Adhere to Openness and Win-win Cooperation and Move into an Era of Global Energy Interconnection

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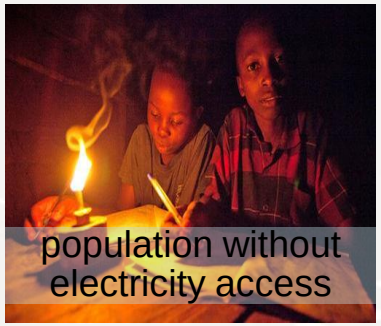
Energy concerns the entire sustainable development of mankind

- At present, the world is facing a series of major challenges, such as resource constraints, environmental pollution, climate change, population without electricity access, health and poverty. The root cause is the massive consumption of and excessive dependence on fossil energy



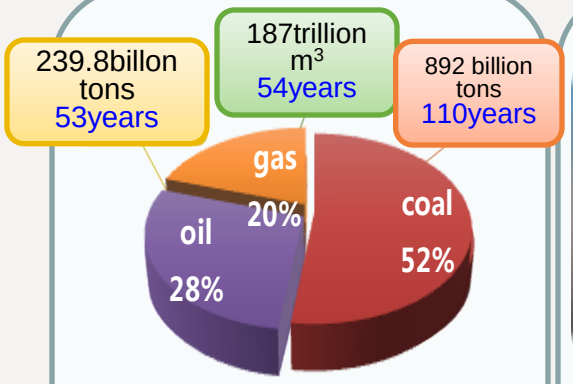
Climate change is getting worse

- Global temperature rises by **0.2°C** every decade
- By the middle of this century, the temperature rise will exceed **1.5 °C**
- At the end of this century, it will exceed **3 °C**

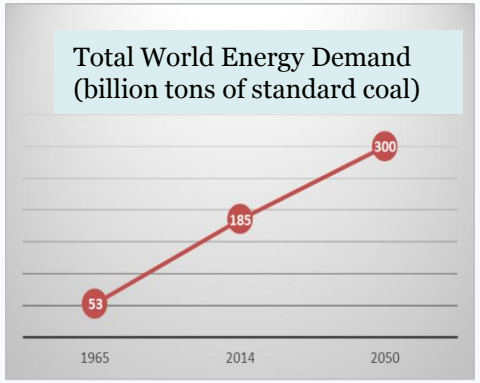
An irreversible impact on the world's ecosystem and economic and social development, bringing catastrophic disaster to mankind

■ World sustainable development faces severe challenges

Resource Scarity



Global Proven Reserve of Fossil Energy



Fast Growth in World Energy Demand

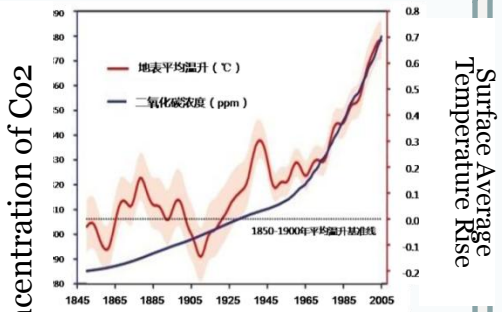
Environmental Pollution

Air Pollution

Ecological Damage

Climate Change

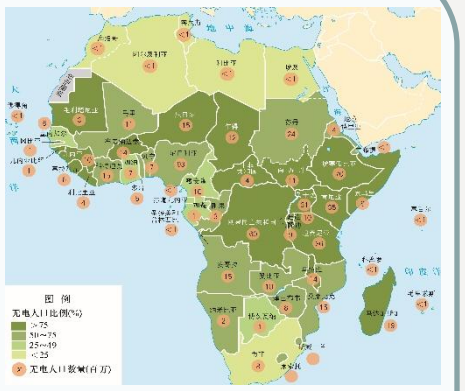
1t of fossil energy→2t CO_2



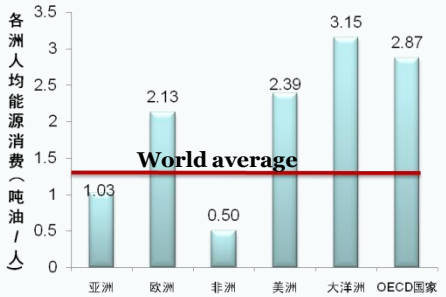
Atmospheric Concentrations of CO_2 and average global temperature rise

Simulation of the effect of sea level rise on the North American continent by NASA

Unbalanced Development



Population with no Power Access in Africa



Per capita Energy Consumption in Each Continent

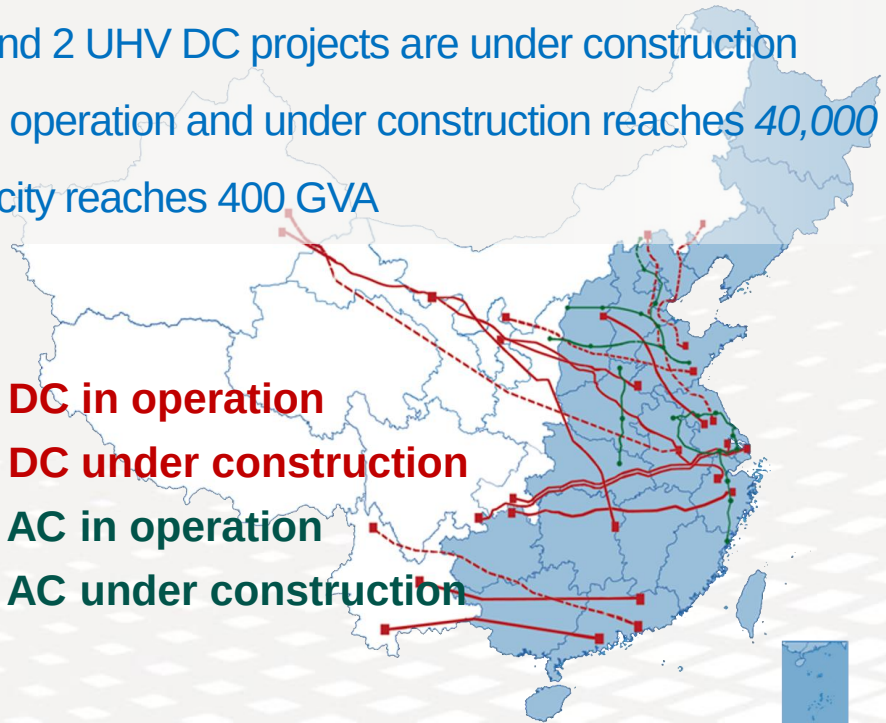
Haze lock the Beijing

雾霾锁北京

China's Action

■ China has built **21** ultra-high voltage projects including “8 UHV AC projects and 13 UHV DC projects”, with installed capacity of hydropower, wind and solar power reaching **340 GW**, **170 GW** and **160 GW** respectively, ranking first in the world

- Built 21 UHV projects including 8 UHV AC projects and 13 UHV DC projects
- 4 UHV AC projects and 2 UHV DC projects are under construction
- Transmission lines in operation and under construction reaches *40,000* km
- Transformation capacity reaches 400 GVA



Hydropower: 340 GW

Wind power: 170 GW

Solar power: 160 GW

1. What is GEI?

- The essence of GEI is "**Smart grid** + **UHV grid** + **Clean energy**". It is a modern energy system featuring clean production, wide distribution and electrification in consumption
- Building GEI, and promoting the **clean replacement** and **electricity replacement** will fundamentally reduce the dependence on fossil fuels and realize green and low-carbon development

Smart Grid

Foundation

UHV Grid

Key

Clean Energy

Priority

What is GEI

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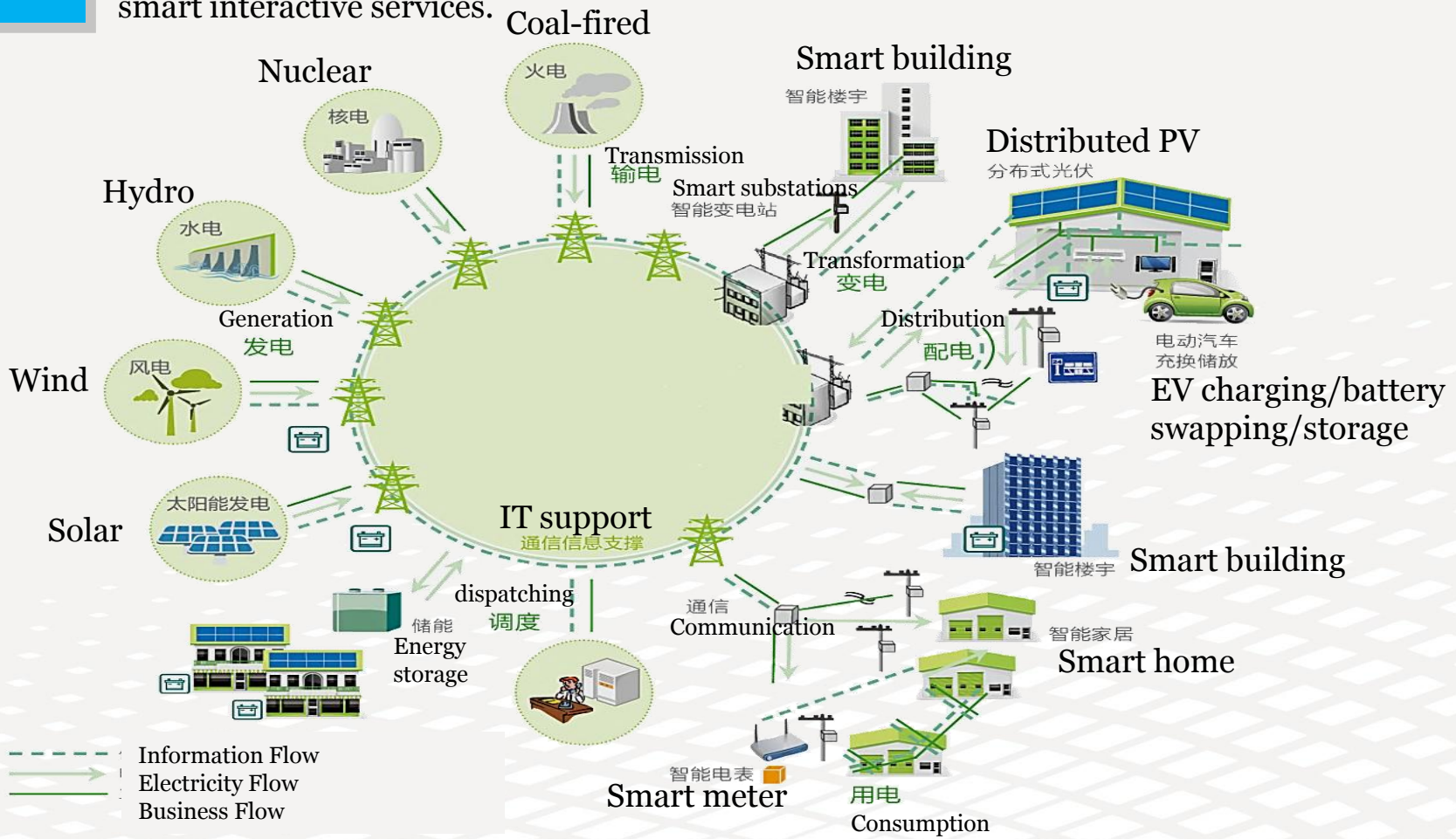
全球能源互联网发展合作组织

