Overview of SGCC and the Integration of Large Wind Power

国家电网概况及大规模风电并网运行情况

National Electric Power Dispatching and Control center

State Grid Corporation of China

September , 2013

国家电网
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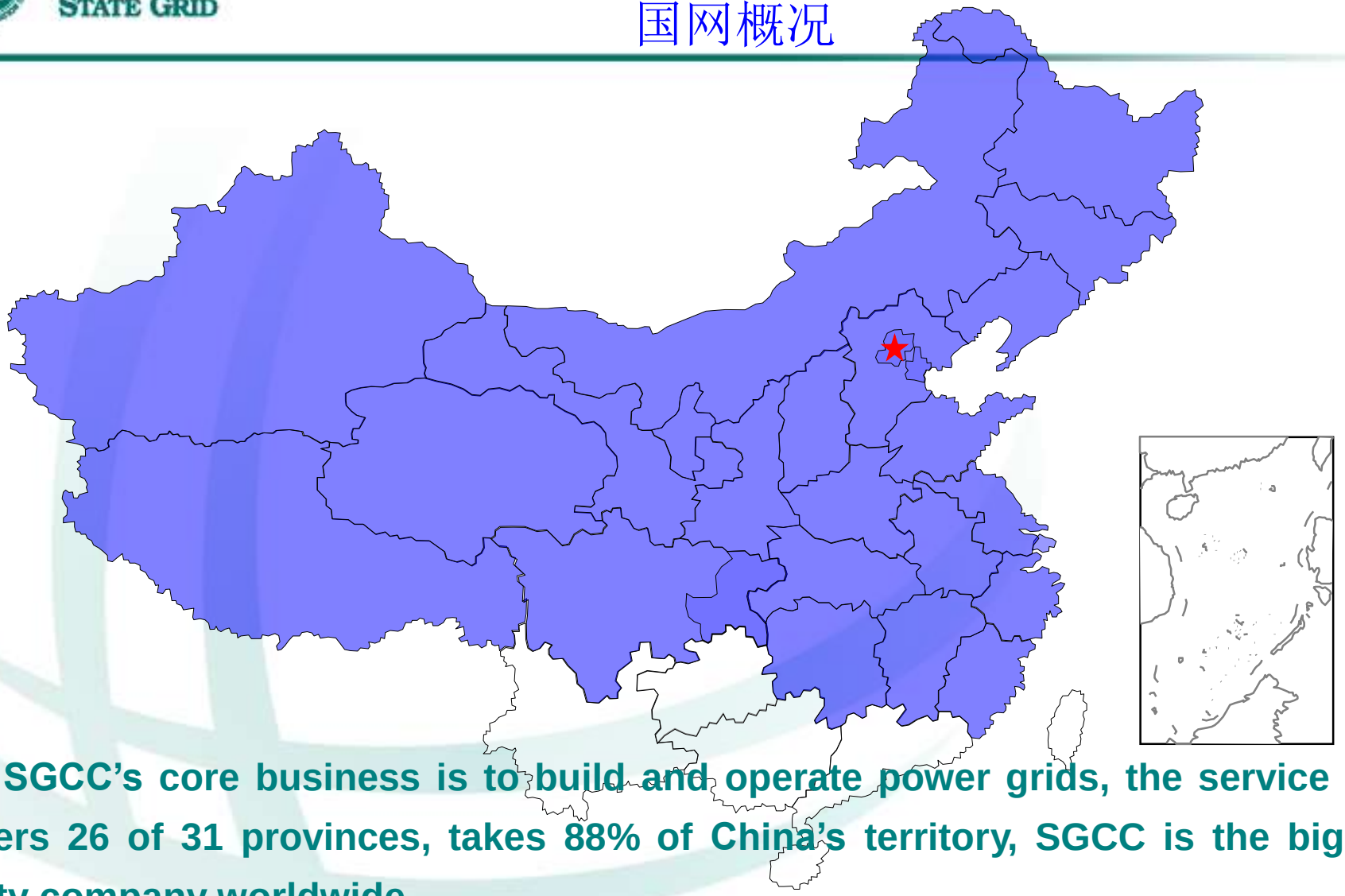
1. Overview of SGCC
国网概况

2. Integration and Operation of Large Wind Power
大规模风电并网运行

3. Problems We Have Interests in
下一步工作展望

Overview of SGCC

国网概况

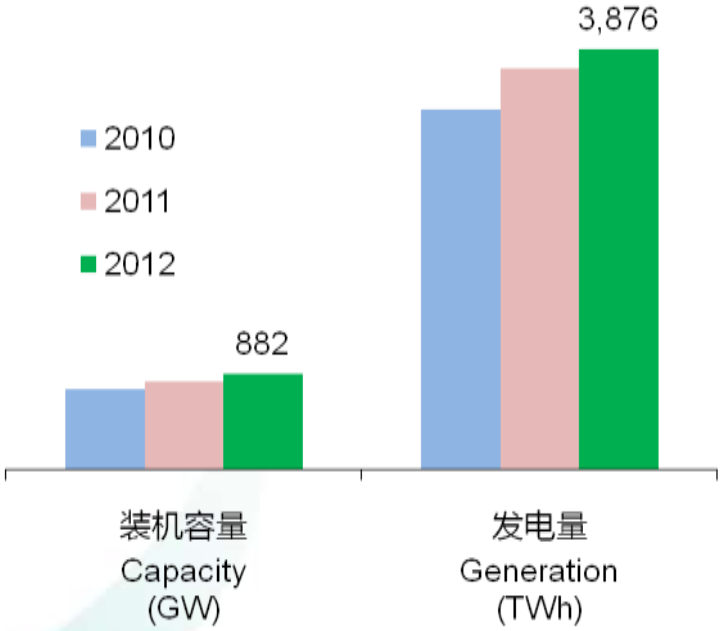


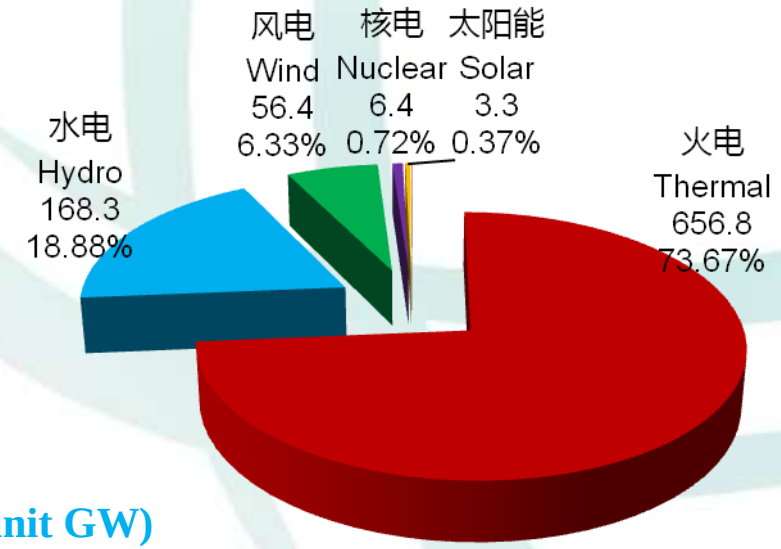
SGCC's core business is to build and operate power grids, the service area covers 26 of 31 provinces, takes 88% of China's territory, SGCC is the biggest utility company worldwide.

作为世界上最大的公用事业企业，国家电网主营业务是建设和运行26个省级电网，经营范围覆盖了国土面积的88%。

Installed Capacity
装机容量

The steady growth of China's national economy leads to the continuous increase of electricity demand and installed capacity at a fast speed. By the end of 2012, total installed capacity and gross generation reached 882GW and 3876TWh respectively. The first is thermal power, takes 74% and the second is hydro power, takes 19%.The wind power increased fast and exceeded 56GW, takes 6.3%.

