

How China Aims to Achieve Environmental Sustainability

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China's Energy Transition: Developing the Energy Internet to Combat Climate Change

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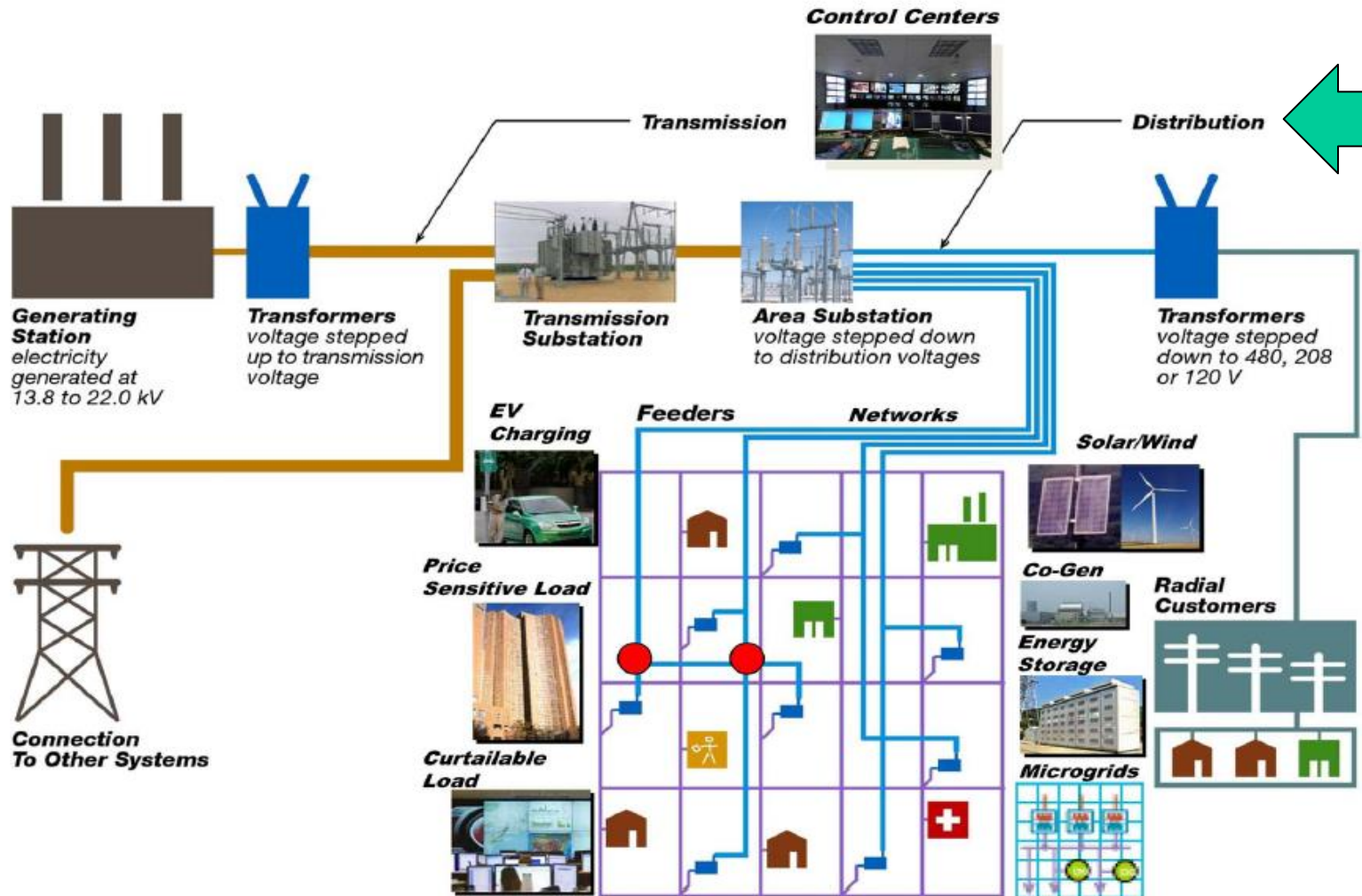
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Overview: A Modern "Smart Grid"

