



国家电网  
STATE GRID

# 智能电网建设实践及发展前景

## Strategy and Practice of Smart Grid in SGCC



国家电网公司

State Grid Corporation of China

2012.8



## 国家电网公司概况 Profile of SGCC



## 智能电网战略与实践 Strategy and practice of Smart Grid



## 智能电网未来发展 Plan of Smart Grid

# 1.1 国家电网公司概况

## Profile of SGCC



员工人数 **156万**  
Employees 1.56 million

总资产 **20775亿元**  
Total assets 2077.5 billion yuan

客户 **服务10亿人**  
Customers Serves over 1 billion population

售电量 **年售电量26891亿千瓦时**  
Electricity Sales Annual electricity sales of 2689.1TWh

地域 **覆盖中国88%的领土面积**  
Service Area 88% of China's territory

海外运营菲律宾国家电网公司、巴西控股公司和葡萄牙能源网公司  
Overseas operation in the National Grid Corporation of the Philippines, Brazilian Holding Company and Portugal's National Power Grid



# 1.1 国家电网公司概况

## Profile of SGCC



SGCC

- 全球最大的公用事业企业  
The **largest** power utility in the world
- 2011年总收入超过16760亿元  
Total income of 2011 was over **1676** billion Yuan
- 位居世界500强第7位  
Ranked **7<sup>th</sup>** in Fortune Global 500 in 2011



国家电网公司概况  
Profile of SGCC



智能电网战略与实践  
Strategy and practice of Smart Grid



智能电网未来发展  
Plan of Smart Grid

## 2.1 坚强智能电网发展背景 Background of Strong & Smart Grid

当前，全球能源变革正在向多元化、清洁化方向发展，建设坚强智能电网意义重大。

The current global energy revolution is on the way to be more clean and diversified. The construction of strong & smart grid plays a significant role.

