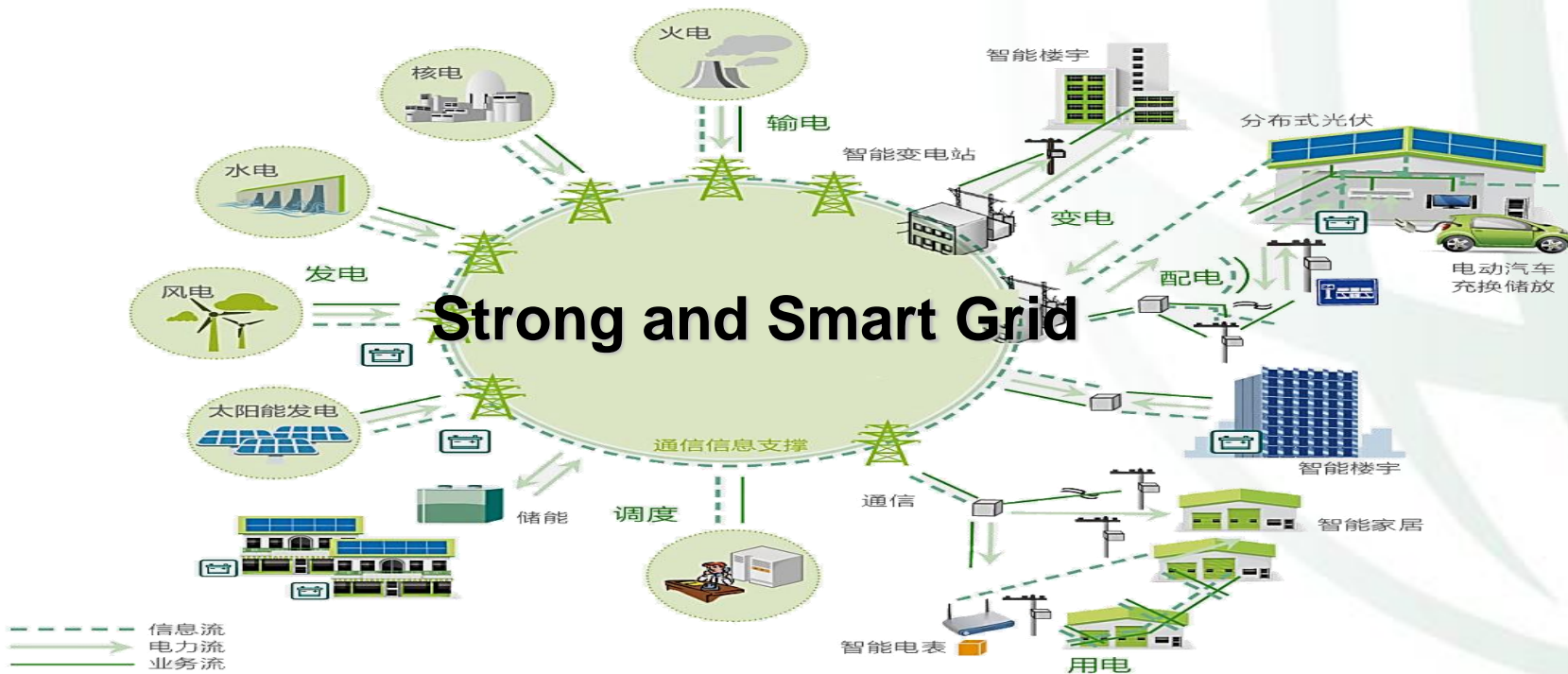
In total: 500MW Wind, 100MW PV, 70MW storage





- Pumping Storage (57 Plants): **65 GW**
- Operation (29 Plants): **25 GW**
- Construction (15 Plants): **21 GW**
- Planned (13 Plants): **19 GW**

- Smart Substations: **2700**
- Smart Meters: **430 million**
- EV Charging Stations/Poles: **1 million**