-- Challenges of Clean Energy Integration into Power Grid

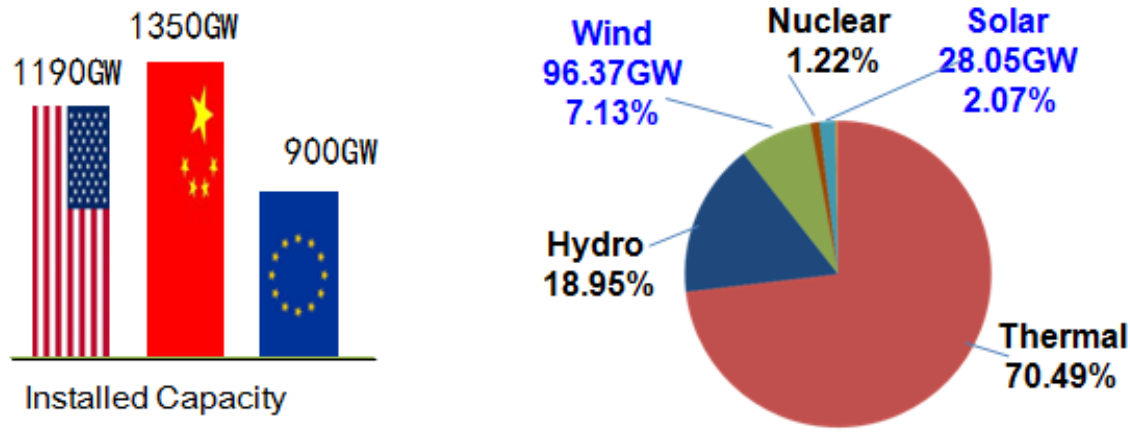


Source: Anderson et al, Proceedings of the IEEE, June 2011

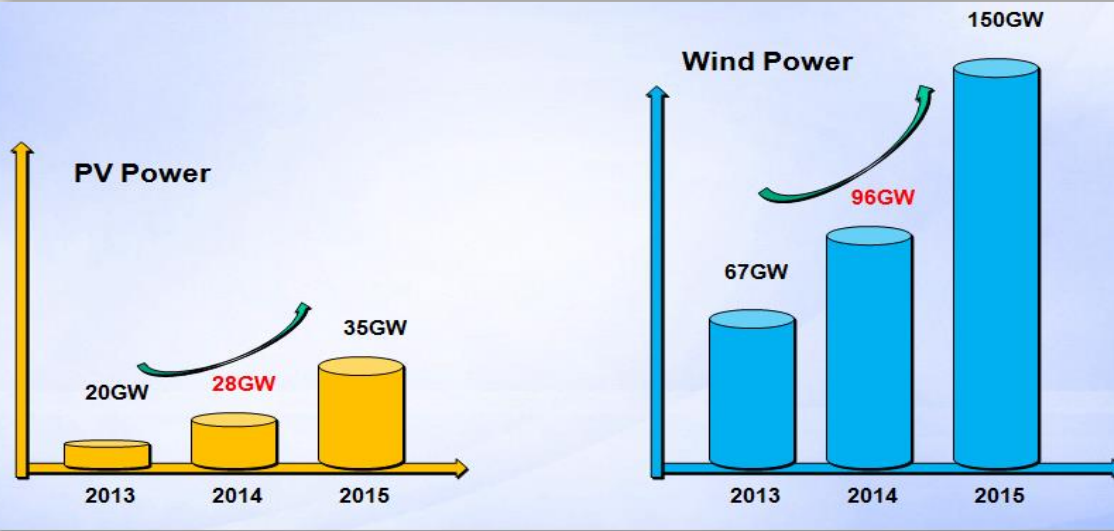
1. China's Energy Transition

Renewable Energy Development in China

The Goal of China's Energy Transition is to build a Clean, Low-carbon, Safe, Efficient and Sustainable modern Energy System by the year 2050 (Renewable Energy 64.5 %)



In 2014, the installed capacity of China reached 1350 GW.