**促进**清洁能源发展  
Developing clean energy



**保障**能源供应  
Ensuring power supply



**坚强  
智能电网  
Strong &  
Smart grid**

**应对**气候变化  
Helping address global climate change

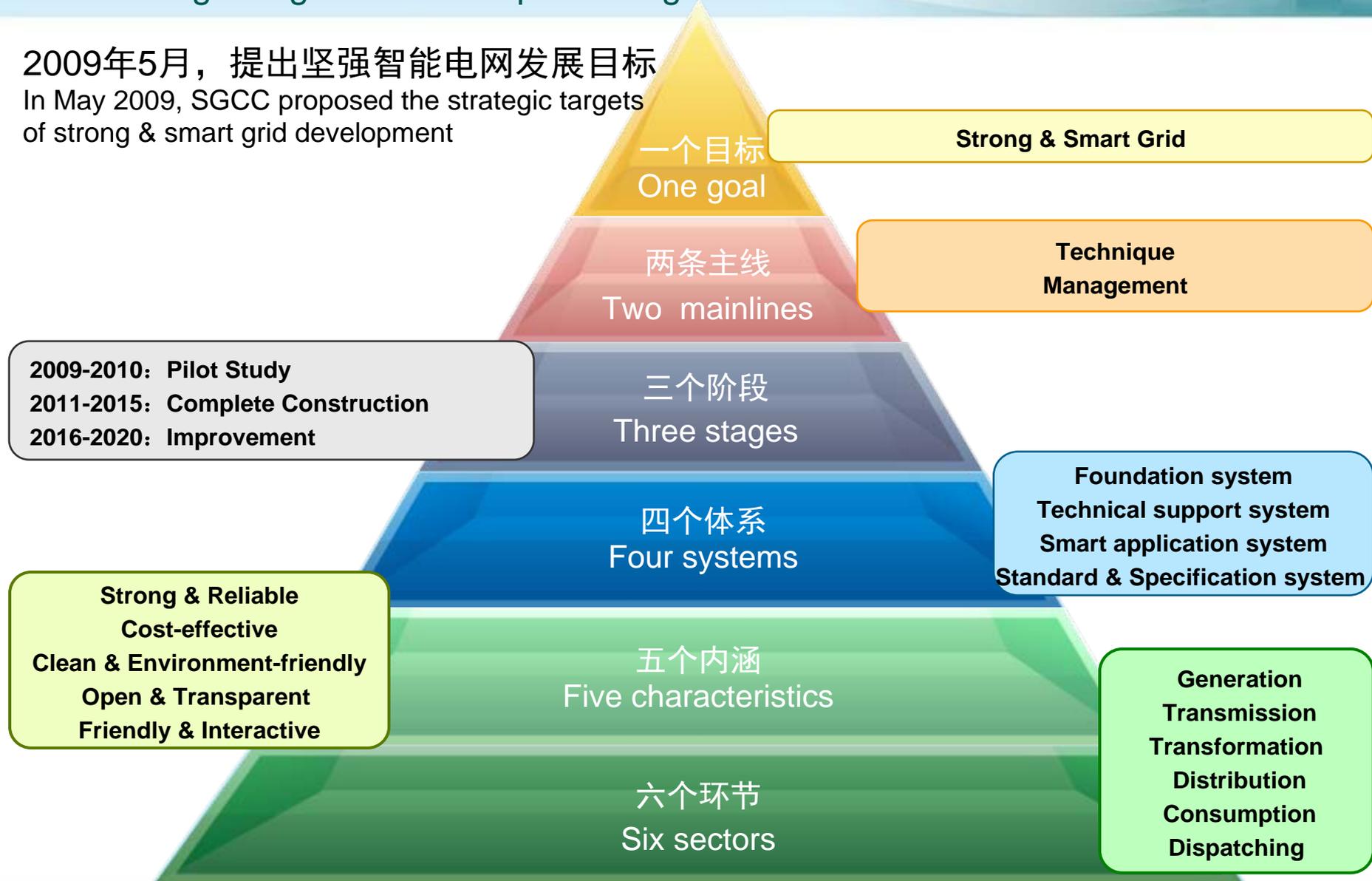


**实现**可持续发展  
Realizing sustainable development



## 2.2 提出了坚强智能电网发展目标 Strategic targets to Develop a Strong Smart Grid

2009年5月，提出坚强智能电网发展目标  
In May 2009, SGCC proposed the strategic targets  
of strong & smart grid development





## 2.3 形成了系统的智能电网理念 Systematic concept of Strong & Smart Grid

提出了坚强智能电网理念

Creatively integrated the concept of Strong and Smart



形成了系统的战略发展框架  
Systematic strategy frame

国家电网智能化规划总报告（2009-2020年）

Developed the "SGCC Umbrella Plan on Smart Grid (2009-2020)"

国家电网公司“十二五”电网智能化规划

SGCC 12<sup>th</sup> Five-Year Plan of Smart Grid

明确智能电网发展目标

Clarified the targets of Smart Grid development



## 2.4 提出了完善的技术标准体系 A Full-range Technical Standard System

### 制定发布《智能电网技术标准体系规划》

Developed "Planning of standard systems for smart technologies"

提出8个专业分支、26个技术领域、92个标准系列，推荐了22项核心标准。

Successfully proposed 8 categories, 26 technical areas, 92 standard series, and 22 recommended core standards

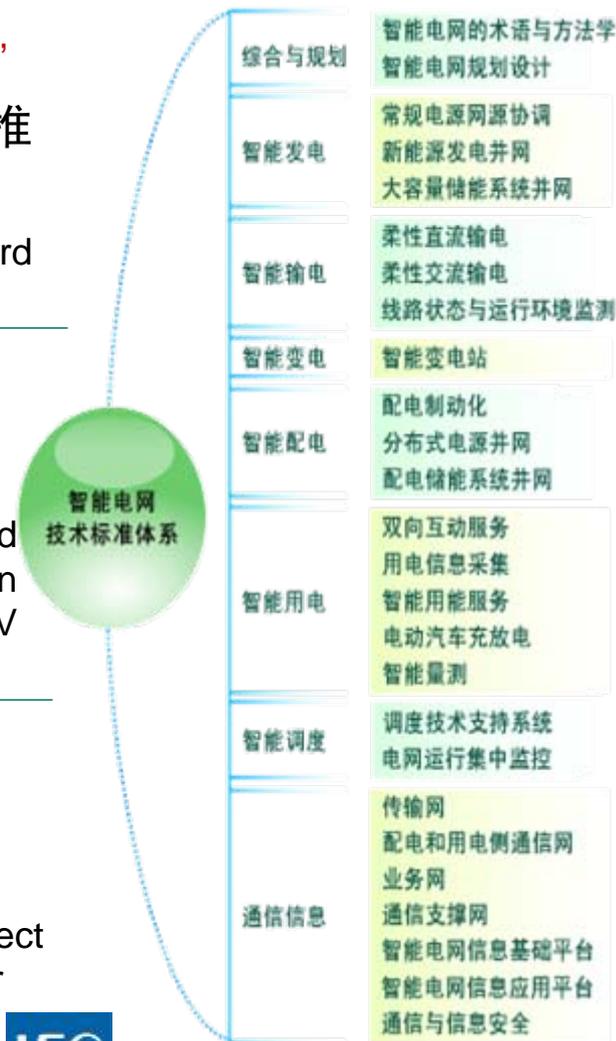
参与制修订国家和行业标准470余项。12项国际标准获得IEC、IEEE立项。在世界上率先建立特高压输电技术标准体系。