Smart Grid is the Foundation

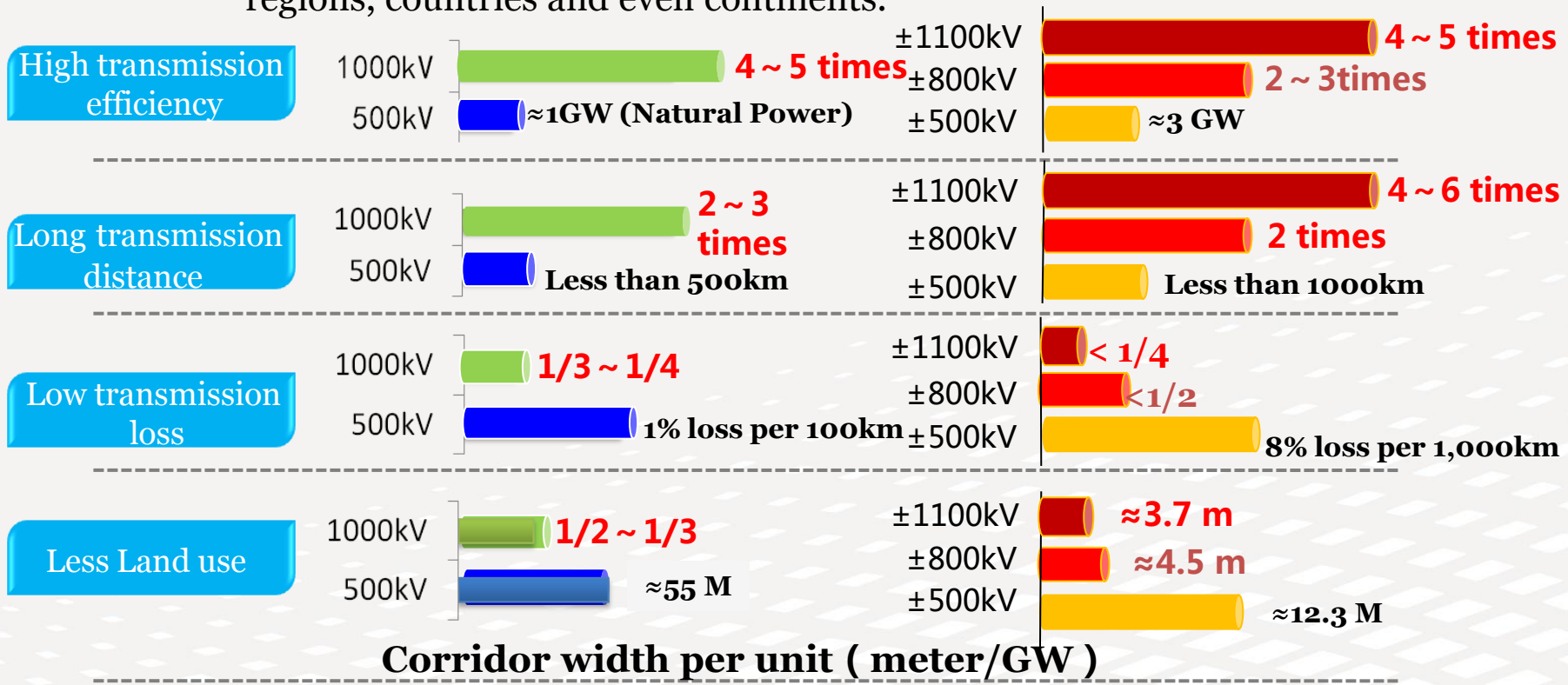
Smart grid integrates modern smart technologies with respect to advanced transmission, smart control, new energy integration and new energy storage. Because of the flexibility and adaptability, it meets the demands to integrate clean energy and distributed generation, make smart devices ready to plug in and play, while provide smart interactive services.



What is GEI

UHV Grid is the key

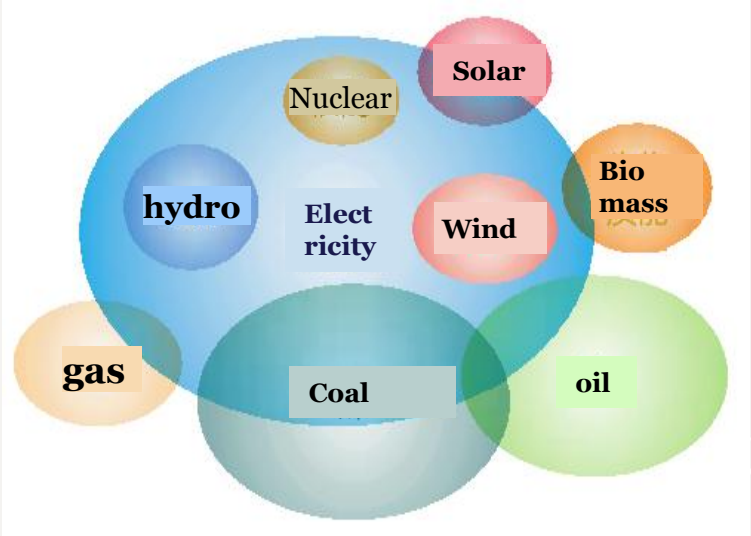
UHV grid is mainly composed of 1000kV (and above) AC and ± 800kV (and above) DC transmission lines, featuring long transmission distance, large capacity, high efficiency, low line loss, less land occupation and high security. As the backbone network, it transmits electricity in 10-GW capacity over thousands of kilometers and interconnects grids across regions, countries and even continents.



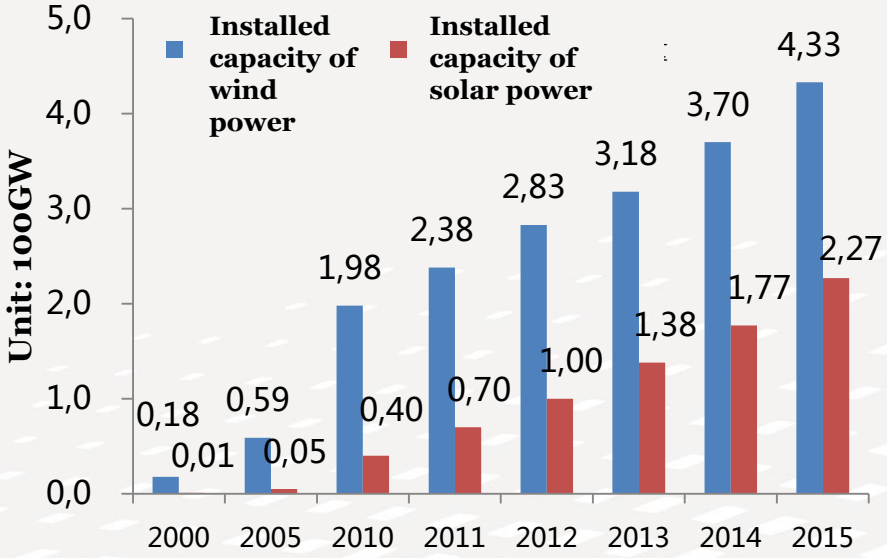
What is GEI

Clean energy is the priority

GEI will be a major transmission strategy in the future for wind power in the Arctic, solar power in the equatorial region, and centralized and distributed clean power generated from across different countries, continents and countries. That is the fundamental to achieve independence on fossil fuel and realize a clean, low-carbon, and sustainable development.