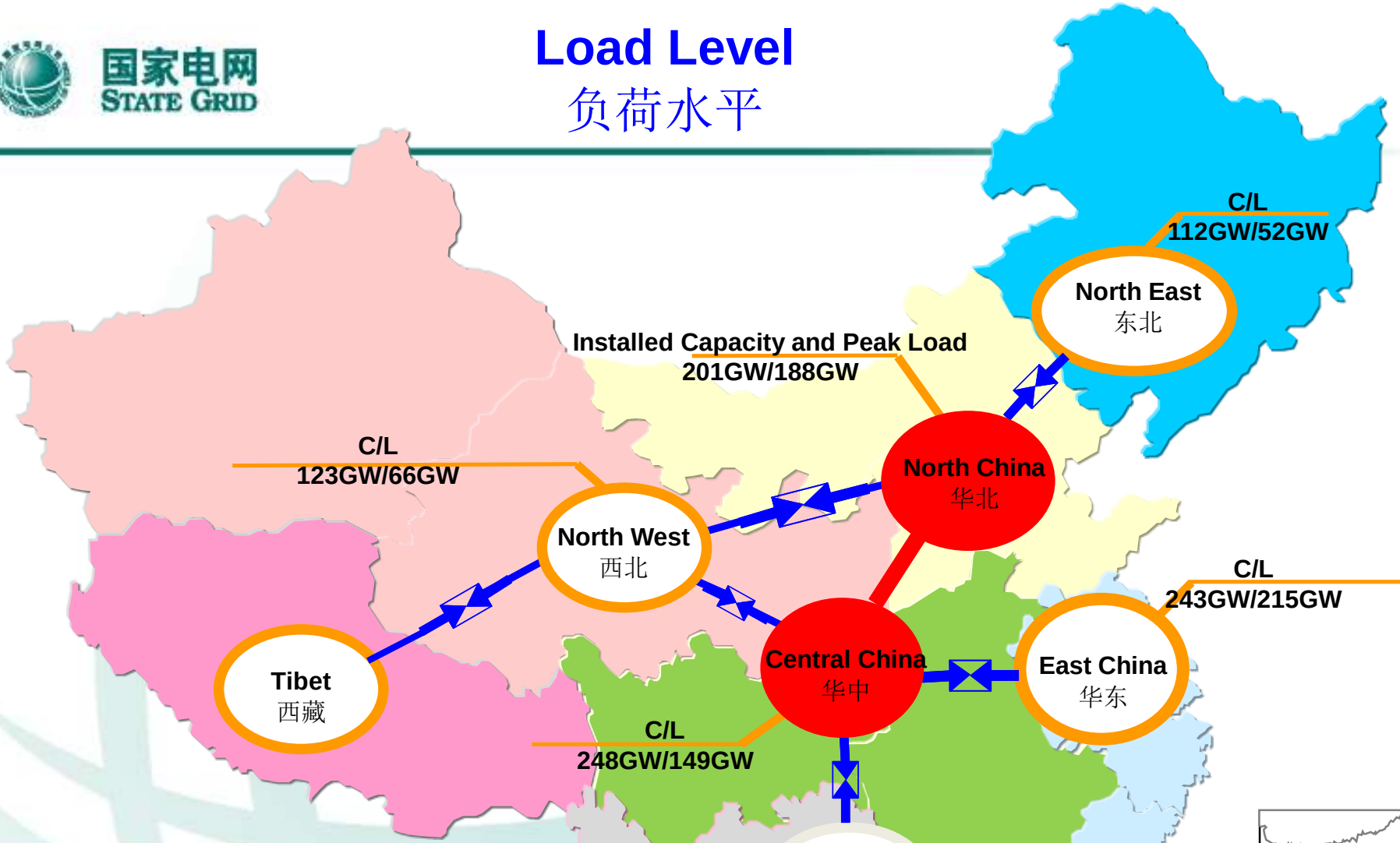




(unit GW)

得益于中国经济的稳定增长，社会用电需求和发电装机容量快速增长。2012年底，国网经营区域内发电装机容量达到8.82亿千瓦时，其中火电占74%，水电19%，风电装机5636万千瓦，占6.3%。2012年总发电量38761亿千瓦时。

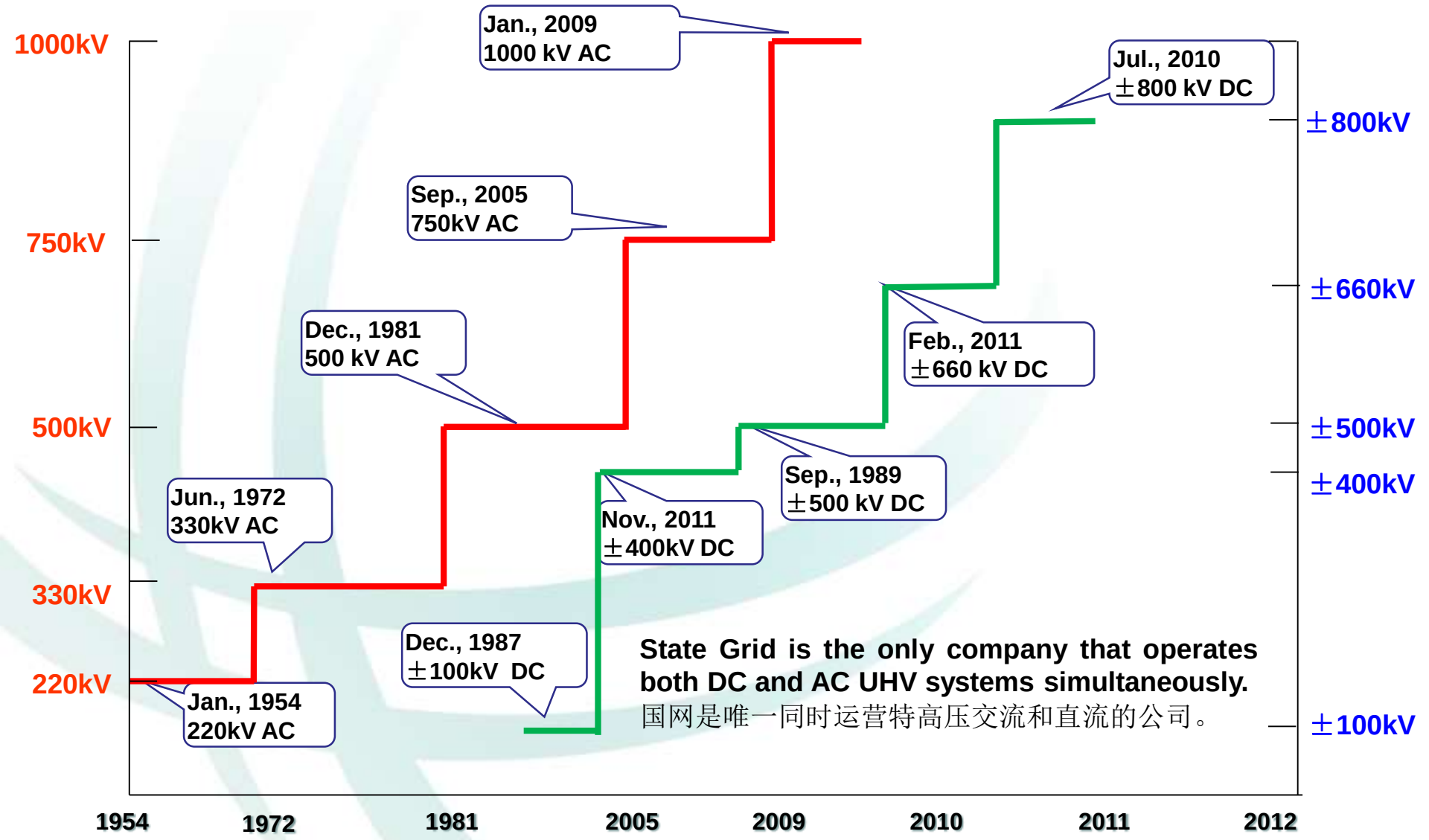
Load Level
负荷水平



By the end of August 2013, installed capacity in SGCC was up to 927GW, and max peak load reached 654GW.

截至2013年8月底，国网经营区域内发电装机容量达到9.27亿千瓦，最大负荷达6.54亿千瓦。

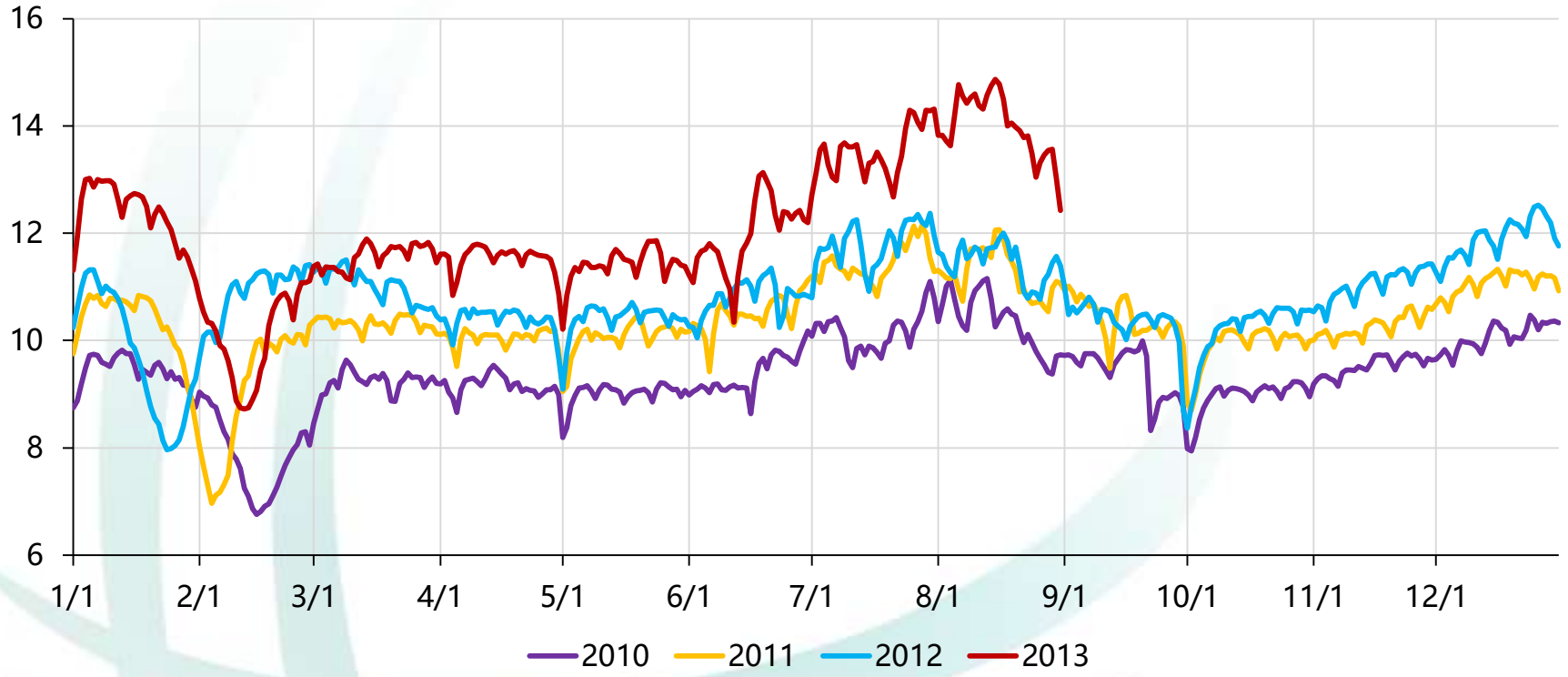
Voltage Level Climbs
电网电压等级的发展



State Grid is the only company that operates both DC and AC UHV systems simultaneously.