Involved in the formulation and revision of more than 470 national and industry standards; Approved of 12 international standard proposals in IEC/IEEE; The establishment of a standard system of UHV transmission technology

发起并成立IEC智能电网用户接口项目工作委员会

(PC118)、高压直流输电技术委员会 (TC115)。

Proposed and successfully established Smart Grid User Interface Project Committee (PC118) and HVDC Technology Committee (TC115) under IEC.





## 2.5 组织研制了先进的智能电网关键设备 arrangement of R&D on smart equipments

- 发布《智能电网关键设备(系统)研制规划》  
--包括7个领域、28个专题和137项关键设备

Released the “R&D Plan for Key Smart Grid Equipment/System” . Including 7 technical areas, 28 specific technical topics and 137 equipments

- 引导电力装备制造企业提升研发创新能力，推动其转型升级

Guide stakeholders, especially equipment manufacturers and system providers



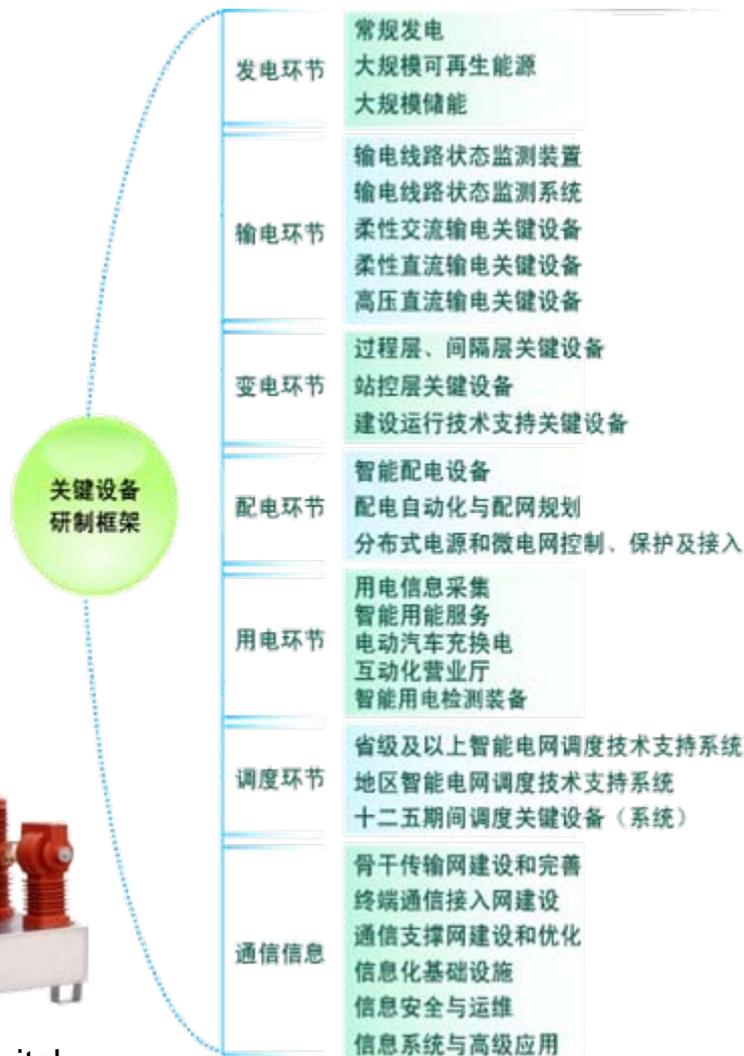
Smart GIS



Smart terminal



Smart switch





# 2.6 建成了全面的试验检测能力 Established Full-scale Testing Capabilities

## 智能电网综合试验检测能力建设 The cultivation of smart grid overall testing ability



国家能源大型风电并网技术  
研发（实验）中心  
National Energy Large Scale Wind Power  
Integration Technology R & D Center