Electric—centric Energy Pattern



Growth in Installed Capacity of Wind, PV Generation in 21st Century

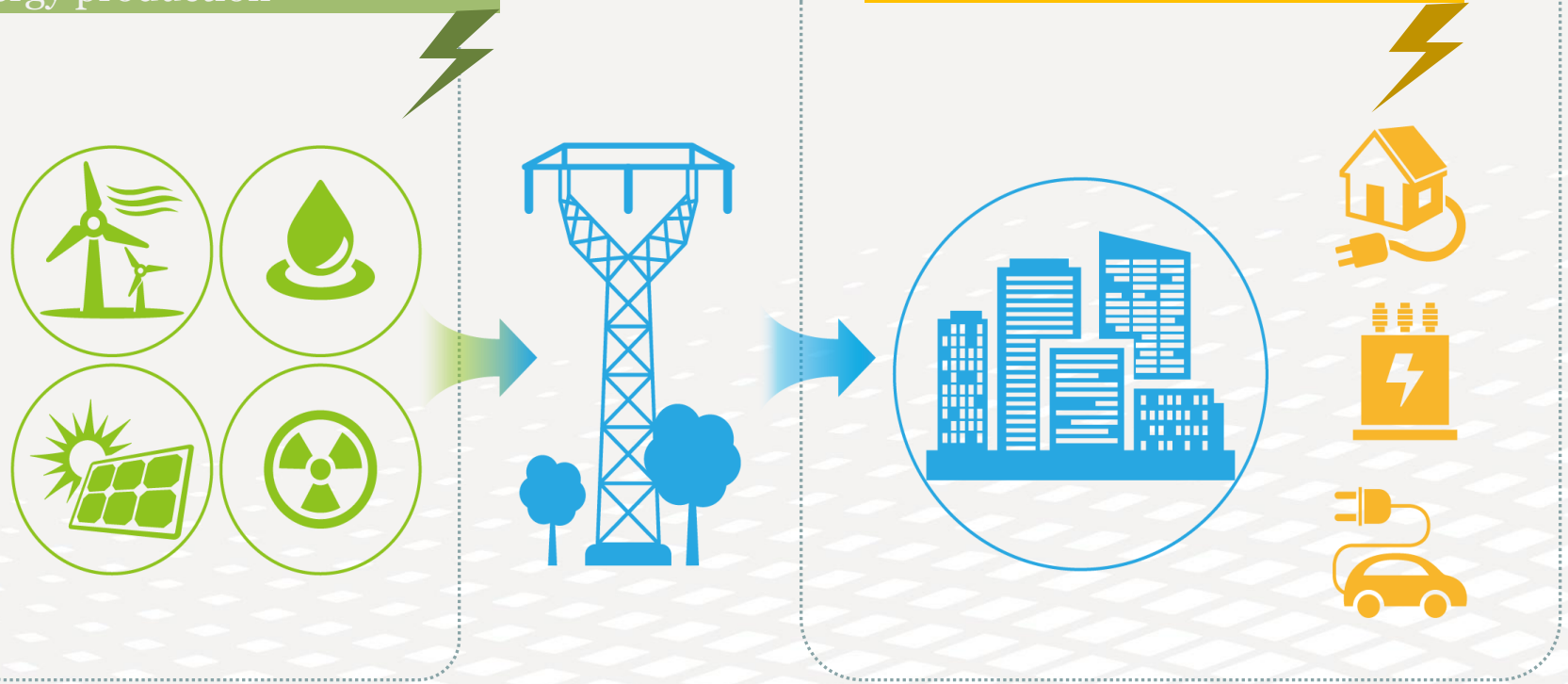
■ Two Replacements

Clean Replacement

Replacing fossil fuels by clean alternatives such as solar, wind and hydro energies in energy production

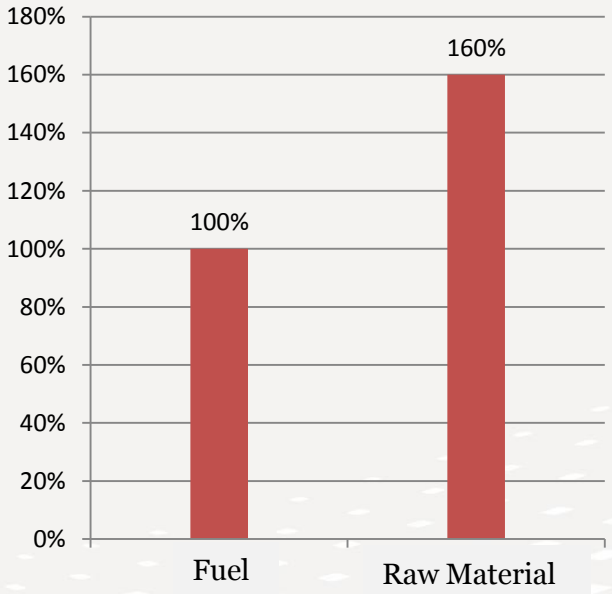
Electricity Replacement

Replacing coal, oil and gas by clean electricity from afar in energy consumption



■ One Restore

Restore fossil fuel's basic attribute as an industrial raw material to create even greater value in socio-economic development

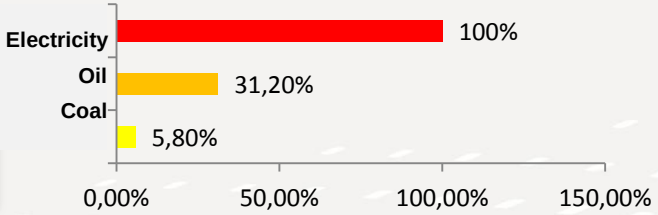


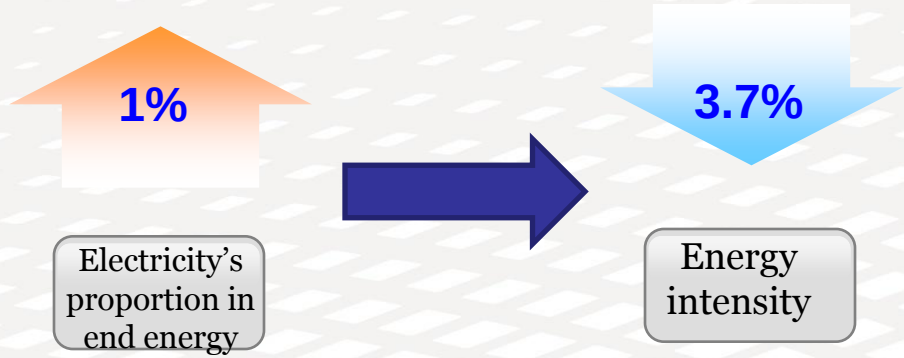
Economic value of equivalent petroleum

■ One Increase

Increase electrification, which enlarges the proportion of electric power in energy consumption and reduces the total amount on the grounds of meeting energy demand.

Economic value of equivalent energy





The core of sustainable development is clean development

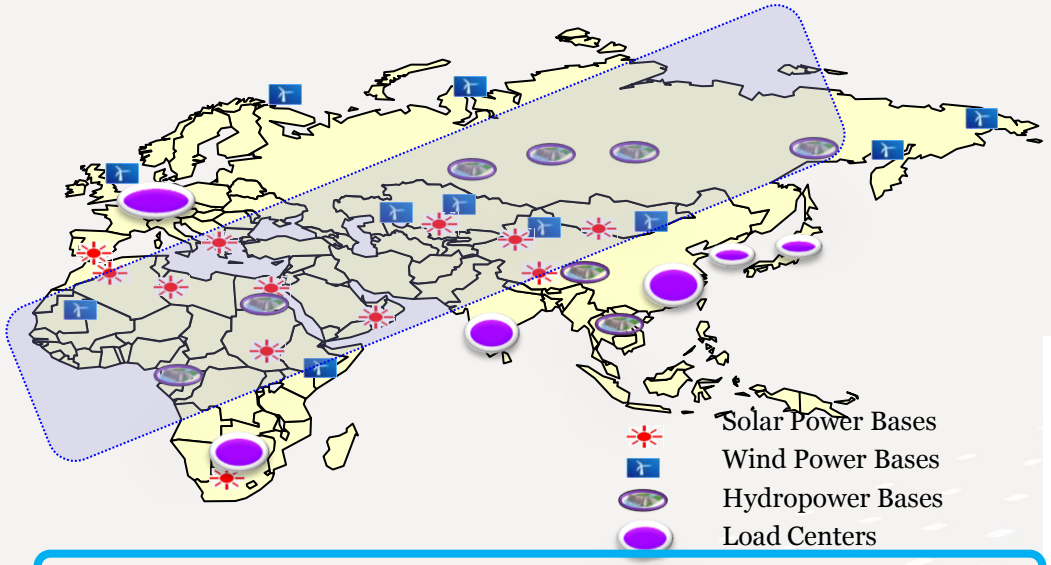
- Clean development is the core of sustainable development, and the key is to build GEI to achieve clean replacement and electricity replacement
- Global clean energy resources are abundant, but unevenly distributed, so the resources need to be converted into electricity, transmitted over long distances and allocated in a large area

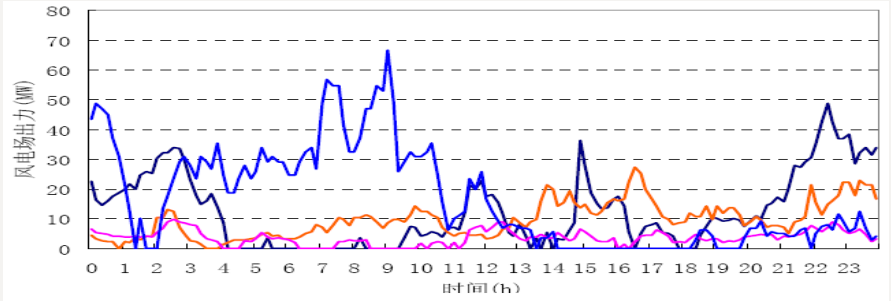
2. Why constructing GEI

■ GEI is the key to implementing "Two Replacements".

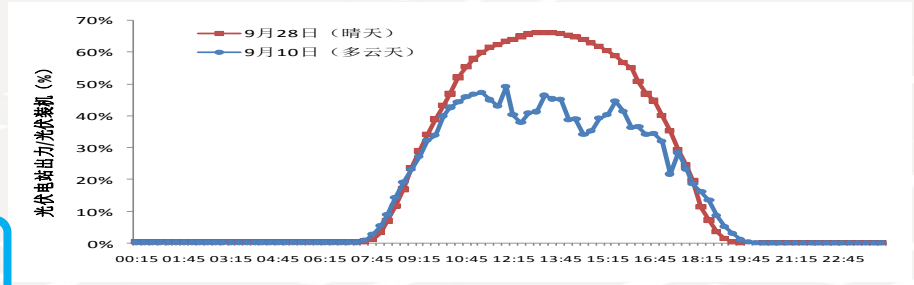
Distribution: Clean energy resources are not evenly distributed while the loads are mainly located in East Asia, South Asia, Europe and southern Africa.