国网是唯一同时运营特高压交流和直流的公司。

Electricity Demand Growth
电力需求增长



In this summer, as the temperature climbs higher than former years, the electricity demands increased rapidly. On August 15th, the electricity demand reached its highest level of 14.87TWh, with a peak-value growth of 20%.

今夏，气温偏高，电力需求大增。8月15日，全社会用电量达到148.7亿千瓦时，同比增长19%。

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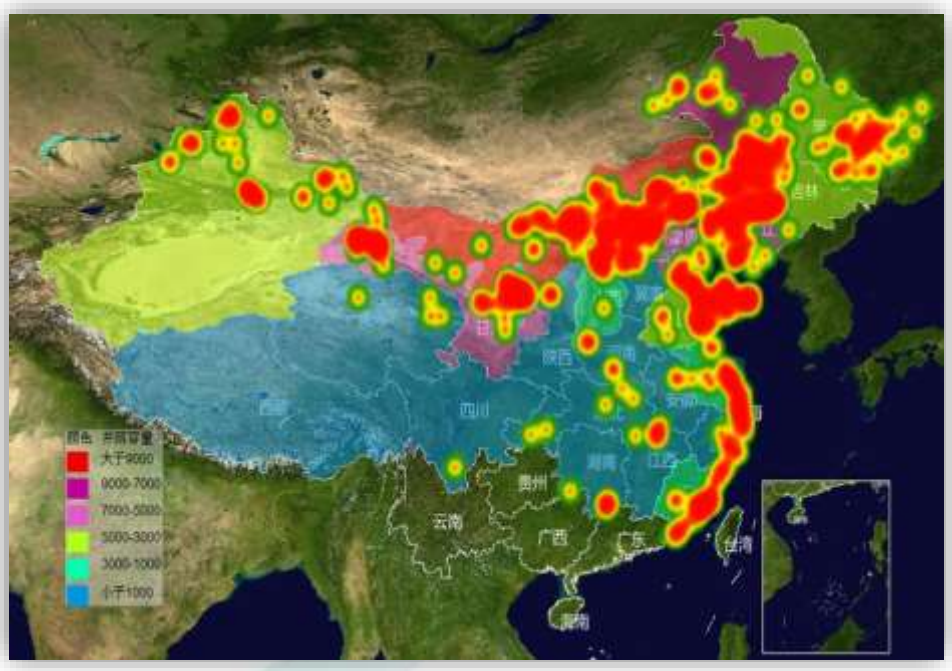
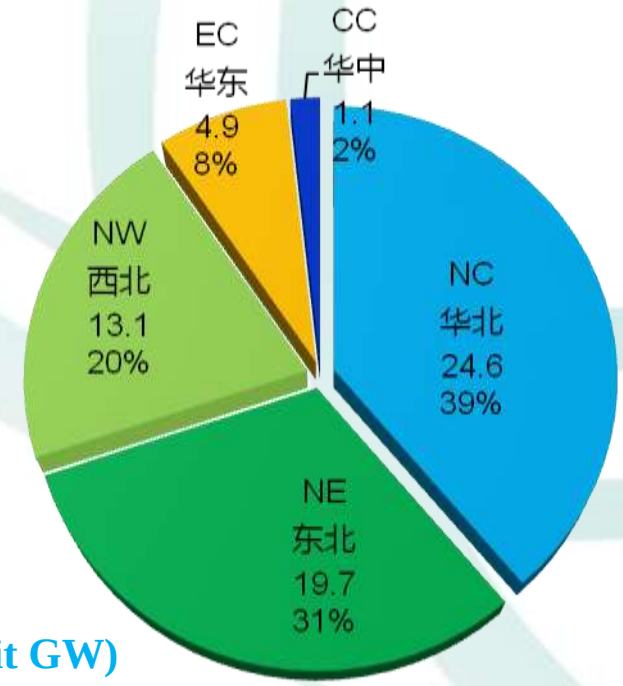
Distribution of Wind Power
风电分布

截至2013年8月底，国网经营区域内风电并网容量达到6334万千瓦，占总装机容量的6.6%，其中“三北”并网容量占90%。

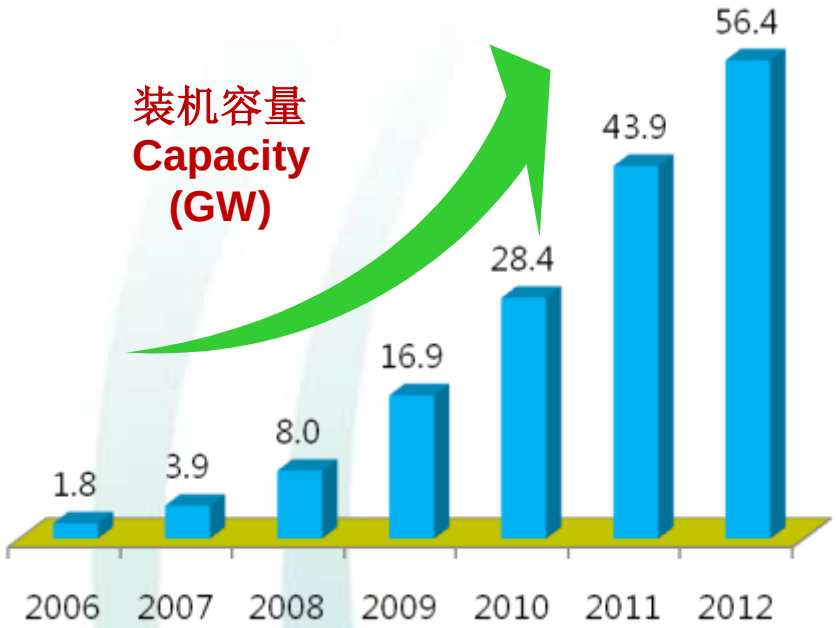




(unit GW)

By the end of August, the integration capacity of wind power for SGCC reach 63.34GW, accounting for 6.6% of gross installed capacity, 90% of which is distributed in the ‘3-North’ — North China, Northeast & Northwest.

Growth of Wind Power Capacity & Generation
风电装机和电量快速增长

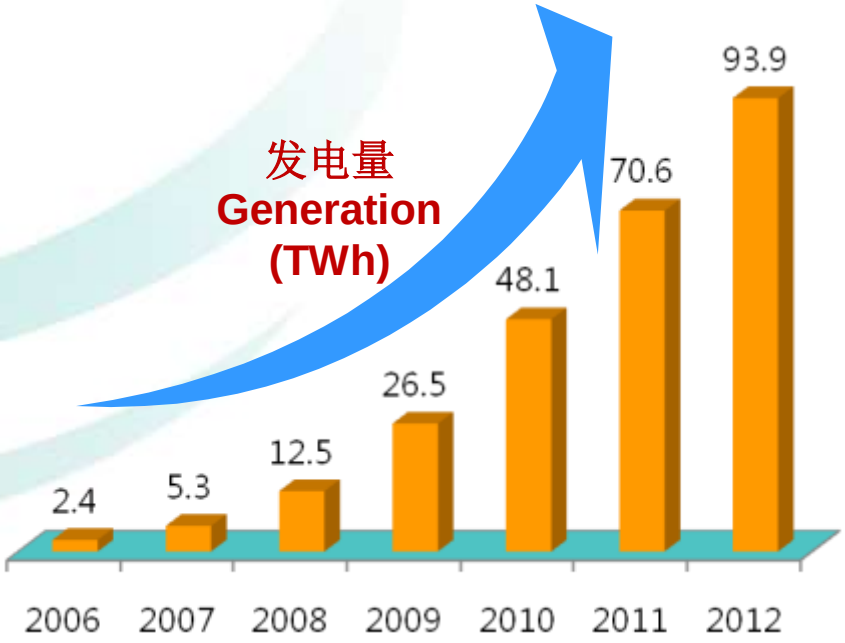


During the last several years, SGCC has witnessed a rapid growth of wind power with 29 times since 2006. By the end of 2012, wind power capacity was up to 56.36GW, and annual generation reached 93.9TWh with growth of 38 times.