国家能源太阳能发电技术  
研发（实验）中心  
National Energy Solar Power Technology  
R & D Center



智能输变电技术分中心  
Smart transmission technology sub-center



柔性输电技术分中心  
Flexible transmission  
technology sub-center



微电网技术分中心  
Micro-grid technology  
sub-center



定制电力技术分中心  
Custom power technology sub-center

国家能源智能电网技术  
研发（实验）中心  
National Energy Smart Grid  
Technology R & D Center



信息安全保障技术分中心  
Information security  
technology sub-center



储能技术分中心  
Energy storage  
technology sub-center



智能用电技术分中心  
Smart power consumption  
technology sub-center



能效测评技术分中心  
Energy efficiencyT  
technology sub-center



## 2.6 建成了全面的试验检测能力 Established Full-scale Testing Capabilities

### 特高压试验研究体系(四基地、两中心) world-class UHV test & research system (4 bases, 2 centers)



特高压交流试验基地  
UHV (AC) test center



特高压直流试验基地  
UHV (DC) test center



国家电网仿真中心  
SGCC Simulation center



高海拔试验基地  
High-altitude test base



特高压工程力学试验基地  
UHV engineering test center



特高压直流输电成套设计研发(实验)中心  
R&D (experiment) center of UHV DC transmission  
complete design



## 2.7.1 特高压输电技术取得重大突破

### Breakthroughs in UHV Transmission

- 研制了代表世界最高水平的特高压交流全套设备和直流关键设备  
 Developed the world's first class UHV AC equipments and DC key equipments



世界上容量最大的1000kV变压器  
 The world's largest 1000kV transformer



世界上首次研制成功的特高压直流换流阀  
 The world's first success in UHV DC converter valve



世界上第一片6英寸晶闸管阀片  
 The world's first 6-inch thyristor valves

- 1000kV特高压交流试验示范工程于2009年1月6日投产  
 1000kV UHV AC pilot demonstration project started operation in January 6, 2009
- ±800kV特高压直流输电示范工程于2010年7月8日投产  
 ±800kV UHV DC transmission demonstration project started operation in July 8, 2010





## 2.7.2 可再生能源并网能力显著增强

### Remarkable enhancement in Renewable Energy Integration

- 攻克了大规模可再生能源发电并网技术  
Breakthrough in bulk renewable energy integration
- 实现了分布式光伏发电接入  
Success in integration of distributed PV power



#### 国家风光储输联合示范工程

National Wind and Solar Power Generation/Energy Storage/  
Transmission Demonstration Project

- 一期建设风电10万千瓦，光伏发电4万千瓦，储能电池1.4万千瓦，规模最大、技术先进、运行灵活的清洁能源综合示范工程

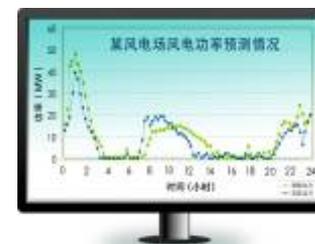
100 MW wind power, 40 MW solar power, 14 MW energy storage in Project Phase I. Most advanced comprehensive demonstration project of clean energy with flexible operation and largest scale ever



#### 大规模风功率预测及运行控制

Large-scale Wind Power Forecast and Operation Control

- 华北、东北、西北、新疆、吉林、甘肃6个试点投运  
6 pilot projects in operation in North China, Northeast China, Northwest China, Xinjiang, Jilin and Gansu





## 2.7.3 电网智能化水平大幅提升

### Outstanding achievements in Smart Grid

#### 建成110千伏至750千伏智能变电站65座

65 smart substations of 110KV~750KV have been set up.



750kV延安智能变电站  
750kV smart substation in Yan'an



500kV玉山智能变电站  
The 500kV smart substation in Yu'shan



220kV西泾智能变电站  
220kV smart substation in Xi'jing

#### 在23个城市核心区建成智能配电网

Smart distribution system has been built in key zones of 23 cities.