Generation: Wind and PV power generation is random, intermittent and volatile. Only by integrating them into a bulk power grid can they enjoy better development.





Typical Wind Power Output Curve



Typical PV Power Output Curve

In Africa-Eurasia, **85%** of hydro, wind, and solar energy resources are concentrated in the energy belt starting from North Africa through Central Asia to Russia and Far East, which is at **45** ° angle to the equator.

Only by building GEI to optimize allocation of electricity in a large scale can we efficiently develop and use clean alternatives and ensure power supply in a safe, sufficient and convenient manner.

3. How to achieve GEI

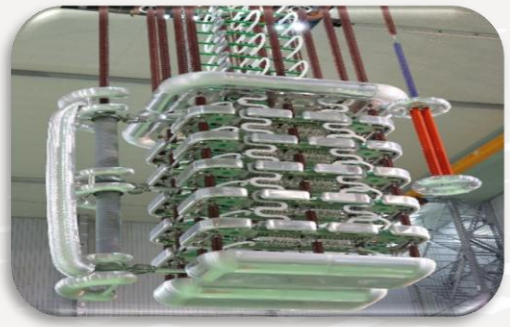
■ Technologically

Critical technologies of UHV and smart grid are becoming mature. Hence the world's major clean energy bases and load centers are within UHV transmission range.

UHV Lines

UHV AC Switch

UHV Converter Transformer



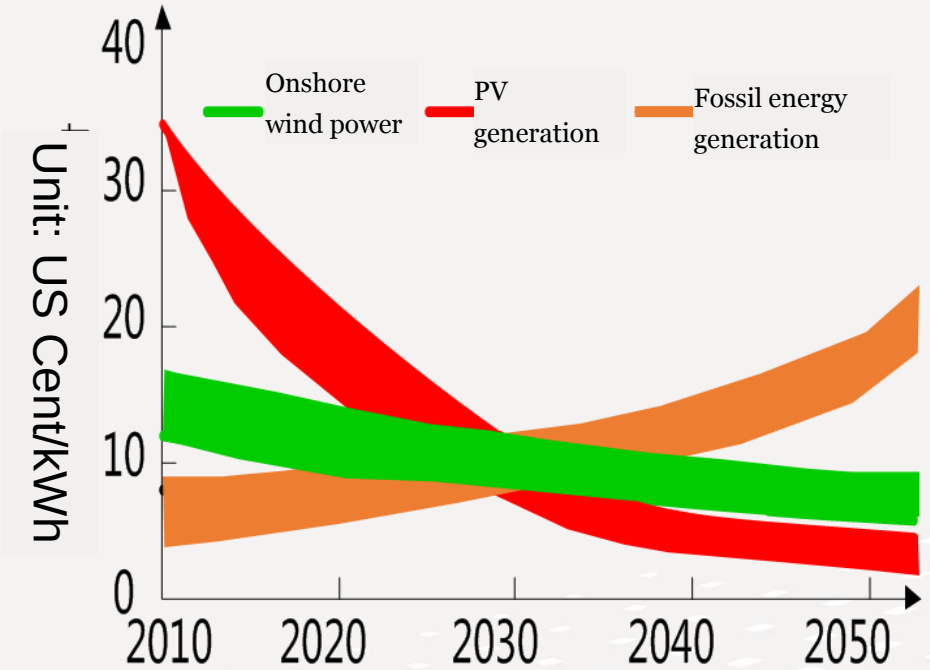
UHV DC Converter Valve

Smart Grid

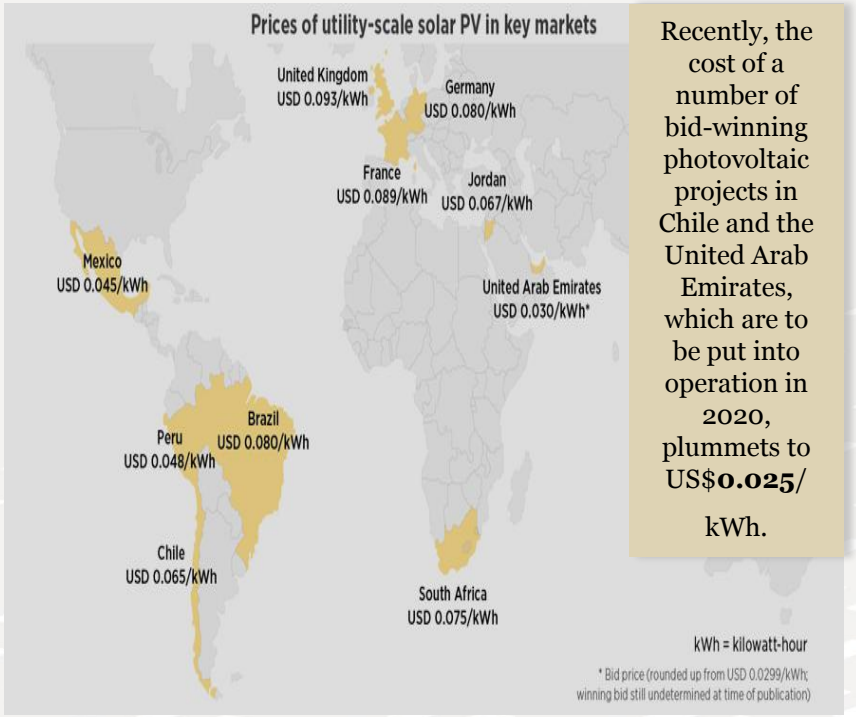
3. How to achieve GEI

Economically

- Renewable energy is becoming increasingly cost-efficient.
- It is expected by 2025, wind and PV power generation will be more cost-effective than fossil energy with the progress in technology.



Generation cost for new energy and fossil energy



Recently, the cost of a number of bid-winning photovoltaic projects in Chile and the United Arab Emirates, which are to be put into operation in 2020, plummets to US$**0.025**/kWh.

Bid-winning prices of PV generation stations (part) in 2015, 2016

Studies about GEI

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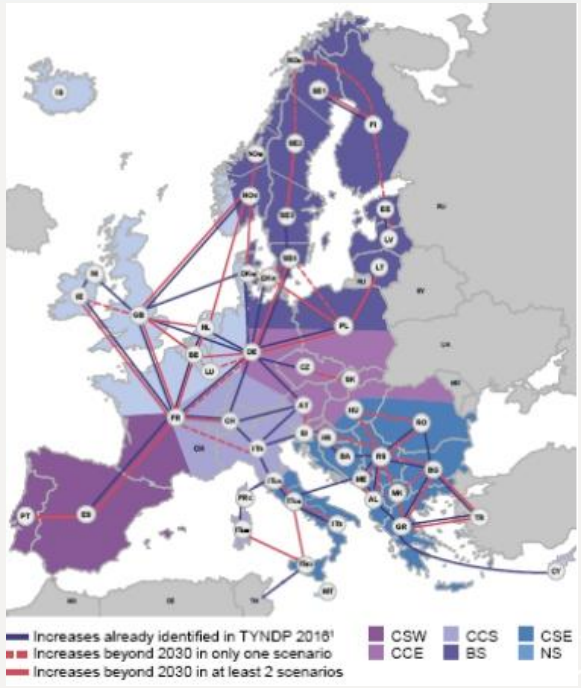
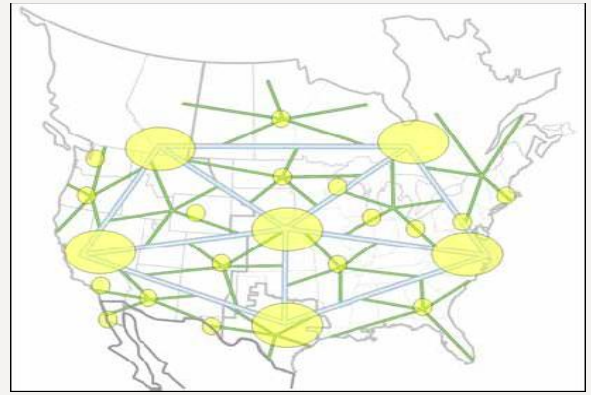
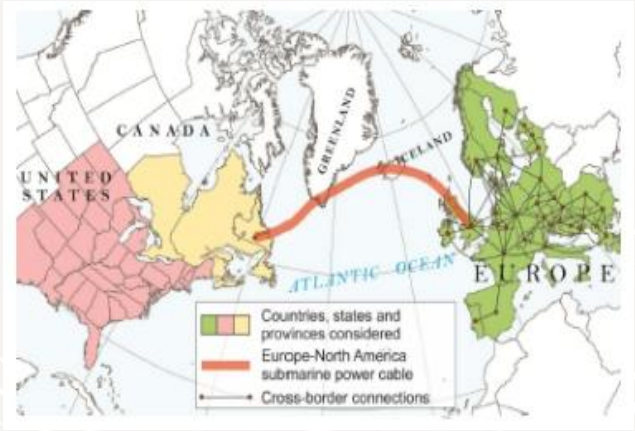


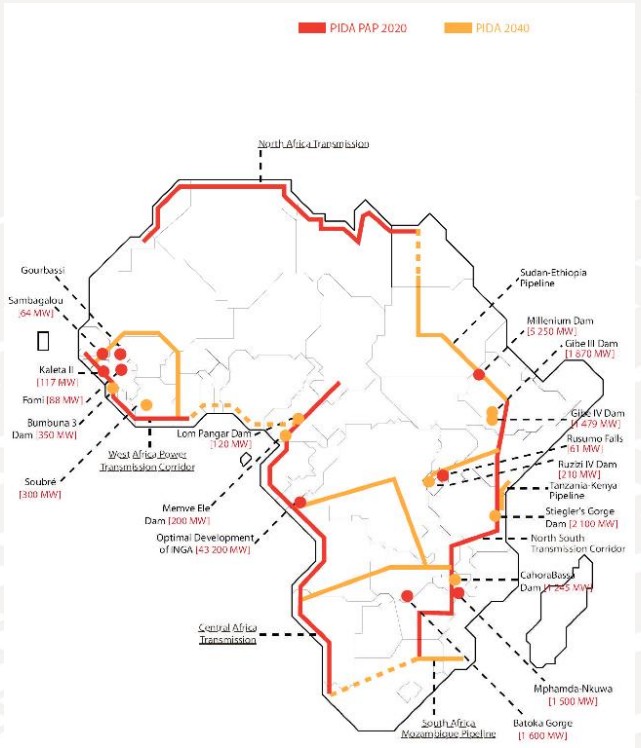
Proposed capacity increase in the European interconnected system by 2040 [4]





Submarine HVDC interconnection between Europe and the North American.