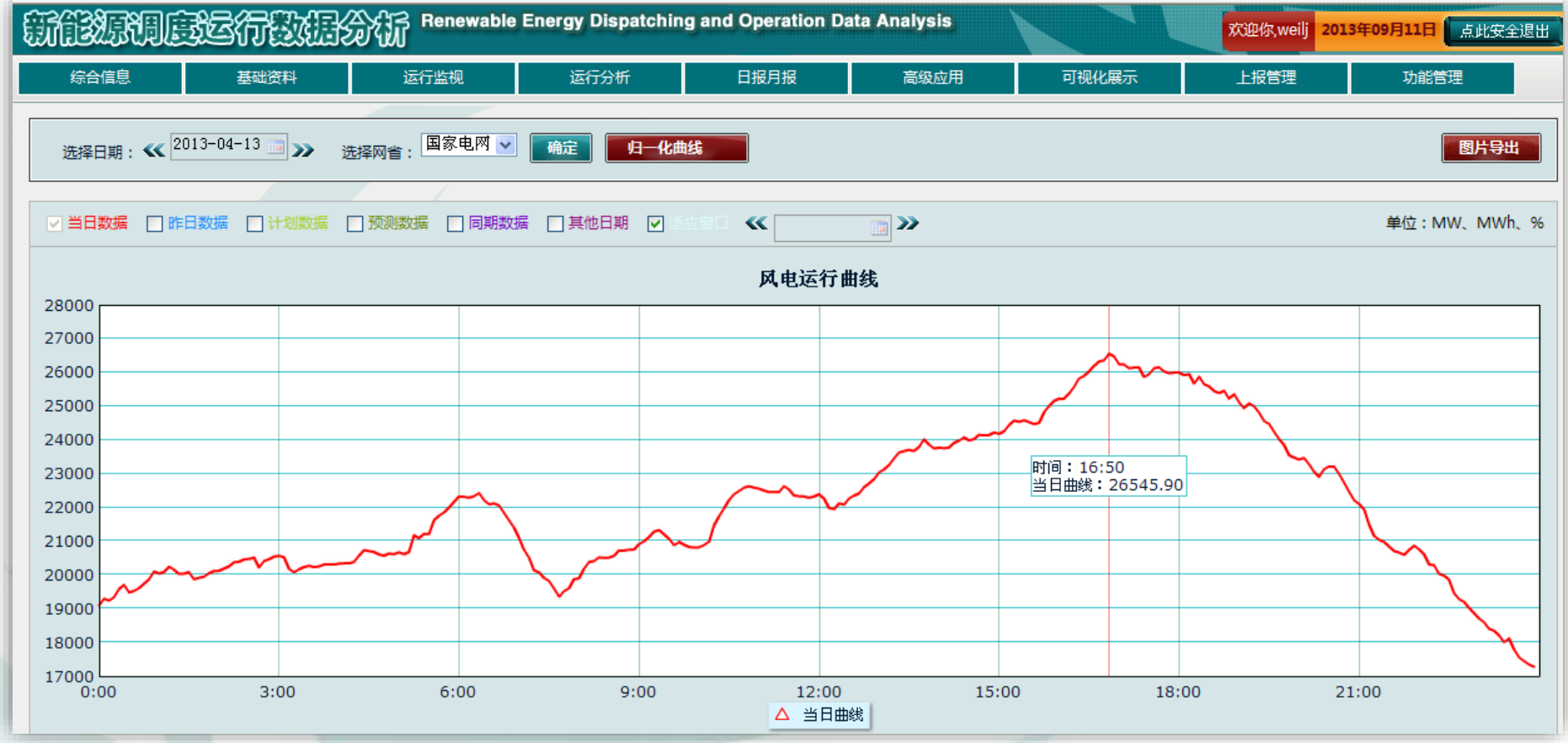
By the end of this August, SGCC has accommodated 81.0TWh of wind production, with growing by 38.4%, which exceeds the total electricity consumption of 12 grids, such as Beijing, Tianjin, etc.

近年来，中国风电等新能源快速发展。2012年底，国家电网公司经营区内风电装机5636万千瓦，较2006年增长了29倍，年发电量达到939亿千瓦时，较2006年增长了38倍。

截至2013年8月底，国家电网公司累计消纳风电电量810亿千瓦时，同比增长38.4%，超过北京、天津等12个省级电网的全社会用电量。



Wind Power Operation
风电运行

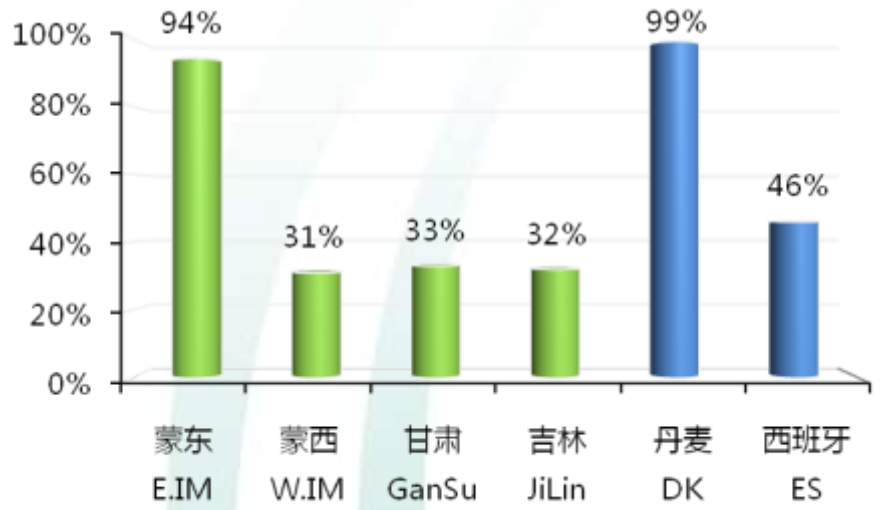


Until now, the max wind power output in SGCC's operation area is up to 26546 MW (13th, April, 2013), which was 5.7% of load.

截至目前，国网经营区域内风电最大出力为26546MW（2013.4.13，占当时用电负荷的5.7%。

Accommodation Accesses Advanced Level

风电富集地区消纳达到世界先进水平

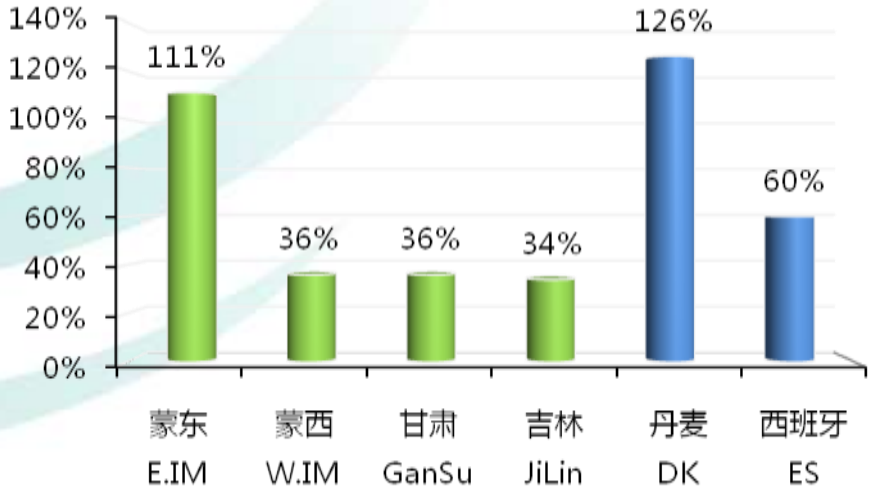


Max daily wind production ratio of total consumption

风电日发电量占总用电量最大比重

Through large grid force, wind power accommodation level of some region with rich wind resource accessed advanced level comparable to Denmark and Espana. The max daily wind production ratio of total consumption reached 94%,31%,33% and 32%, and the max wind output ratio of load reached 111%,36%,36% and 34% respectively in E.IM, W.IM, Gansu and Jilin.

依靠大电网，蒙东、蒙西、甘肃和吉林风电日发电量占用电量的比例最高分别达到94%、31%、33%和32%，风电出力占用电负荷比例最大分别达到111%、36%、36%和34%，与丹麦、西班牙相当。



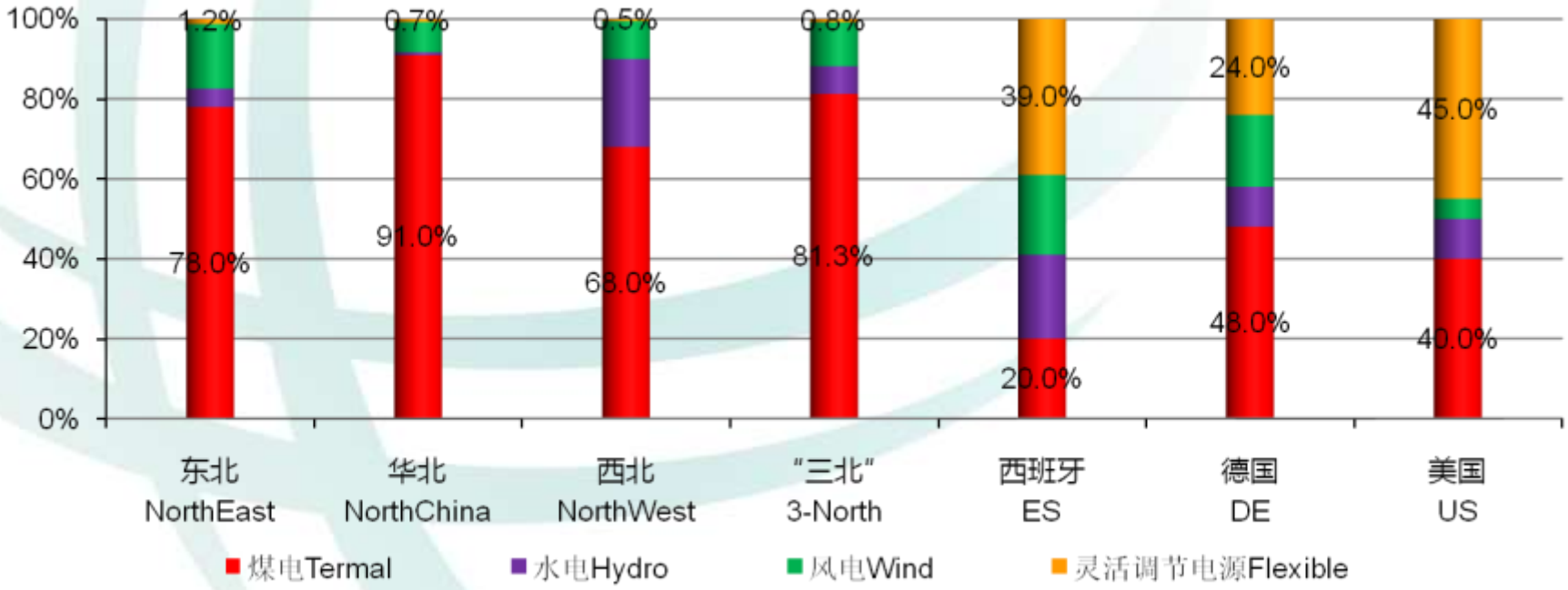
Max wind output ratio of load

风电最大出力占用电负荷最大比重

Irrational Structure of Power Supply
不合理的电源结构难以适应风电的快速发展

Thermal power occupies the majority at the '3-North', while the flexible power, such as hydropower, pumped storage, gas turbines, oil turbines, are quite lack, which leads to inadequate peak-regulating.