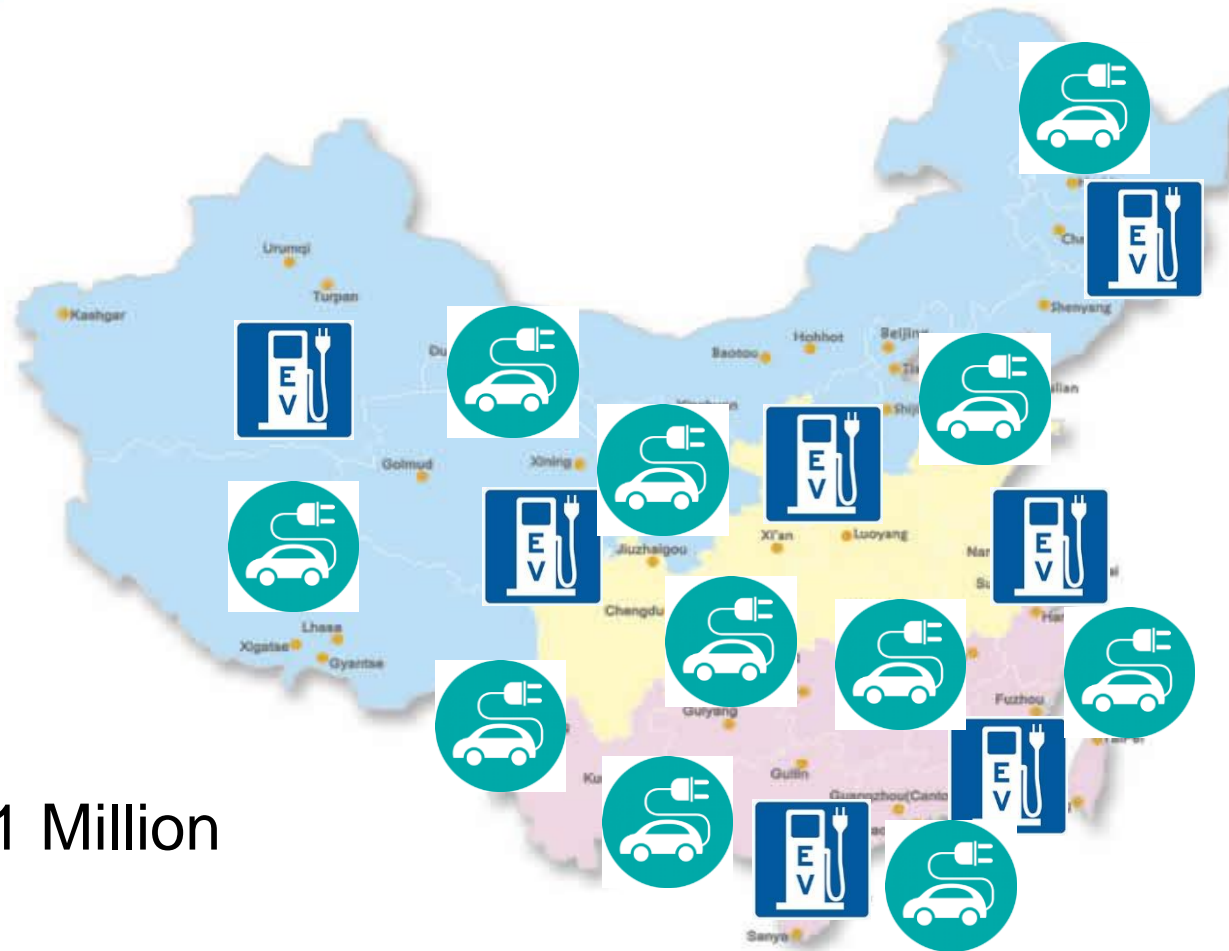




Since 2009

- 500 pilot projects completed so far
- 10 billion Euros invested in total





2017: 1 Million



2020: 5 Million

Growth of Charging Stations and E-Mobility



1. Fossil fuels must be replaced by clean energy sources, such as solar energy, wind power and hydropower.
2. Electric energy replaces coal, oil and gas. Clean electricity is transported over long distances, thus solving the problem of excessive dependency on fossil fuels and the emission of CO₂.



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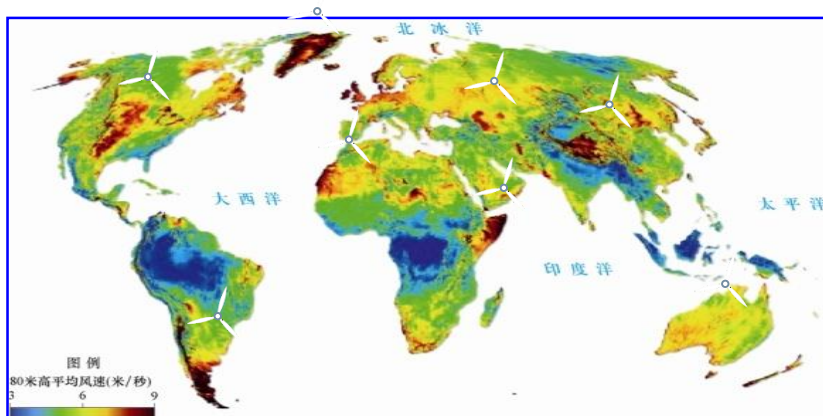
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Integration of Renewable Energy