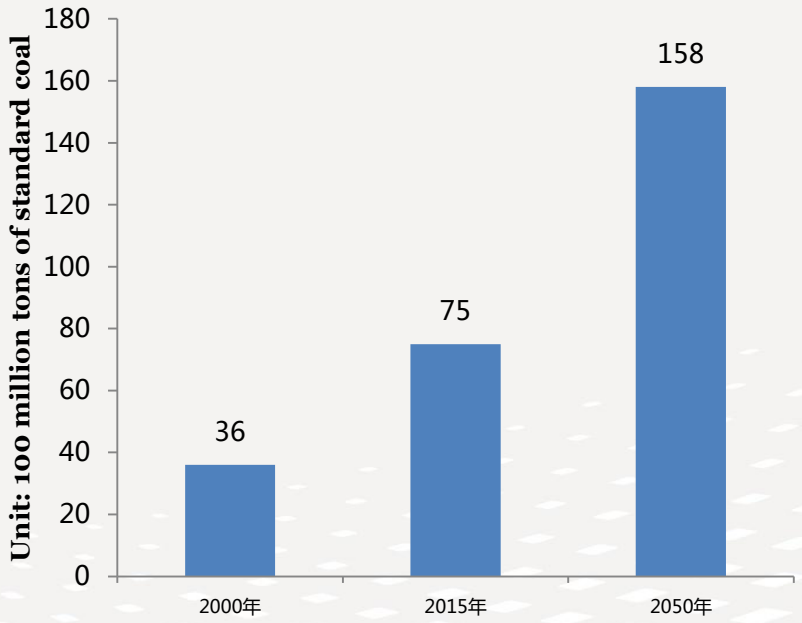
Schematic representation of the proposed Asian Super Grid.



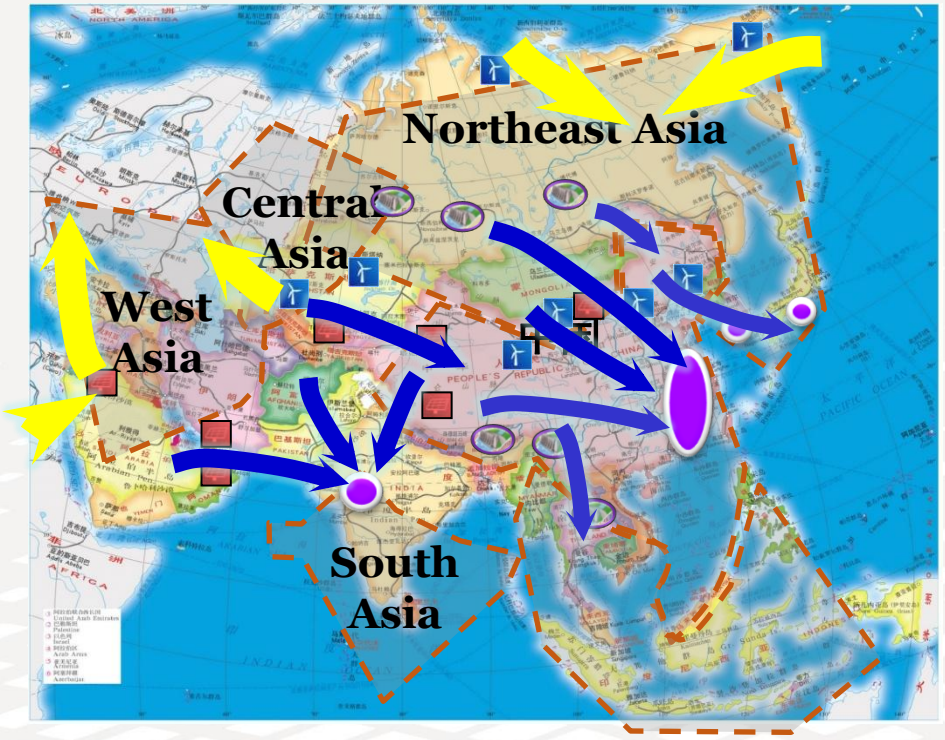
4. How to Build GEI

Asian Energy Interconnection

- Asia is the fastest growing region with the most energy consumption and demand. The per capita electricity consumption is merely 2/3 of the world's average, and 1/4 of that of OECD countries. More than 500 million people still have no access to electricity.
- **General layout:** establish a "1+5" interconnection arrangement linking the grid systems of China, Northeast Asia, Southeast Asia, Central Asia, South Asia and West Asia.



2000-2050 Energy Demand Growth in Asia



Future Energy and Electricity Flow in Asia

3. How to achieve GEI

■ Politically

- Mutual trust among countries is increasing. The UN finalized *the 2030 Agenda for Sustainable Development* and promoted the signing of the *Paris Agreement*, which came into effect on November 4, 2016.
- GEI was included in the *Policy Recommendation Report of the B20* in Hangzhou.

Signing of the *Paris Agreement*

2016 B20 Summit in Hangzhou

International Cooperation of GEI

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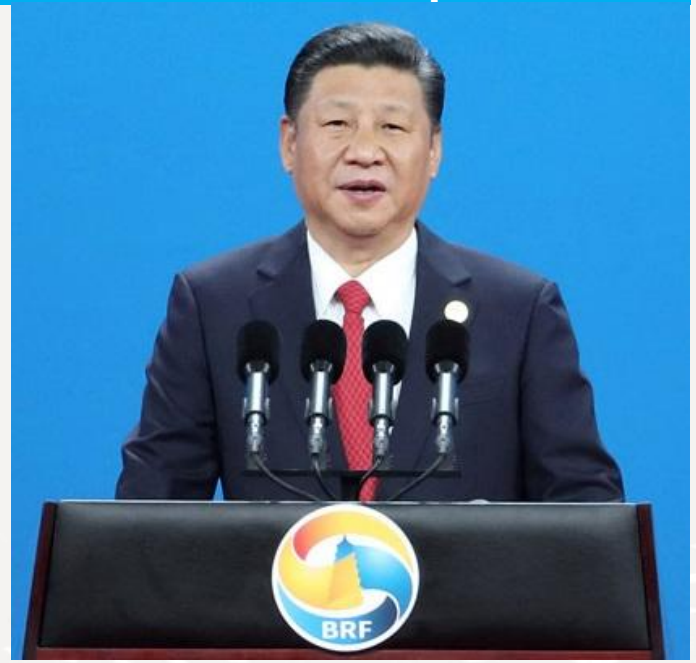
GEI has been incorporated into the "**Belt and Road" development, UN *2030 Agenda for Sustainable Development*** and the working framework for **promoting the *Paris Agreement***.

The Belt and Road Forum for International Cooperation



UN high-level symposium

Released *GEI Action Plan to Promote the 2030 Agenda for Sustainable Development*

COP24 Poland climate conference

Released *GEI Action Plan to Promote the Implementation of Paris Agreement*

(1) From China's initiative to world consensus, new ideas are widely disseminated

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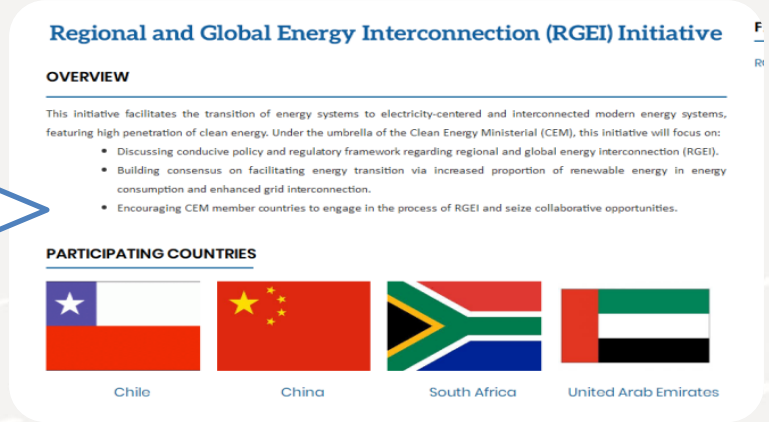
- At present, GEI has been incorporated into the framework of the UN 2030 Agenda for Sustainable Development and the Belt and Road development framework.

António Guterres: **Global interconnectivity allows for inclusivity for energy to reach everybody in need. GEI is in the center of the two central concepts (sustainability and inclusivity) of our commitment to Agenda 2030, and the key to combating climate change.**

The Ninth Clean Energy Ministerial



China-Arab States Cooperation Forum
The 8th Ministerial Meeting of China-Arab States Cooperation Forum
Beijing Declaration and Action Plan

（3）From vision to joint action, efforts were made in all aspects

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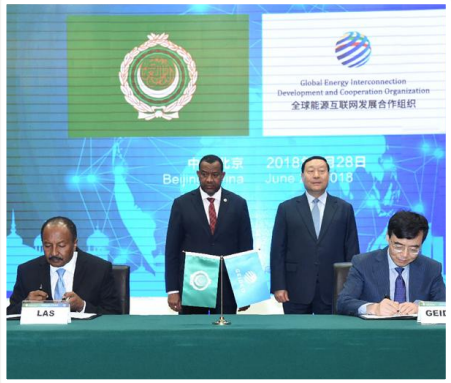
■ Signed **28** cooperation agreements and joint declarations

UN Agencies

- UN Department of Economic and Social Affairs
- UN Economic & Social Commission for Asia & the Pacific
- UN Economic Commission for Latin America and the Caribbean
- United Nations Economic Commission for Africa
- ……

International Organizations



- League of Arab States
- African Union
- G20 Global Infrastructure Connectivity Alliance
- Commission for Regional Energy Integration
- Latin American Energy Organization
- ……

Government Department

- Guinean Government
- Ministry of Energy and Mines of Chile
- Ministry of Mines and Energy of Brazil
- Ministry of Water, Irrigation and Electricity of Ethiopia
- Ministry of Electricity and Renewable Energy of Egypt
- ……

Corporate Institutions

- Portuguese National Energy Network (REN)
- Korea Electric Power Corporation
- Bloomberg Philanthropies
- Royal Academy of Engineering
- International Hydropower Association
- Institute of Electrical and Electronics Engineers
- Association of Power Utilities of Africa
- ……

How to build GEI?