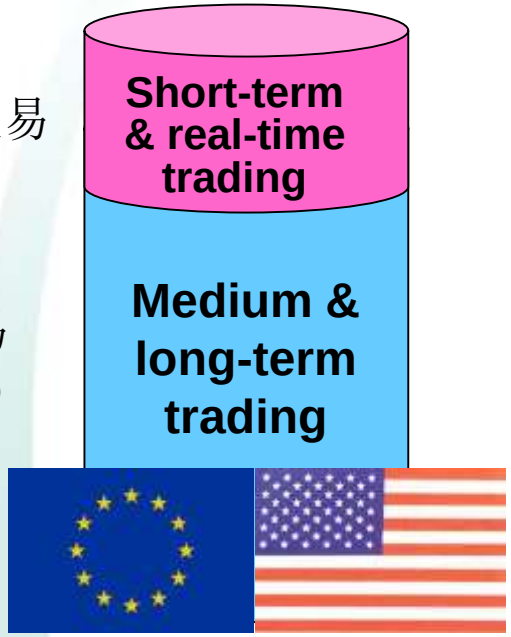
"三北"地区电源结构以火电为主，水电等快速灵活调节电源较少。固有的电源结构，使系统调峰问题突出，不利于消纳风电。

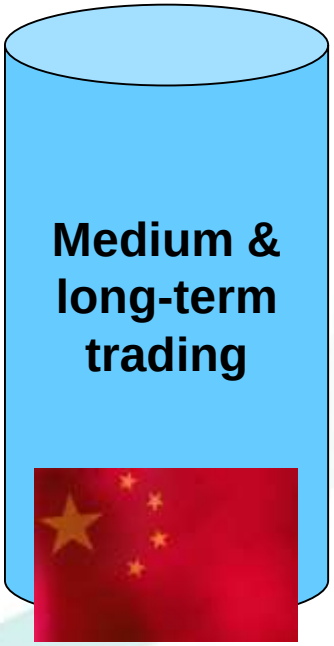


Lack of Support Policy
缺失激励政策

短期和实时交易
20%~30%

中长期交易
70%~80%





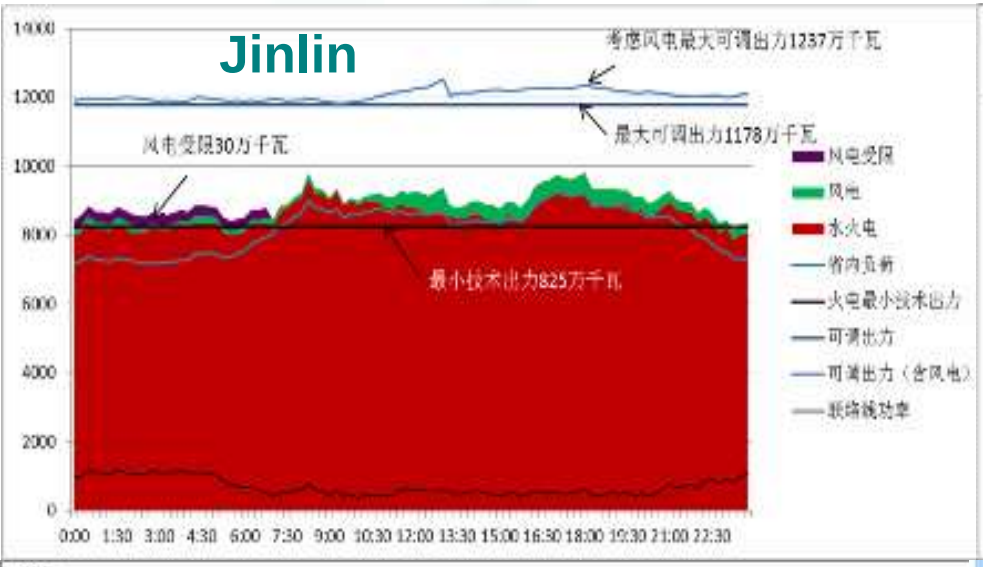
中长期交易
100%

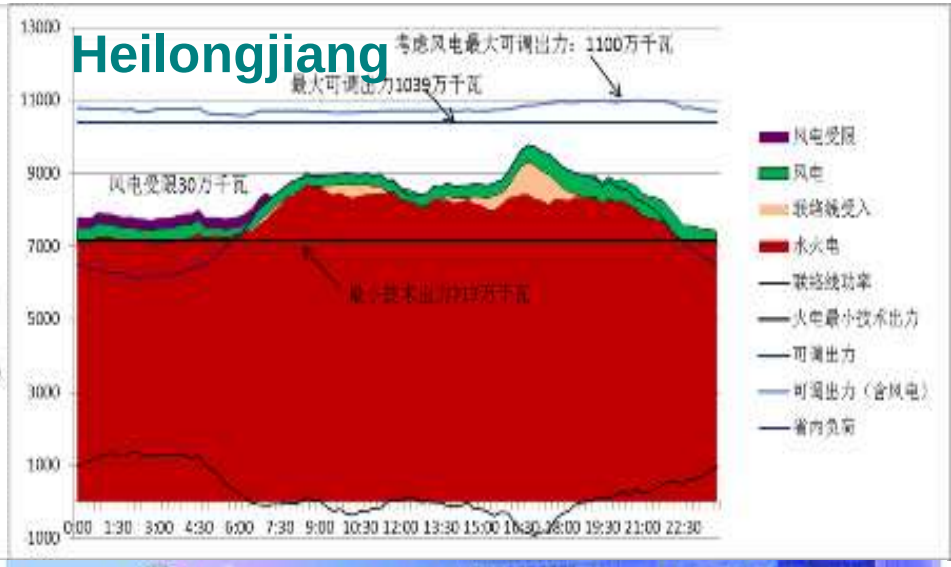
Now, we are still lack of policy for the promotion of the integration of wind power. In addition, the policies for ancillary services is not enough.

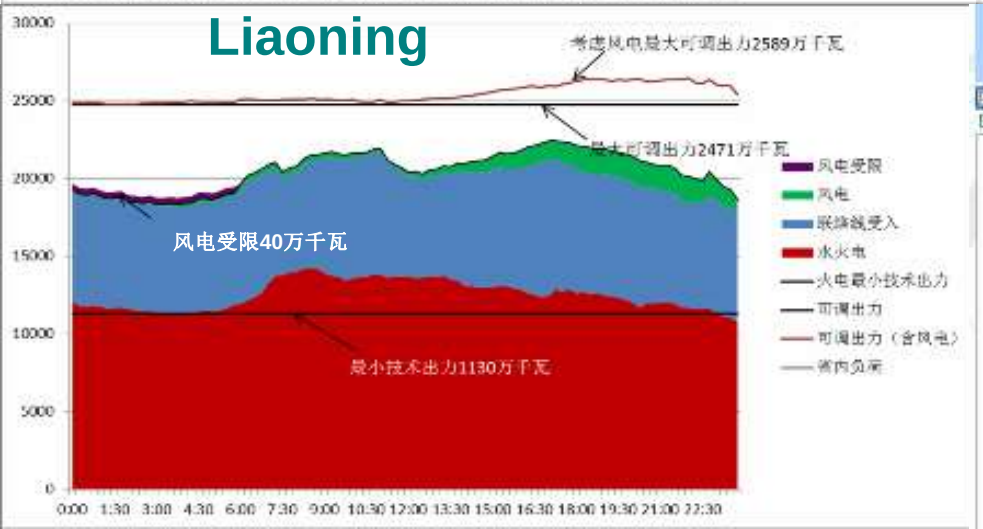
目前，中国尚缺乏风电并网消纳激励政策，辅助服务政策尚不完备。

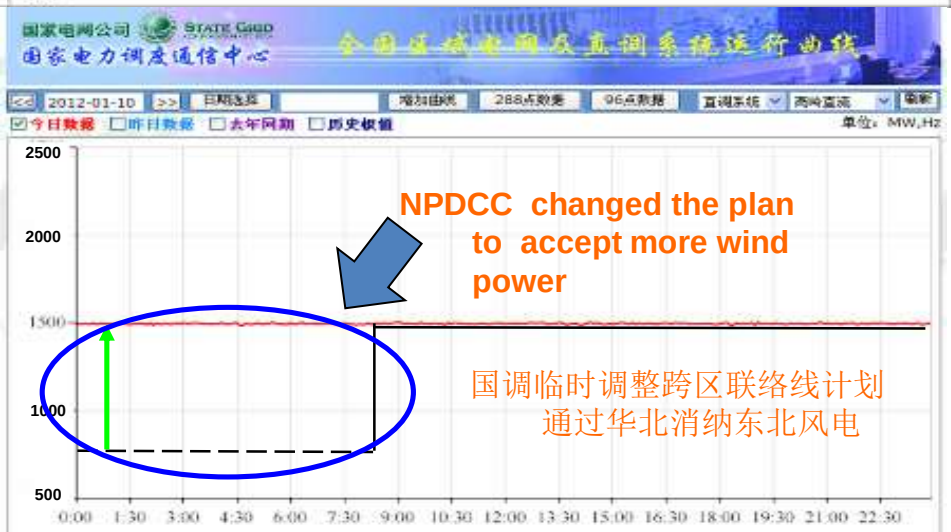
Optimal Dispatch Mechanism of Wind Power in NPDCC, Regional and Provincial Centers