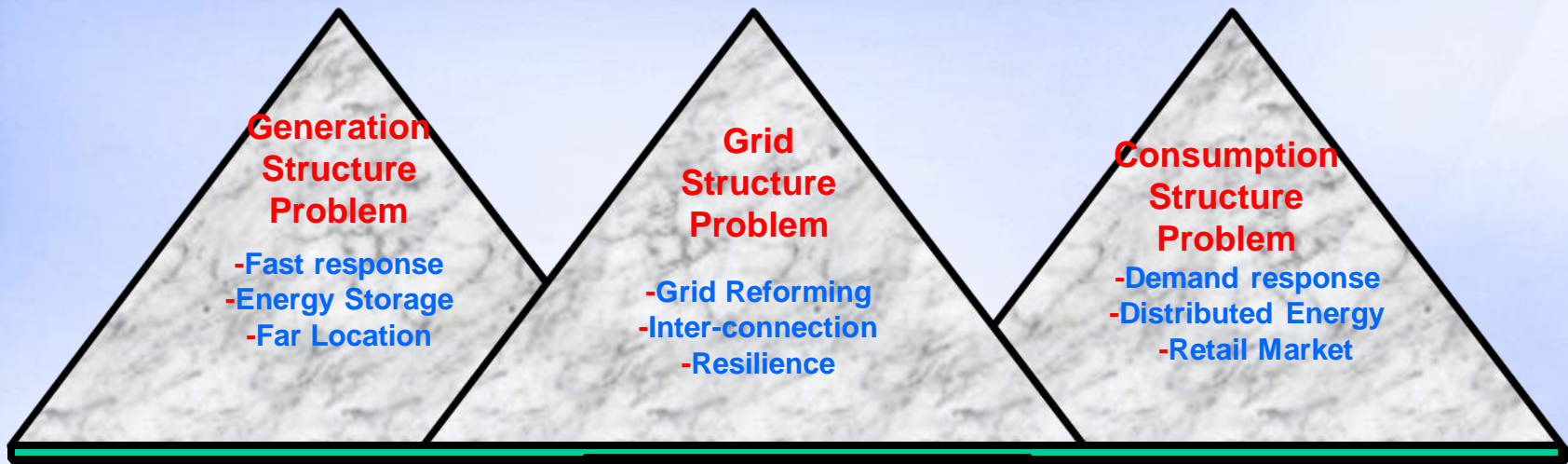


In 2015, 35 GW PV and 150 GW Wind Power integrated to grid in China (24% Renewable Electricity). The penetration has been more than 30% for some provinces in north area.



Great Challenges for Chinese Grid Operator

The 3 structure problems just like 3 mountains: the Chinese Grid Operator is bearing 3 mountains when operating the power system.