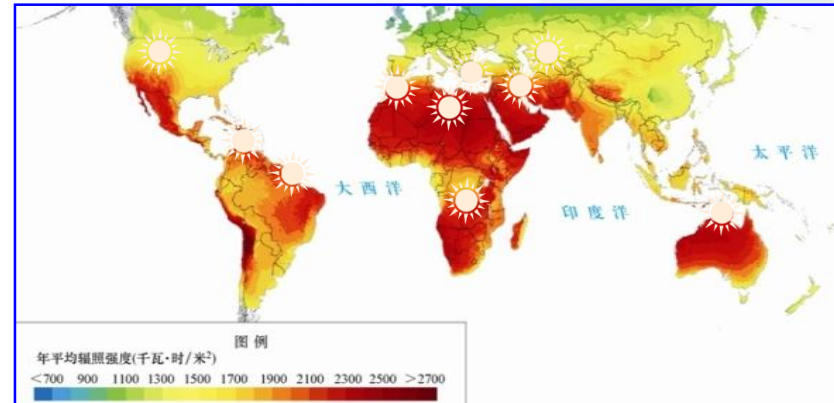
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Global Energy Interconnection

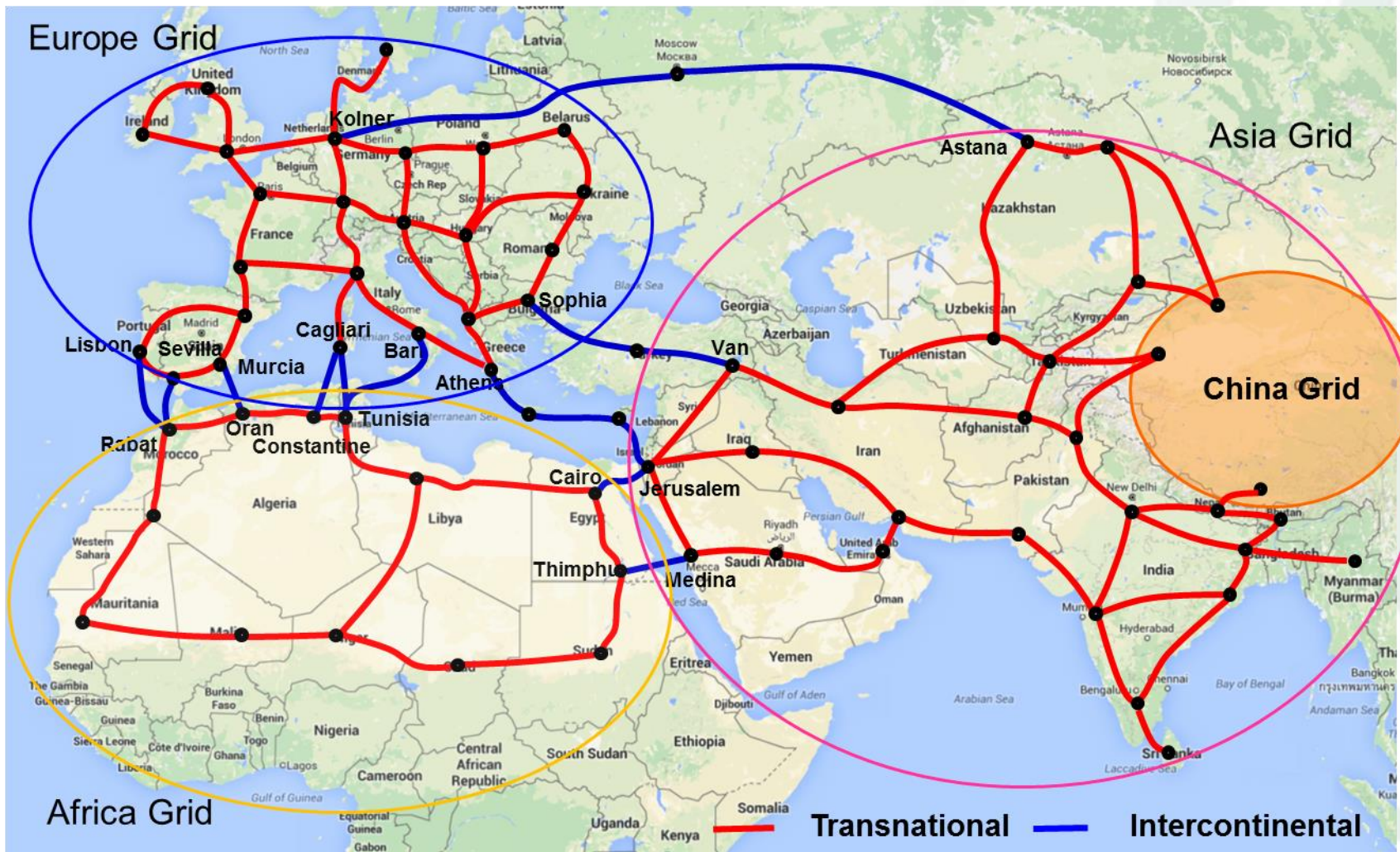
- Wind: North Pole, Northern and Northern Asia, Northern Europe, Central North America, Eastern Africa
- Solar: North Africa, East Africa, The Middle East, Central and South America and Equatorial Regions
- RE: Random & intermittent: only large power grids can fundamentally solve the integration & utilization of RE: **Global Energy Interconnection**