青岛配电调度大厅  
Distribution and Dispatching Hall in Qing'dao



青岛配电自动化管理系统  
DA management system in Qing'dao



集成型终端  
Integrated Terminal



## 2.7.4 智能用电体验日益丰富 Various smart grid service

- 在北京、上海等地建成**28个**智能小区，服务平台覆盖**25.1万**用户  
**28** smart communities constructed in Beijing and Shanghai, serving **251 thousand** households



- 建成**243座**充换电站，**13283个**充电桩，覆盖**26个**省  
**243** charging/battery-swap stations and **13,283** charging spots have been built, covering **26** provinces and municipalities

- 在青岛、杭州建成了充换电服务网络  
EV charging/battery-swap service networks have been set up in Qingdao and Hangzhou.



青岛薛家岛电动汽车换电站  
Xuejia Dao EV Battery-swap Station in Qingdao



# 2.7.4 智能用电体验日益丰富 Various smart grid service



在环渤海和长三角两个区域建设了跨城际的智能充换电服务网络。

Intercity electric vehicle charging / battery-swap service networks have been built in Bohai-sea Rim and Yangtze River Delta region.



## 2.7.5 区域智能电网示范工程相继投运 Achievements in Smart Grid Demonstration Project

**上海世博园、中新天津生态城**两个智能电网综合示范工程已经建成投运  
Shanghai Expo and Sino-Singapore Tianjin eco-city Comprehensive smart grid demonstration project already started operation.



上海世博园

2010 Shanghai EXPO



中新天津生态城  
Sino-Singapore  
Tianjin ECO-CITY



(世博会智能电网展厅接待观众161万人次)  
State Grid Pavilion received 1.61 million audience



正在北京、扬州等20个地区建设智能电网综合示范工程

Smart grid comprehensive demonstration projects are under construction in over 20 districts, such as Beijing, Yangzhou, etc.



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### 3.1 智能电网发展展望 Development Outlook of Smart Grid

力争到2015年基本建成坚强智能电网  
By 2015, the Smart & Strong Grid will take shape.



#### 发电环节 Generation

- 满足**9000万千瓦**风电和**800万千瓦**太阳能接入。
- Able to accommodate **90** GW wind power and **8** GW solar power by 2015



#### 输电环节 Transmission

- 推广输变电状态监测、柔性输电、智能巡检技术  
Promote status monitoring systems for transmission and transformation devices, VSC-HVDC Transmission System and applications of various smart patrol methods



#### 变电环节 Transformation

- 新建110(66)千伏及以上智能变电站**5100**座、改造**1000**座。  
Newly construct 5100 and refurbish 1000 smart substations(above 110(66)kV)

## 3.1 智能电网发展展望

# Development Outlook of Smart Grid



### 配电环节 Distribution

- 在重点城市的核心区域实施配电自动化系统建设。  
Implement construction of distribution automation system in core areas of major cities.



### 用电环节 Consumption

- 推广应用约**1.87亿**只智能电能表；建成**1140**座充换电站和**15.3**万个充电桩。  
Promoting application of 187 million Smart Meter, as well as a Construction plan of 1140 EV charging stations and EV 153,000 charging poles.



### 调度环节 Dispatching

- **100%**省级以上调度和**70%**地市级调度建成智能电网调度技术支持系统。  
SGOSS construction with a 100% coverage of provincial dispatching and 70% district-level dispatching centers will take form .



### 通信信息平台 Information platform

- 110kV以上核心通信网**100%**光纤；全面建成SG-ERP。  
100% optical fiber for 110kV (and above) core communication networks and a fully construction of SG-ERP.

建设坚强智能电网，可有效提高清洁能源发电的接纳能力，提高电网安全稳定运行水平，提高能源开发和利用效率，是世界电力工业发展的趋势。

国家电网公司将坚持开放、创新、合作、共赢的原则，全面加强在智能电网领域的技术交流与合作，共同应对世界能源和电网发展挑战，为推动21世纪能源变革和发展作出积极的贡献。

Our work has proved that Strong & Smart Grid, the driving force for the 21<sup>st</sup> century, is viable, feasible, and affordable. It will facilitate renewable energy development, improve power grid stability, lower the economic and environmental costs of energy use, as well as empower customers to an unprecedented level.

As usual, with an open attitude, innovative spirit, cooperative will and pursuit of mutual benefits, we are looking forward to working with you in the exploration of smart grid, so that we could make the most of this energy revolution for our planet and human beings.





谢谢  
Thank you