形成了国网省三级协同配合的风电优先调度机制







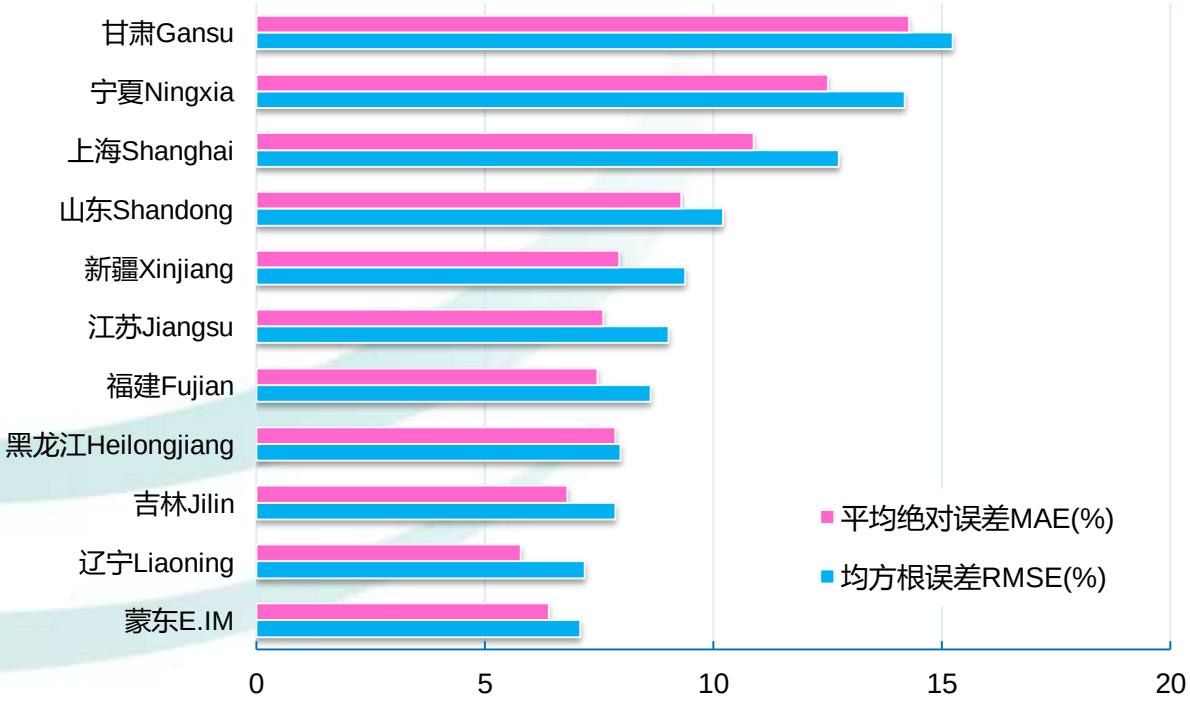


Wind Power Forecasting System (WPFS)

建立了风电功率预测系统

Dispatch side WPFS covered all the dispatch centers of SGCC. The forecast accuracy exceeds 90% in some regional grids with rich wind power, which have already achieved ultra-short term wind power forecasting to support real-time dispatching of wind power.

公司调度端风电功率预测已实现全覆盖，风电富集地区预测精度可达到90%以上。一些网省调还实现了超短期预测功能，为风电实时调度提供更强大的技术支撑。



Heat Supply On-line Monitoring System (HSOMS)

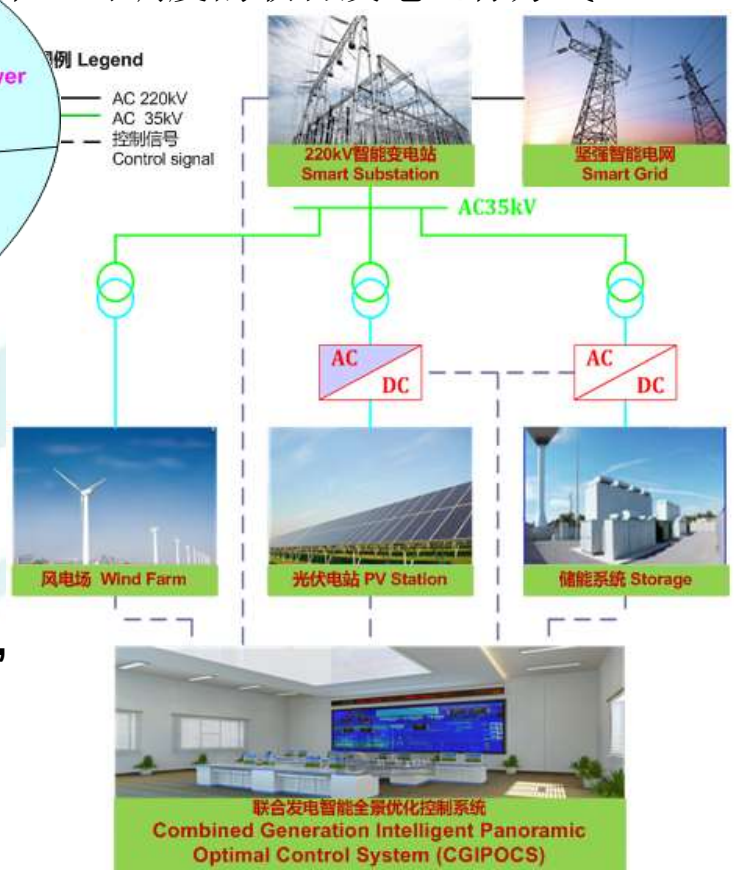
建立了供热机组供热信息在线监视系统

In order to ease the contradiction between high wind output and thermal heating in winter and spring season, heat supply on-line monitoring system was constructed in 3-North grid. Wind power accommodation goes to maximize by on-line monitoring heat load and real-time measuring adjustment space of thermal power.

“三北”地区为缓解冬春季风电大发与火电供暖矛盾，采取在线监测供暖负荷、实时测算火电调节能力等措施，全力发挥火电机组调峰能力，最大限度地接纳风电。

National Wind-Photovoltaic-Storage-Transmission Demonstration Project 国家风光储输示范工程

联合发电智能全景优化控制系统可根据调度计划、风能预测和光照预测，对风电场、光伏电站、储能系统和变电站进行全景监测、智能优化，实现风、光、储的七种组合发电方式与平滑出力、跟踪计划、系统调频、削峰填谷四种功能的结合，实现多组态、多功能、可调节、可调度的联合发电运行方式。

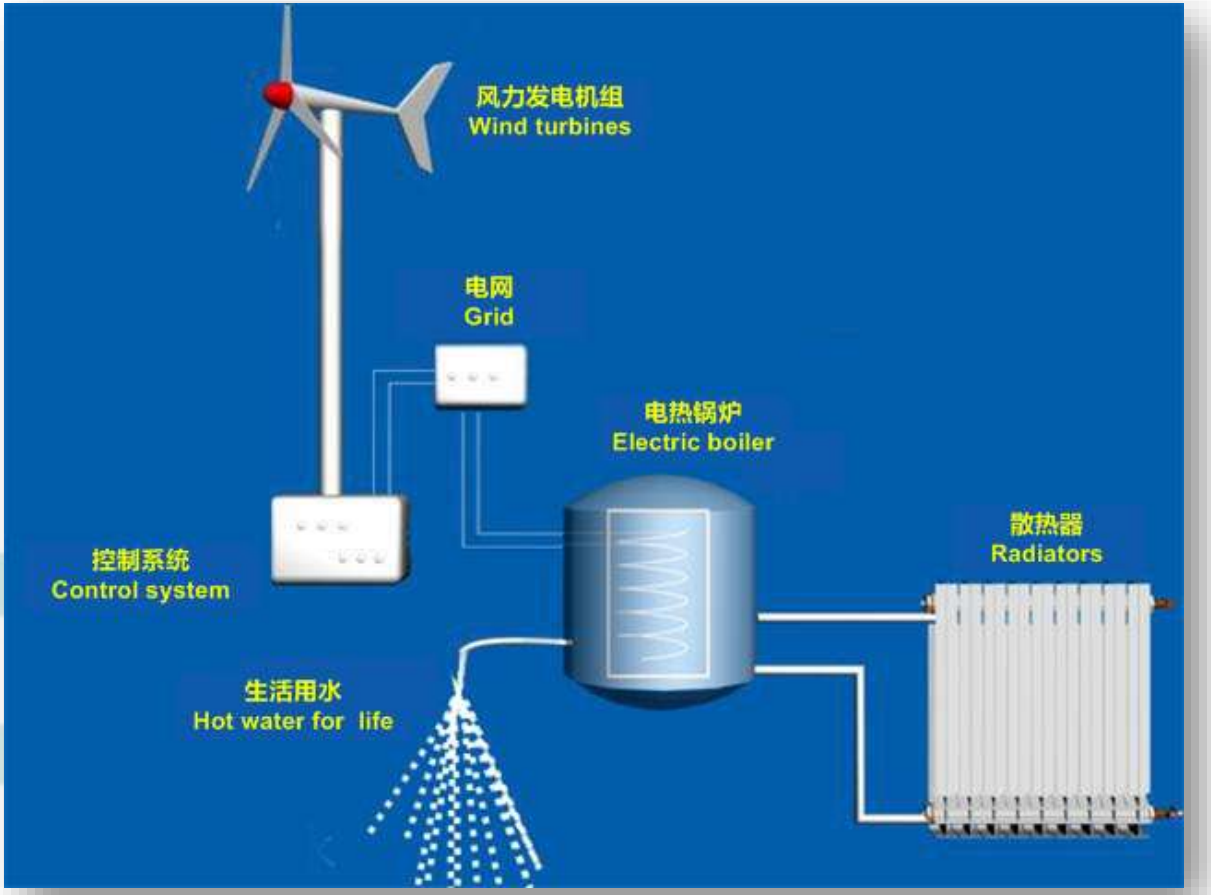


Wind farm, PV station, storage System and substation are involved in panoramic monitoring and intelligent optimization by CGIPOCS with the consideration of the results of dispatch planning, wind and illumination forecasting. 7 modes are combined with 4 functions — smoothing output, following plan, frequency adjustment, peak shifting— to realize multi-mode, multi-function, adjustable and dispatchable combined operating mode.