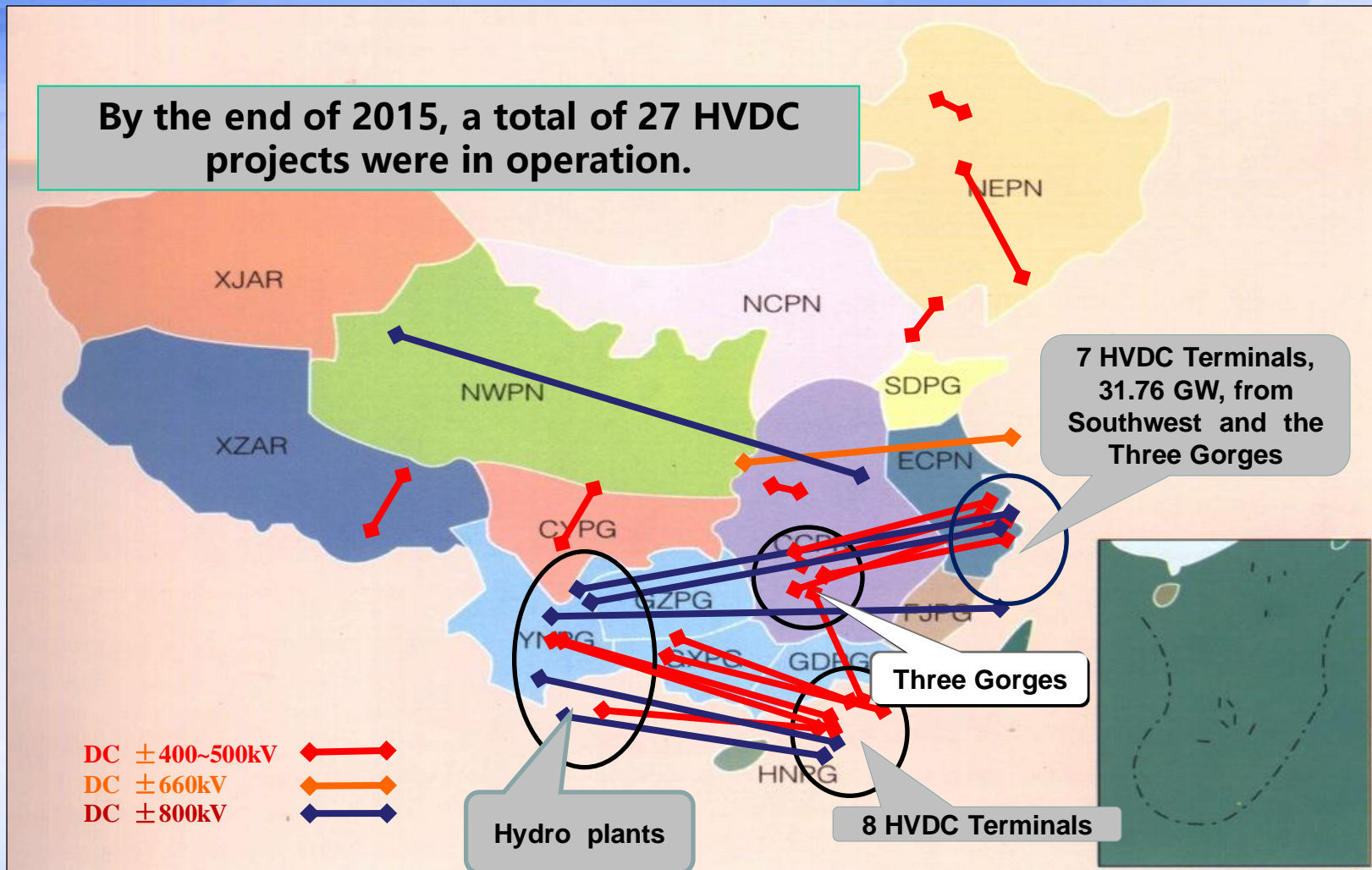


- **Safe**
- **Reliable**
- **Low Cost**

Keep Lights On !



2. Fast Development of HVDC in China Power Systems

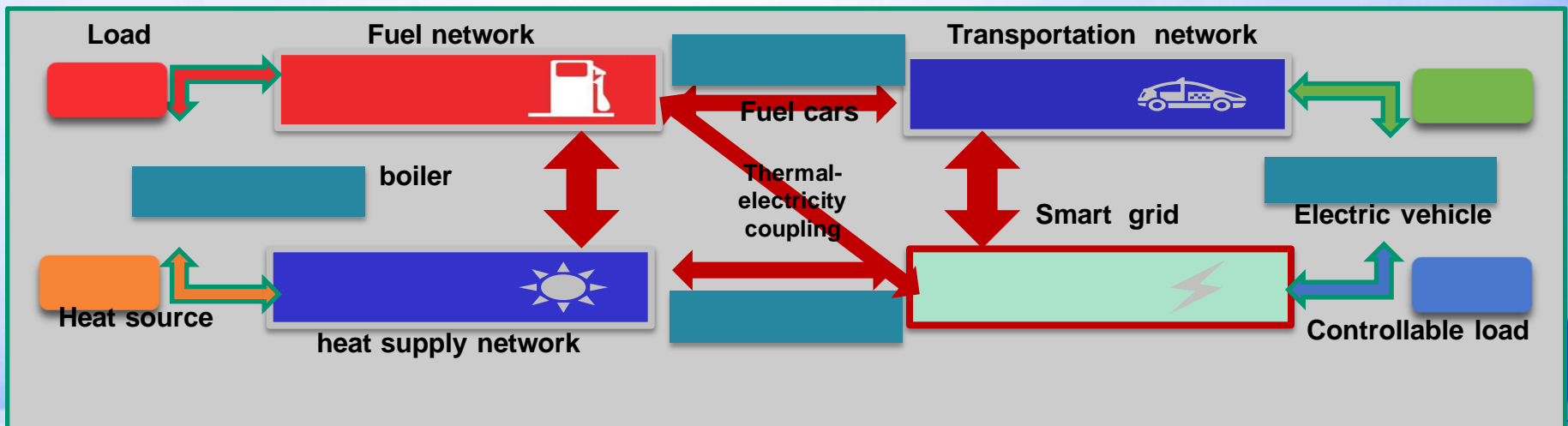


Note: A High-Voltage, Direct Current (HVDC) electric power transmission system (also called a electrical super highway) uses direct current for the bulk transmission of electrical power, in contrast with the more common alternating current (AC) systems. For long-distance transmission, HVDC systems are less expensive and suffer lower electrical losses.

3. Power System Evolution in China

- Smart Integrated Energy Systems

- The Smart Integrated Energy Systems is the concept expansion of **Smart Grid** to “**Integrated Energy System**”, is a **New Generation of Energy System (Energy Internet)**; a new evolution trend of traditional power systems.
- In 2016, the China’s National Energy Board issued guidance on promoting the development of **Energy Internet -- Internet + Smart Energy**
 1. Physical Energy System: Energy Generation, Transmission & Distribution, Consumption (Electric Car, Energy Storage, Energy Efficiency, Demand Site Management).
 2. IoT for Energy: Smart Meter, Energy & Information Management System, Big Data, etc.
 3. Financial System: Started Energy Trading, Electricity Market/Retailer Market in China. In 2016, opened Electric Power Trading Centers and established Retailer Markets.