- The conditions for building GEI are ready, and the overall interconnection can be divided into three stages: domestic interconnection, intra-continental interconnection and global interconnection

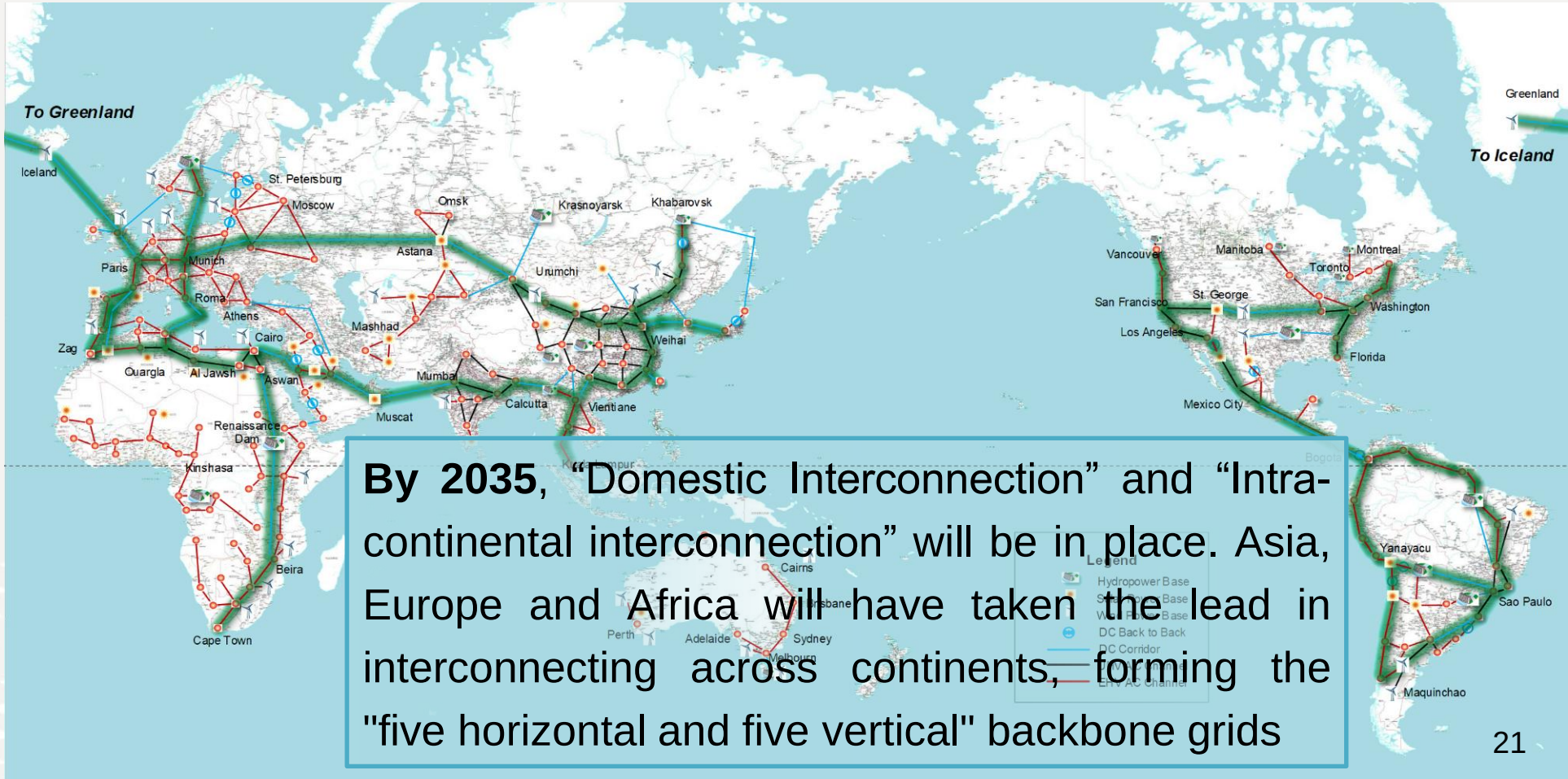
Domestic Interconnection

↓

Intra-continental Interconnection

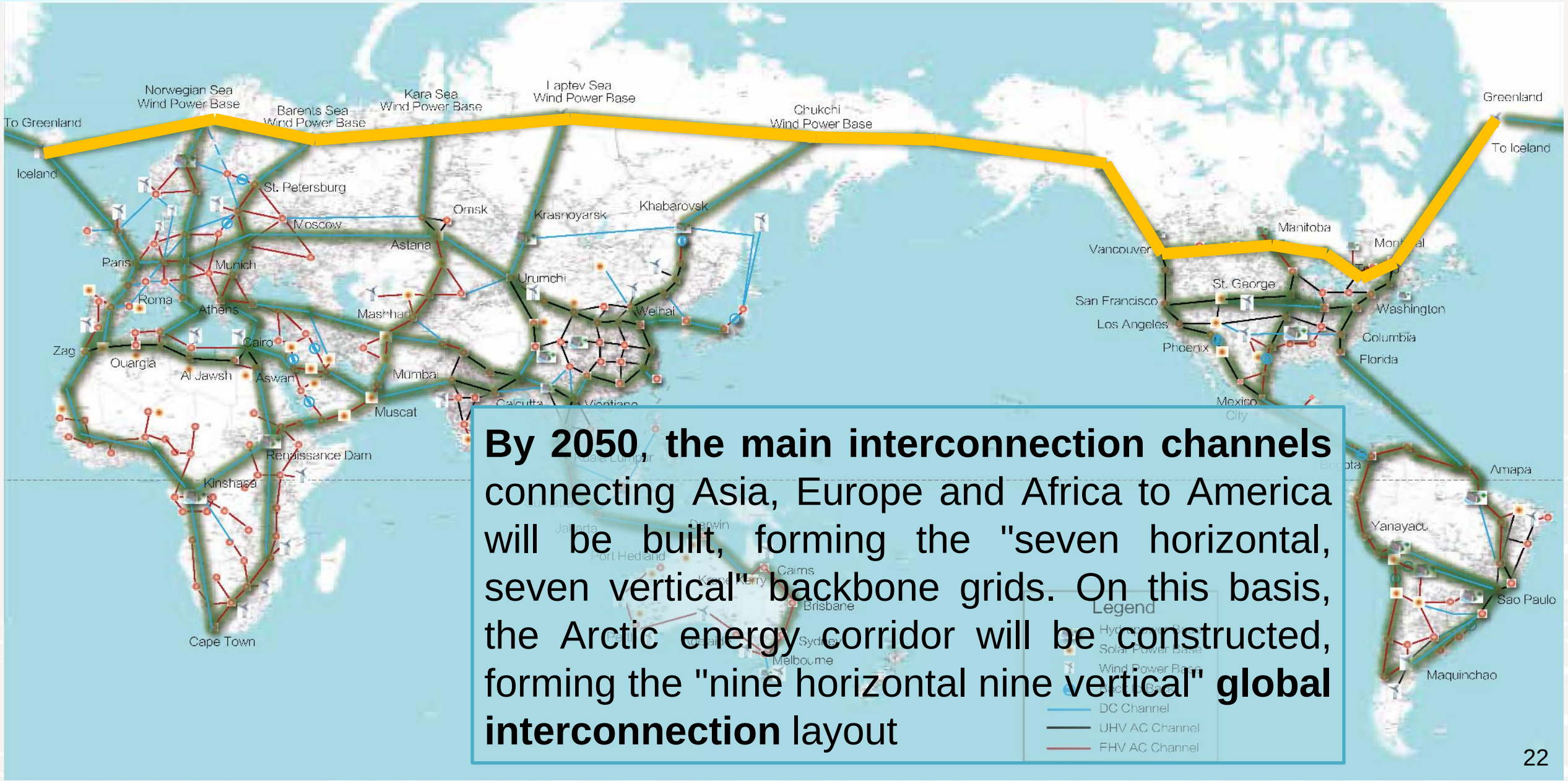
↓

Global Interconnection



By 2035, "Domestic Interconnection" and "Intra-continental interconnection" will be in place. Asia, Europe and Africa will have taken the lead in interconnecting across continents, forming the "five horizontal and five vertical" backbone grids

How to build GEI?