Wind Power Heating Demonstration Project
风电供暖示范项目

Jinlin Taonan wind power heating demonstration project, which is equiped with 9×2MW electric boilers and in charge of 163,000 sq.m. heating area, can locally accommodate 27GWh of wind production during a heating period of 176 days.

洮南风电供热示范项目，安装2MW的电锅炉9台，供热面积16.3万平方米，一个采暖期（176天）可就地消纳电量2700万千瓦时。

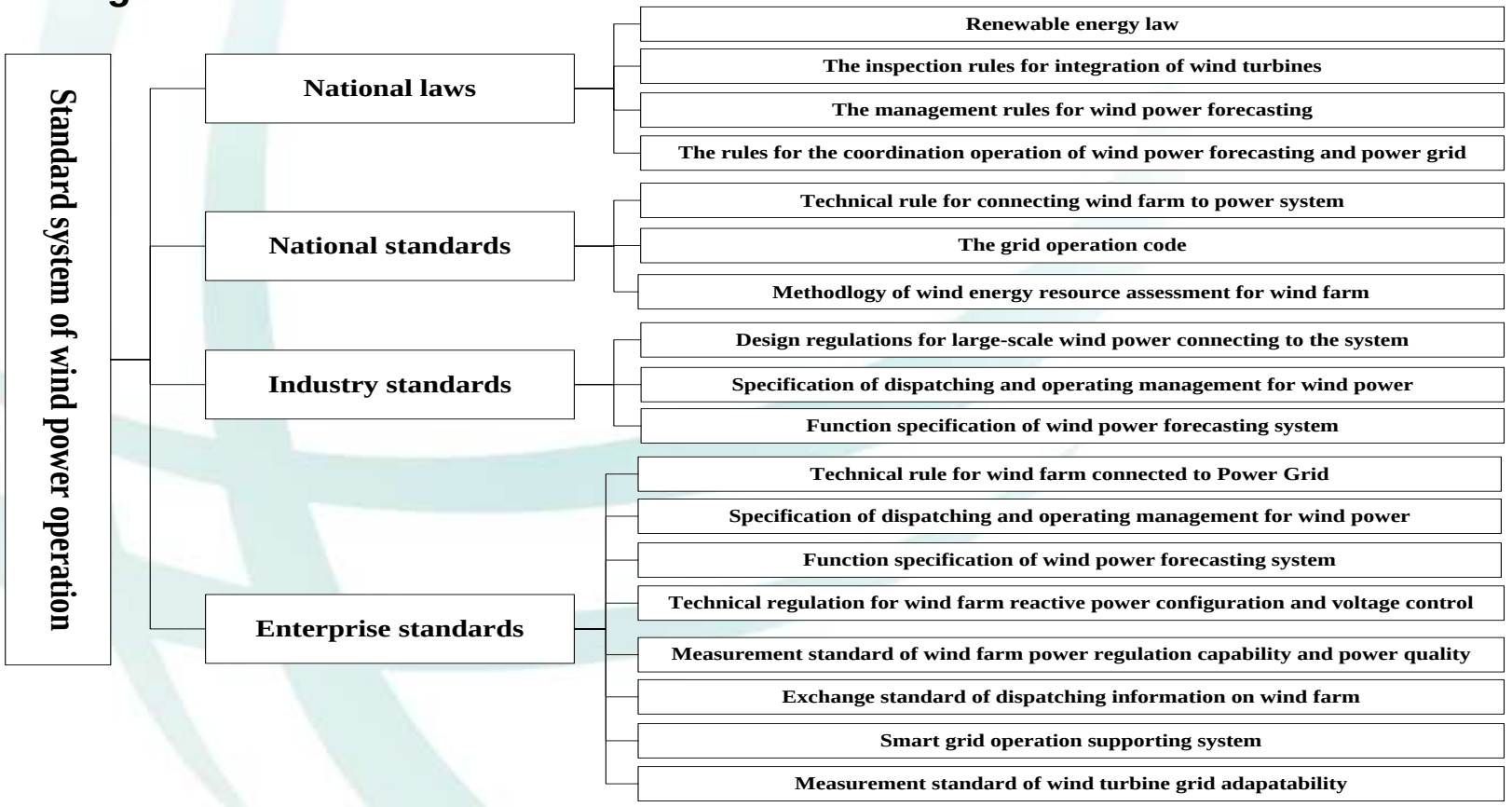


Established Standard System of Wind Power Operation

建立了风电运行标准体系

国家电网公司总结分析了近年来风电运行情况，制定了《风电场接入电网技术规定》等20余项企业标准和《风电反事故措施要点》等有关规定，规范了整个行业从技术、运行、安全到管理的相关要求。

SGCC has issued over 20 enterprise standards and rules, such as *'anti-accident measures for wind power operation'* , which standardized technology, operation, security and management.

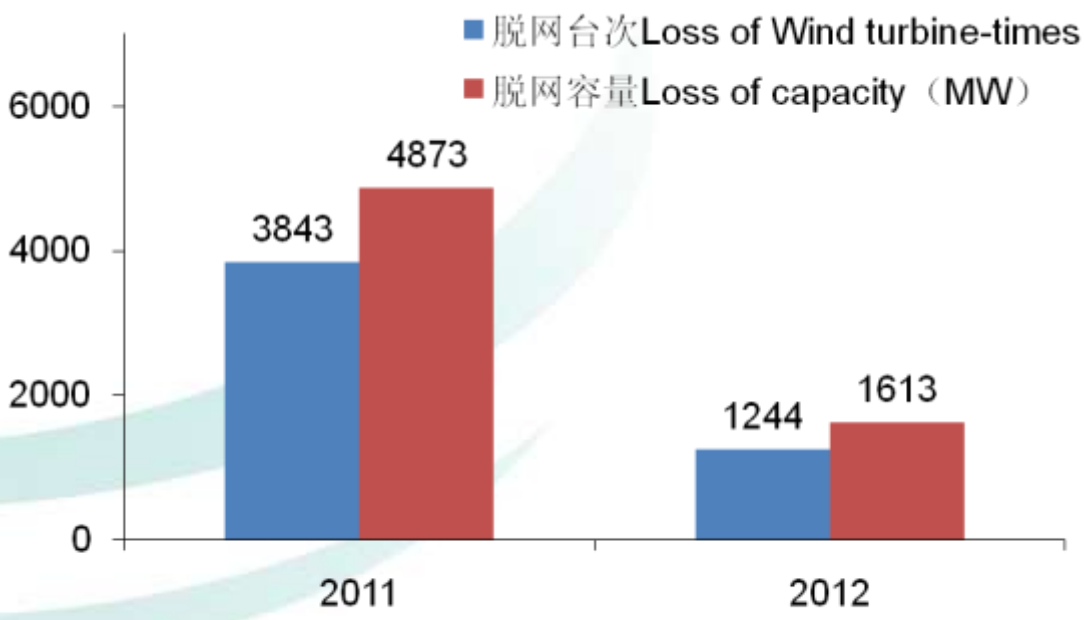


Anti-accident Measures for Wind Power Operation

制定并落实了大规模风电脱网反事故措施

To reduce the loss of large capacity of wind power. the dispatching center established measures, such as the strengthen of inspection of integration and the reconstruction of wind turbines, to direct the security operation of wind farm and avoid the loss of large capacity of wind power. Off-grid of large wind power has not occurred since June 2012.

针对近年来出现多次风电大规模脱网事故的新情况，调度机构制定了风电反事故措施要点，指导风电安全生产工作。2012年6月以来，没有发生大规模风电脱网事故。



The Comparison of Large Wind Power Outage in 3-North area in 2011 and 2012.

