Global Energy Interconnection

State Grid Corporation of China

Japan Representative Office

March 2016
State Corporation of China (SGCC)

Geographic Coverage
26 out of 32 provinces in China; 88% of China’s territory

Customers
Serving over 1.1 billion population, 83% of China’s population

Employee
1.95 million

Core business:
Power grid construction and operation, electricity retail, R&D, Finance, equipment manufacturing

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

Ranked 7th Fortune Global 500
1. Challenges
2. Solutions
3. Practices
4. Prospects
Challenges

Energy Security

Environmental Pollution

Climate Change
Challenge 1 - Energy Security

Global proved reserve of fossil energies

Natural Gas
187 trillion m³
54 years

Petroleum
239.8 billion tons
53 years

Coal
891.5 billion tons
110 years

World Energy Demand
(billion tons of standard coal)

World energy demand will nearly double by 2050!

Data: BP (British Petroleum), Statistical Review of World Energy 2015
Challenge 2 - Environmental Pollution

2013 China haze days distribution

Smog, haze and acid rain occur frequently.

Data: Chinese Ministry of Environmental Protection, 2013 China Environmental Bulletin
Challenge 3 - Climate Change

Emissions of CO$_2$ for 1 ton of standard coal:
- Coal ~ $2.77$ t
- Petroleum ~ $2.15$ t
- Natural Gas ~ $1.65$ t

1 Fossil Fuel = 2 CO$_2$

CO$_2$ Concentration vs Global Temperature

- Temperature (°C)
- CO$_2$ (ppm)

North America
The entire Atlantic seaboard would literally swell with water, along with Florida and the Gulf Coast of California. San Francisco's bay would become a matter of lakes and the Central Valley a great bay. The Gulf of California would extend north past the latitude of San Diego—not that there'd be a San Diego.
The challenges of fossil energy are rooted in its resource limitation and its high pollution and emission. The present world energy supply system that over-reliant on fossil energy is unsustainable. We must change and find a new way into the future.
What is GEI?

Solutions
During Summit of Global Sustainable Electricity Partnership (G-SEP) in May, 2014 (Moscow, Russia), the concept was first put forward.

- The chairman of SGCC, Mr. Liu Zhenya proposed a strategic concept of building a global energy Interconnection.

In his bylined article published in Forbes of the US, Mr. Liu Zhenya appeals all countries to work together to build a global energy Interconnection.
The Global Energy Interconnection (GEI) is a globally interconnected strong and smart grid backboned by UHV grids. It is the basic platform for large-scale development, allocation and utilization of global clean energy.

GEI = UHV Grid + Smart Grid + Clean Energy
Solutions

Through GEI, clean energy can be developed in large scale. While five in ten thousands of which can meet the demand of the whole human society in future.
With GEI, we can realize two replacements.

- **Clean Energy Replacement**: Replacing fossil energy with clean energy like solar and wind at supply side.
- **Electricity Replacement**: Replacing direct consumption of fossil fuels with electricity at consumption Side.
Through GEI, clean energies, after transformed into electric power, can be allocated globally, and replace fossil energy in large scale, which overcome the challenges of energy security, environmental pollution, climate change.
Is GEI Possible?

3 Practices

- UHV
- Smart Grid
- Clean Energy
- Inter-connection
Practices - UHV

China:

UHV transmitted Power
520 TWh

China UHV Projects under Operation:
3AC+6DC

Construction:
4AC+6DC

Planning:
5AC+8DC

Other Countries:

UHVDC Projects under construction
2 in Brazil
2 in India
Practices - Smart Grid

Distribution of Smart Grid Demonstration Projects of SGCC

- **Projects**: 342
- **Substations**: 2286
- **Smart Meters**: 310 Million
- **EV Charging Stations**: 1537
- **Charging Poles**: 29600
Practices – Clean Energy

World Installed wind power capacity and growth rates, 2000-2014

- By 2014,
  - Wind power 370GW
  - Solar power 190GW

World Installed solar power capacity and growth rates, 2000-2014

Comparisons of costs development trends of onshore wind power, Solar power and fossil fuel

Unit: cents per KWh

- Onshore Wind
- Solar
- Fossil
Practices – Regional Energy Interconnection In China

- East China Grid
- North China, Middle China Grid
- East-North China Grid
- West-North China Grid
- Tibet
- China Southern Grid

Trading Power (TWh) between Province:
- 2005: 214 TWh
- 2014: 725 TWh

Annual Growth Rate: 14.6%
Grid interconnection with neighbor countries has been considered to be expanded.

Import and Export of Electricity of China

2.05 TWh in 2008
2.45 TWh in 2014
19.5% Total increase rate
Practices – Regional energy interconnection in other area
Successful application of UHV Technologies, Smart Grid and Clean Energy Integration provide solid foundation to construct a global energy interconnection. The formed and under forming regional grid will be an important part of GEI.
**Prospects**

By 2020, to reach global consensus, enhance domestic interconnection and develop domestic clean energies.

By 2030, to interconnect trans-national grids within every continent, and develop large scale clean energy bases within continent.

By 2050, to start developing energy bases of Arctic wind power and Equator solar energy and promote intercontinental interconnection with UHV backbone grids.
Prospects—GEI road map

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Continental interconnection – Asia

By 2050,

Distributed

4,500 TWh

Centralized

29,000 TWh

Arctic and Equatorial regions

4,700 TWh

Asian interconnected power grid
Global interconnection

<table>
<thead>
<tr>
<th></th>
<th>Asia</th>
<th>Europe</th>
<th>North America</th>
<th>South America</th>
<th>Africa</th>
<th>Oceania</th>
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<tbody>
<tr>
<td>Distributed type</td>
<td>4,470</td>
<td>860</td>
<td>1,570</td>
<td>810</td>
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<td>Centralized type</td>
<td>28,850</td>
<td>6,330</td>
<td>7,670</td>
<td>3,320</td>
<td>3,510</td>
<td>465</td>
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<tr>
<td>Arctic and equatorial regions</td>
<td>4,700</td>
<td>2310</td>
<td>1,000</td>
<td>1,000</td>
<td>4,500</td>
<td>1,000</td>
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Prospects– GEI Benefits

“Five Enjoy”
- Sufficient Energy
- Clean Energy
- Affordable Energy
- Efficient Energy
- Smart Energy

“Five Promote”
- Economic Development
- Green Culture
- Smart Manufacturing
- Civilization Sharing
- World Peace
Prospects—Emission Reduction

Remarkable benefits for Climate Change

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<th>By 2050, clean energy will account for 80% of total mix</th>
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<td>Annually fossil energy replaced</td>
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<tr>
<td>Equivalent of 24 billion tons of standard coal</td>
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<td>Reducing emission</td>
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<tr>
<td>67 billion tons of CO₂ annually</td>
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<td>Global carbon emission</td>
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<td>Less than 11.5 billion tons, half of that in 1990</td>
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The target of controlling temperature rise within 2°C can be reached.
GEI Will Change The World!
Thanks!