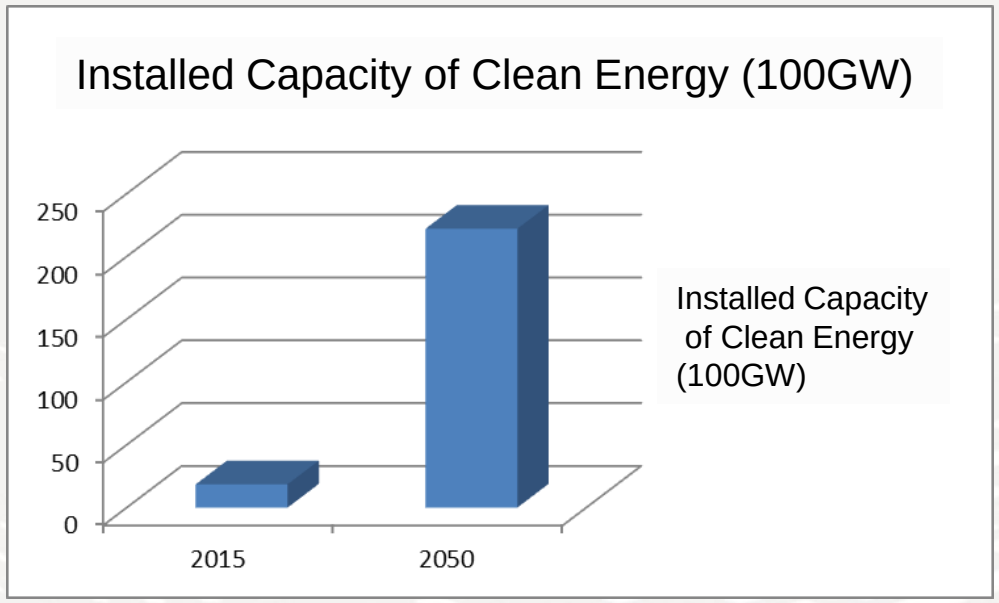


By 2050, the main interconnection channels connecting Asia, Europe and Africa to America will be built, forming the "seven horizontal, seven vertical" backbone grids. On this basis, the Arctic energy corridor will be constructed, forming the "nine horizontal nine vertical" **global interconnection** layout

4. Comprehensive Benefits of GEI

Creating a new energy and electricity pattern

- By 2050, the installed capacity of global clean energy generation will reach 20.6 TW, accounting for more than 80% of the total installed capacity. The cross-regional power flow will reach 720 GW
- Forming a new pattern of energy development that is clean, highly electrified and globalized



4. Comprehensive Benefits of GEI

Opening up a New Path of Sustainable Development

- Realizing safe, cost-effective, clean and sustainable energy supply, benefiting the entire world with reliable power access, and embarking on a road of sustainable development for mankind

Air Pollution

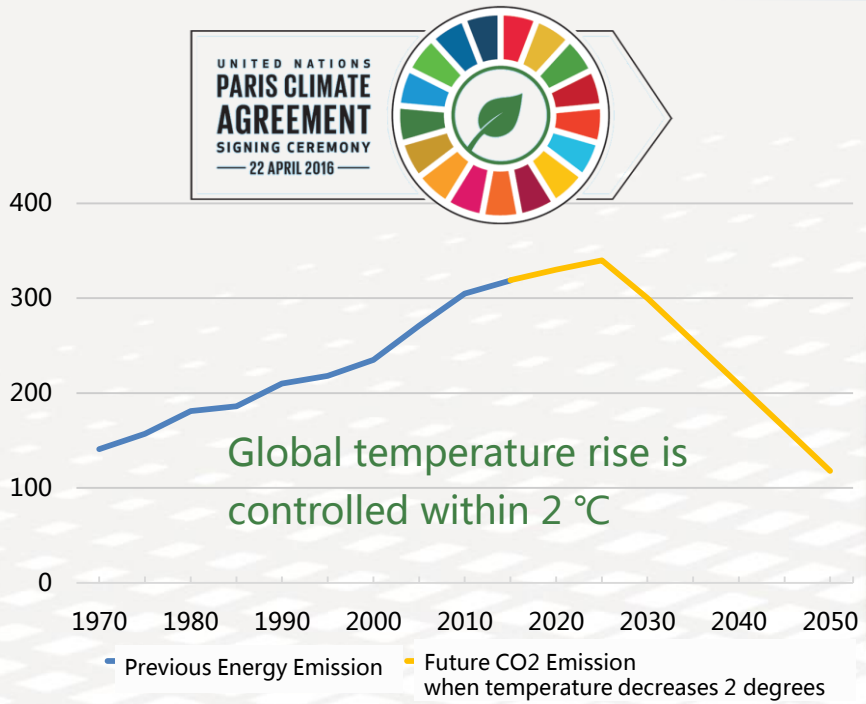
Reducing sulfur dioxide emissions: 250 million tons / year

Reducing nitrogen oxide emissions: 240 million tons / year

Reducing inhalable particulate matter emissions: 140 million tons / year

Reducing related diseases: 8~10 million cases

Climate Change



Electricity Access

Global electricity penetration will increase to 95% in 2035

Basically achieved electricity for all in 2050

4. Comprehensive Benefits of GEI

Creating a New Engine Driven by Innovation

- Promoting technological innovation in all aspects of clean energy development, deployment and use

Clean Energy Generation

- High power and intelligent wind turbine
- Highly efficient solar cell
- Centralized and distributed power generation

Advanced Transmission

- UHV high-capacity submarine cables
- VSC HVDC
- Superconductivity

Power Grid Safety

- Operation control of extra large AC / DC hybrid power network
- Large capacity virtual synchronizer
- Electrochemical and hydrogen energy storage
- Coordination of wind, solar, hydro and coal fired power

Power Distribution Technology

- Active distribution network
- Smart city
- Smart home
- Electric vehicle
- Electric cooker

4. Comprehensive Benefits of GEI

Building a New Platform for Open Cooperation

- The development of GEI requires joint participation of governments, enterprises and institutions but in the meantime, it also creates a broad platform for cooperation

A total investment of 38 trillion US dollars to promote cooperation in power, equipment, information, finance and other industries

Electricity trade will become the main form of energy trade around the world, to transform resource advantages into economic advantages

Create a green, low-carbon, interconnected, co-constructed and shared energy community, reduce conflicts, and build the Belt and Road and a community of shared destiny for mankind

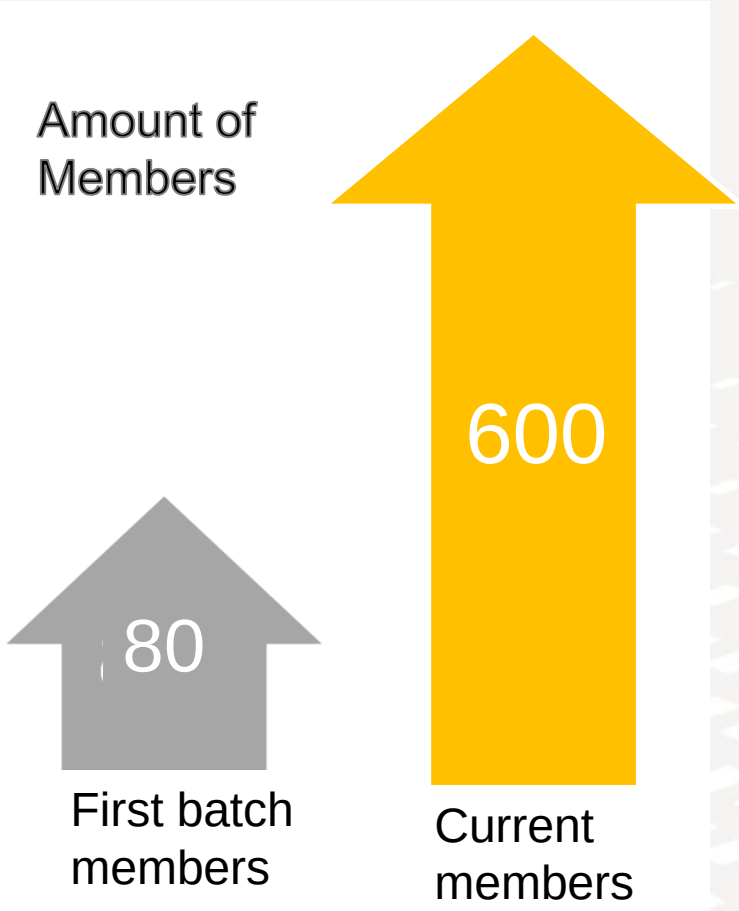
In short, GEI is a magnificent undertaking that transcends national boundaries and civilizations, links all mankind and benefits the entire world. It will build the world into a bright, peaceful and harmonious global village with sufficient energy, blue sky and green land, and open up a bright future for the sustainable development of mankind.

5. Introduction of GEIDCO

Global Energy Interconnection Development and Cooperation Organization
全球能源互联网发展合作组织

GEIDCO is committed to **promoting power grid interconnection and meeting the global power demand in a clean and green way.**

- Currently, GEIDCO has over ***600*** members from more than ***80*** countries and regions across 5 continents.