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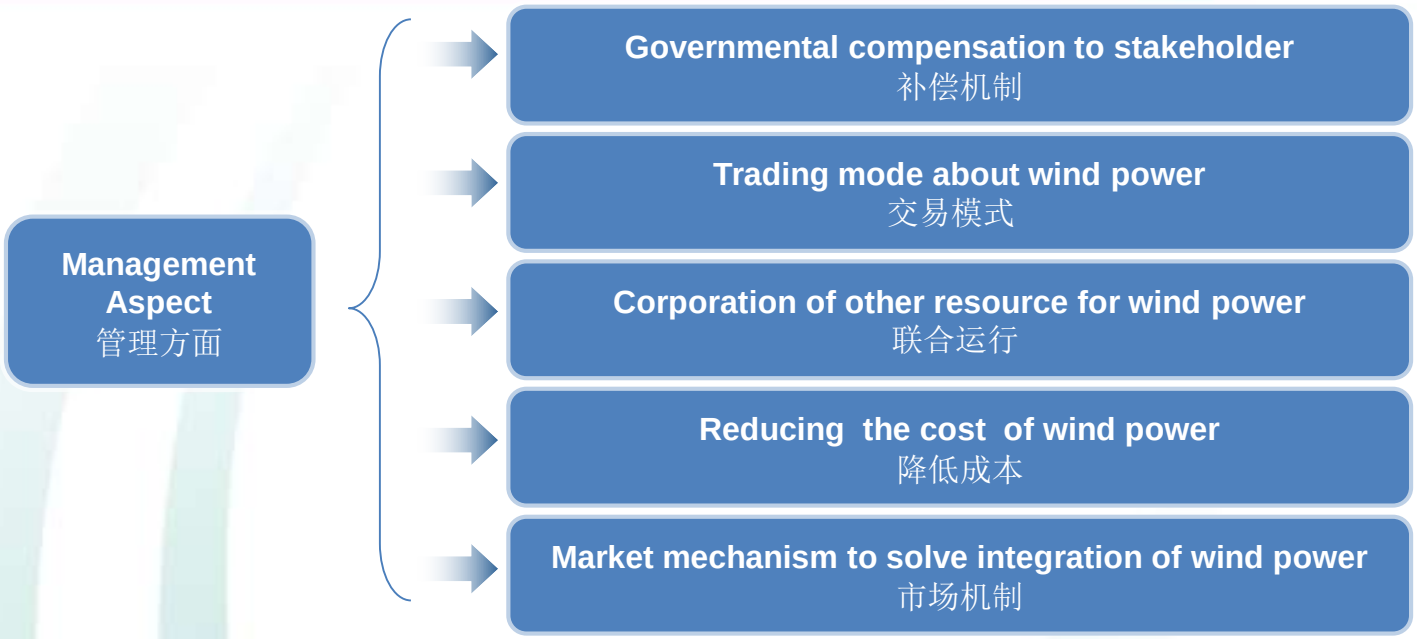
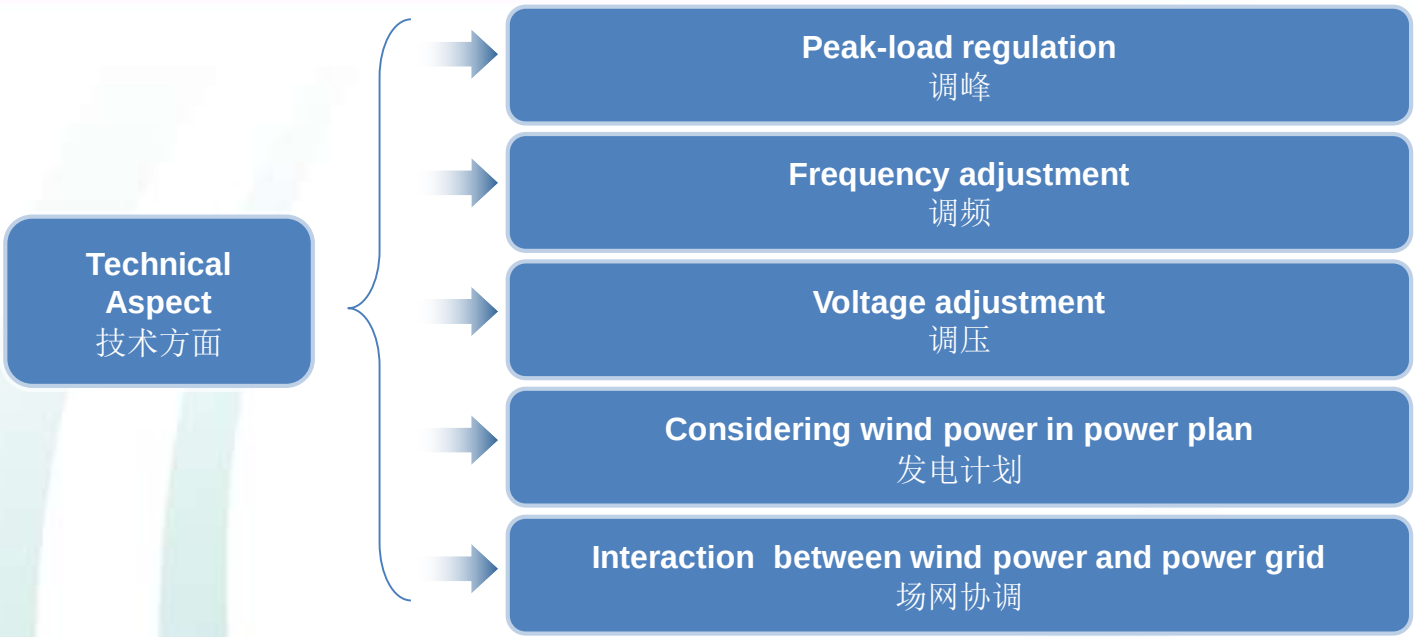


Establishing compensation mechanism and incentive measures involving wind power enterprise, conventional power producer and grid company. Exploring trading mode of wind power suited to China's policy environment. Researching combined operating mode of wind power with thermal and hydro power. Studying methods to reduce the cost of operating large wind power. Founding market mechanism to solve accommodation of wind power.

制定覆盖风电企业、常规电源企业和电网企业的补偿机制和激励措施，探索适合于中国政策环境的风电交易模式，研究风电与火电、水电等电源联合运行管理模式，研究降低电网接纳大规模风电的运行成本的方法，建立大规模风电消纳市场机制，营造良好的风电消纳环境。

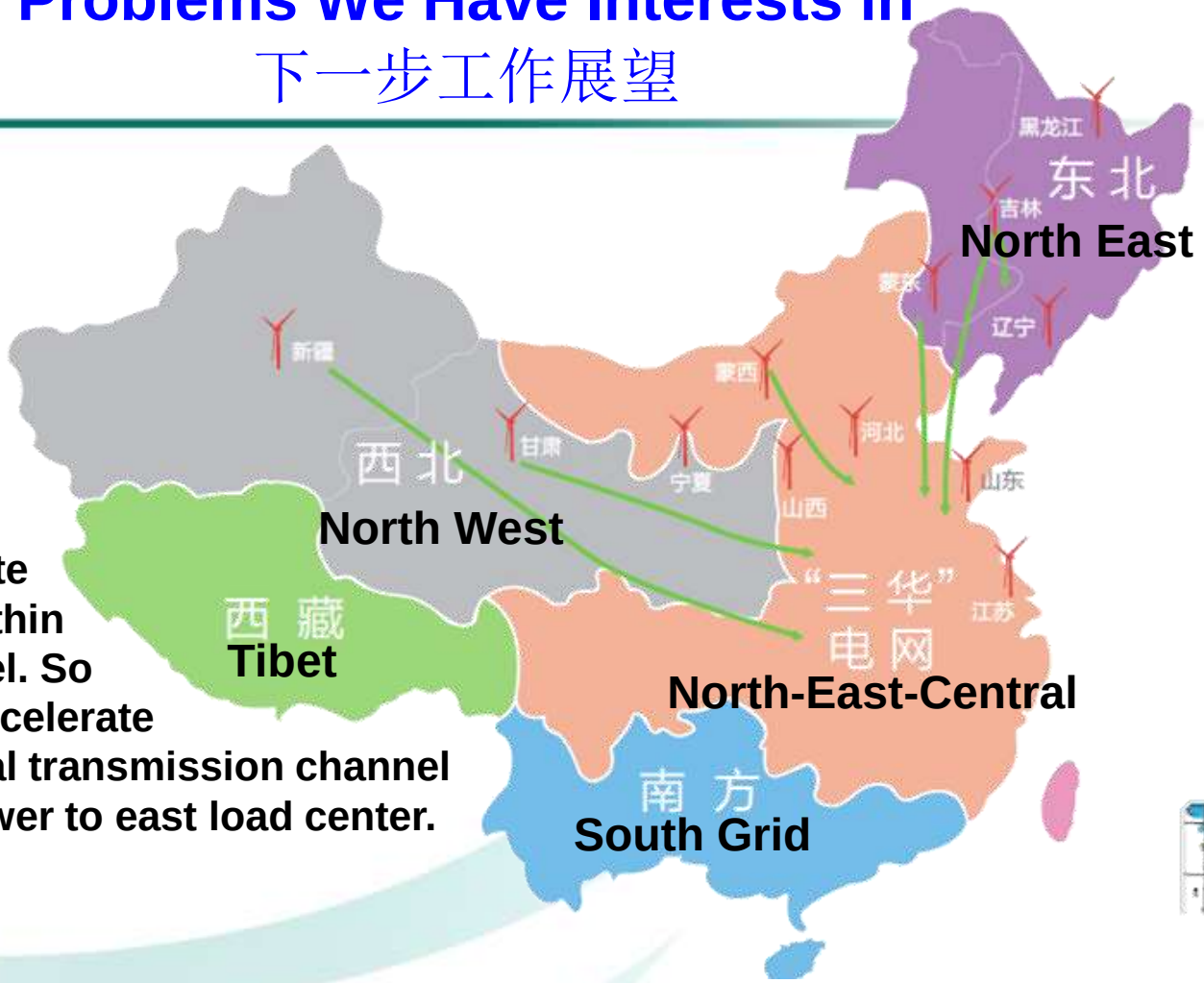
Problems We Have Interests in
下一步工作展望



Researching ancillary service strategies for wind power to taking part in peak-load regulation, frequency adjustment and voltage adjustment. Achieving consideration wind power into power planning. Studying interaction between wind power and grid to improve the ability of large grid to accommodate large wind power.

研究风电参与调峰调频和调压等辅助服务技术策略，实现风电纳入系统发电计划编制，深入研究风电与电网的相互影响，进一步提升大电网运行大风电的水平。

Problems We Have Interests in
下一步工作展望



“三北”负荷水平较低，大规模风电难以就地消纳，亟需通过建设跨区输电通道送往东部负荷中心。

It is difficult to accommodate large wind power locally within 3-North due to low load level. So the most imperative is to accelerate construction of interregional transmission channel to send redundant wind power to east load center.

正在规划论证蒙西风电送出的锡盟～南京、蒙西～长沙特高压交流工程，解决西北风电送出的酒泉～湖南特高压直流，解决东北风电送出的呼伦贝尔～山东特高压直流等输电工程。

UHVAC and UHVDC projects are involved in demonstrating and programming, such as Ximeng to Nanjing and Mengxi to Changsha UHVAC for wind power of W.IM, Jiuquan to Hunan UHVDC for wind power in northwest, Hulunber to Shandong UHVDC for wind power in northeast.

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Thanks for Your Attentions!

谢谢！