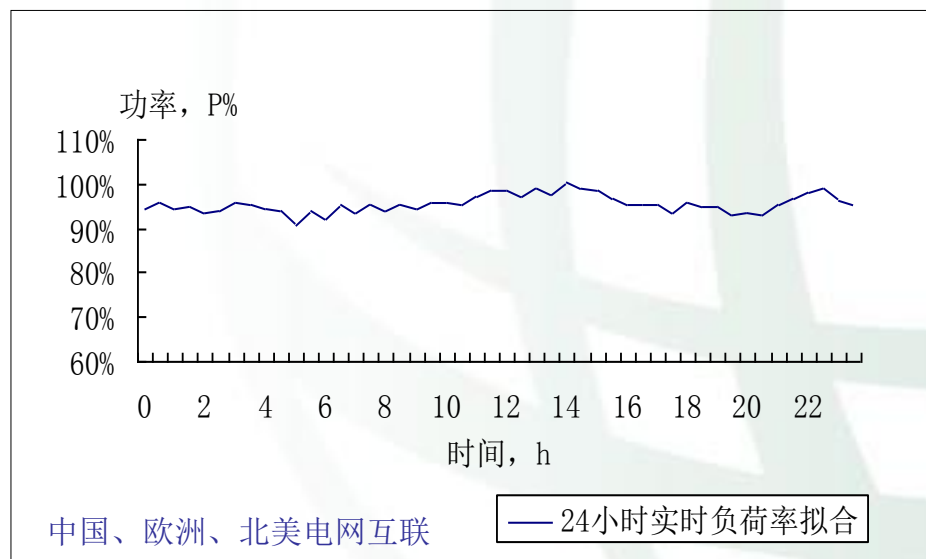
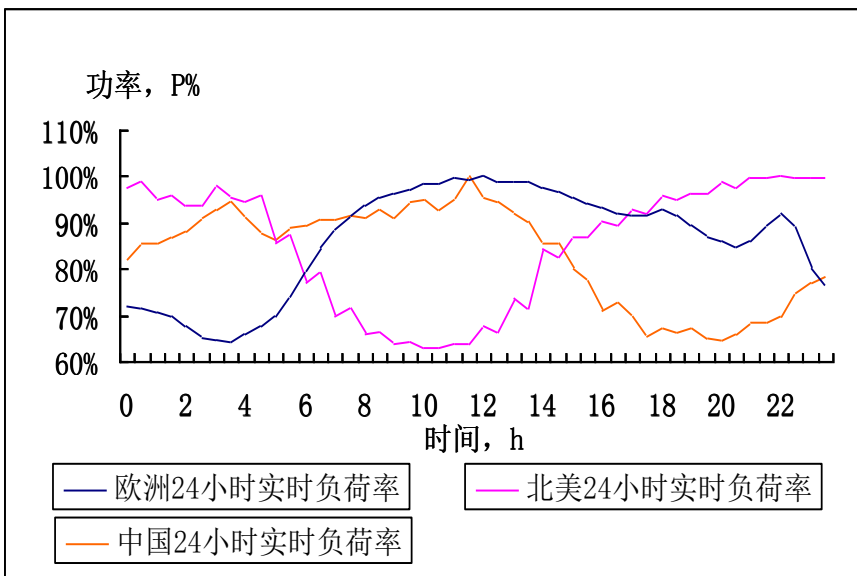


Distribution of global wind energy resources



Distribution of global solar energy resources





24 Hour Power Curves of China、Europe、North America respectively

24 Hour Power Curve stemming from the superposition of the curves of China、Europe、North America



- 1.If 80% of the Energy Consumption comes from Clean Energy by 2050, CO₂ will be reduced to the half of its level in 1990.**
- 2.By the end of 21 century, the increase of global temperature can be limited to 1.5°C, which will meet the target requirement (COP21).**



Thank you for your attention!