GEIDCO Members

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GEIDCO Membership Structure

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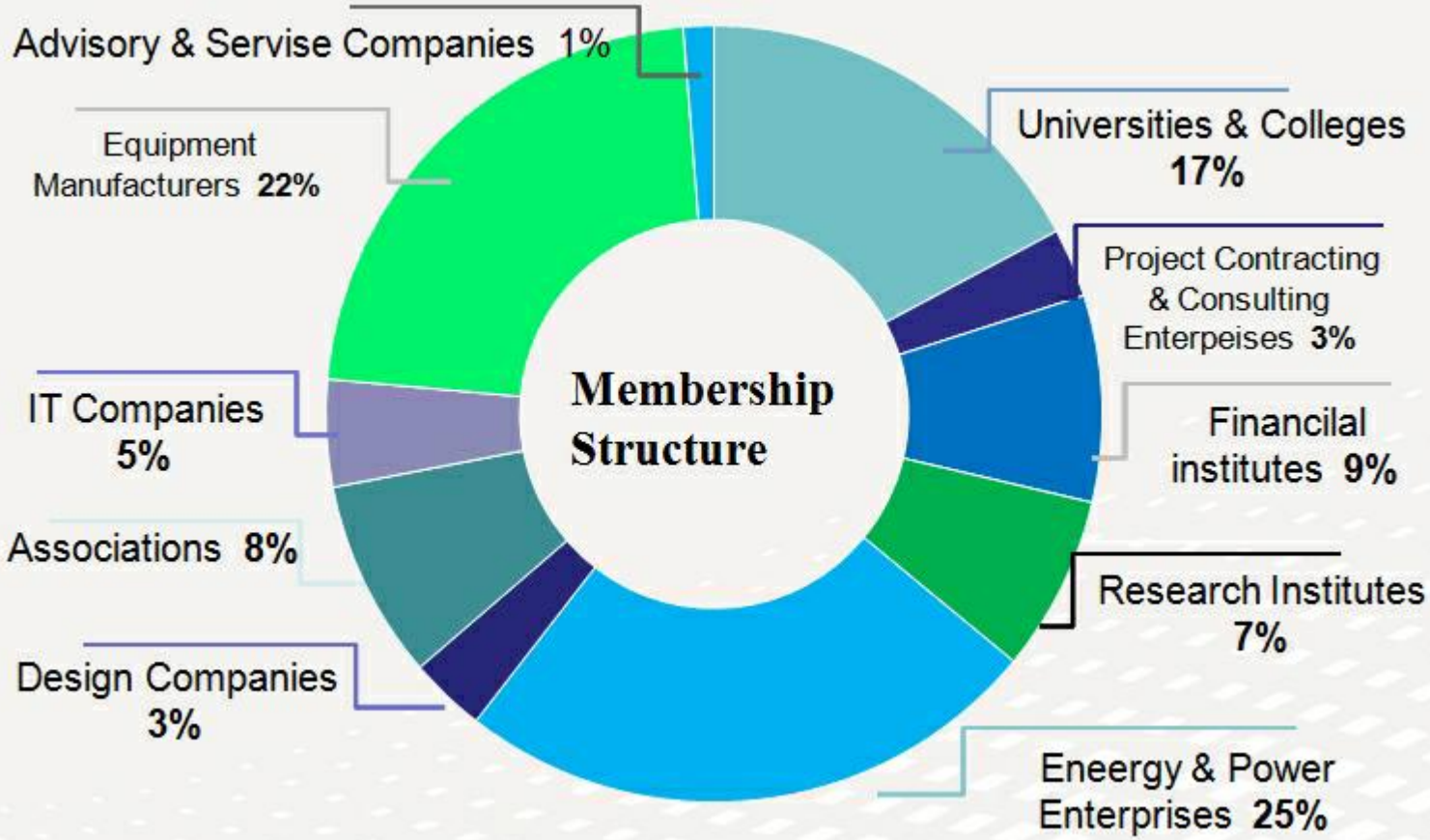
Industry Areas & Companies



GEIDCO International Network

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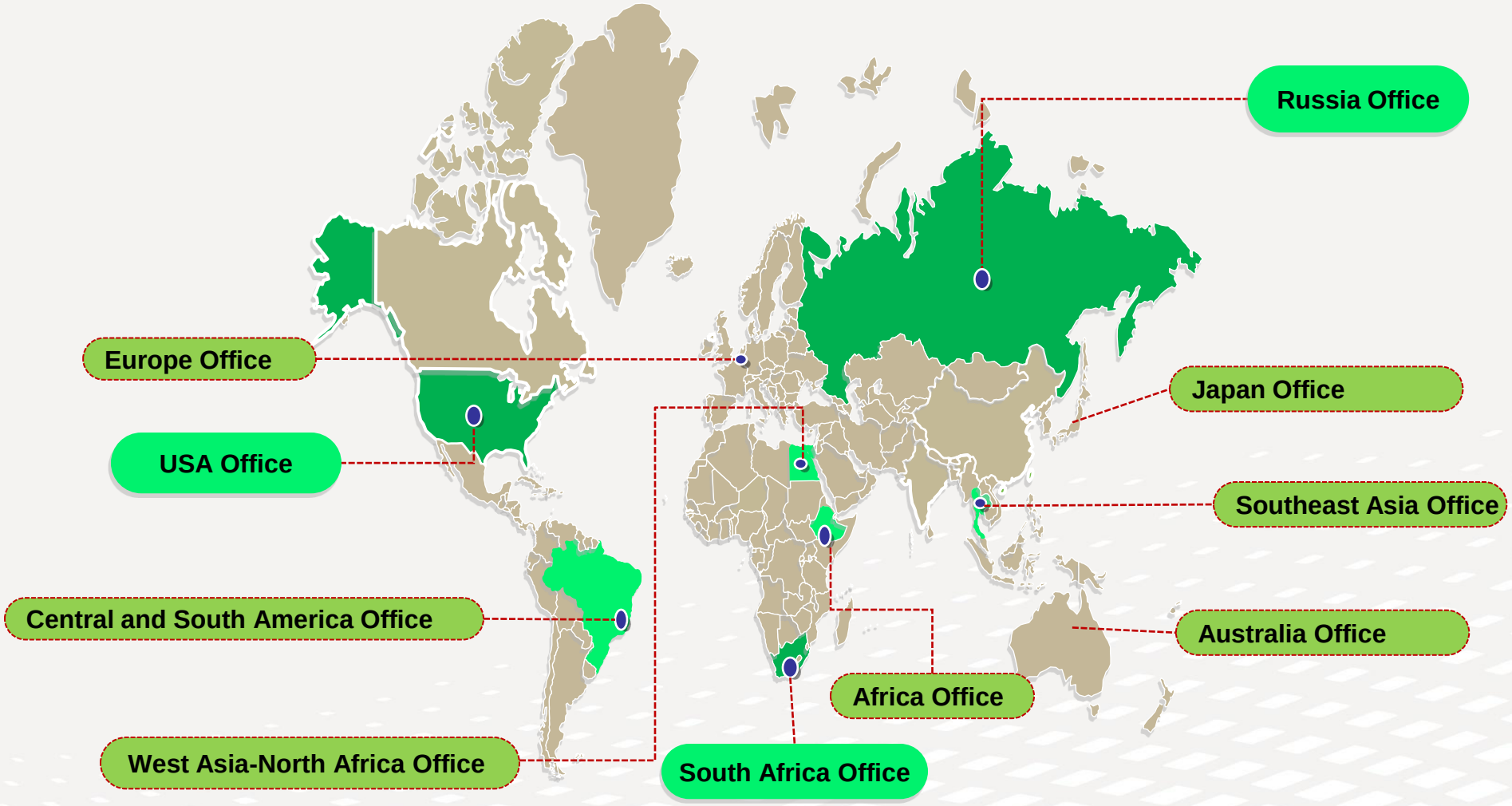
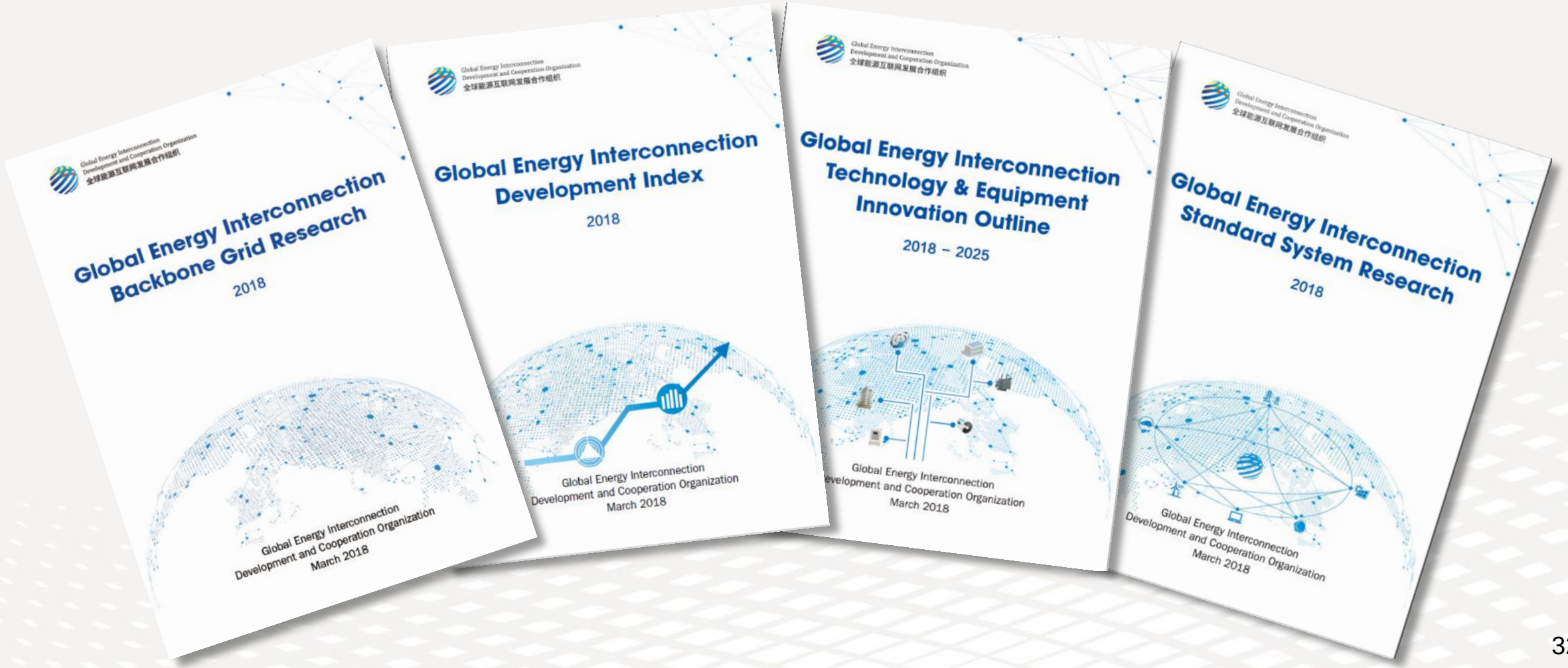
Development and Cooperation Organization
全球能源互联网发展合作组织



Research progress of GEI

Global Energy Interconnection Development and Cooperation Organization
全球能源互联网发展合作组织

It has released dozens of significant results including **GEI Backbone Grid, Development Index, Technology & Equipment and Standards System**.



Building GEI is a great cause. GEIDCO is ready to join hands with all parties to promote GEI that will benefit all mankind!

Thank You
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