4. China's Plan for Distribution Grid Construction

Investment Forecast (2015 to 2020)

China Energy Bureau's Action Plan for Distribution Grid Construction (2015-2020):
 Distribution Grid Construction investment is not less than 20,000 YI RMB (\$299 Billion USD)
 The average investment/year: 3400 YI RMB (\$50.7 Billion USD/year) from 2016 to 2020.

Investment Forecast: Distribution Grid Construction Action Plan (2015-2020)

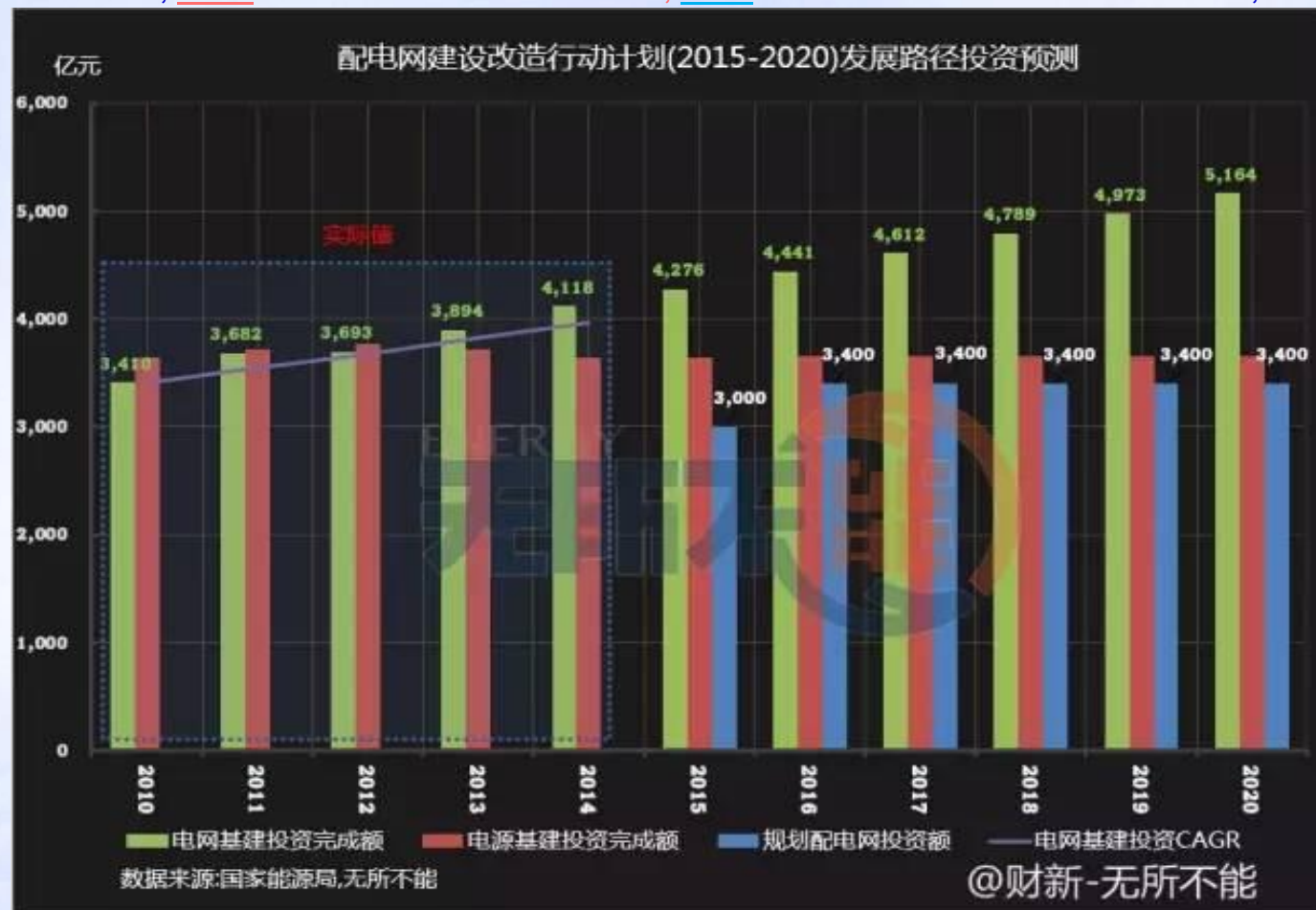
Green: Investment in Electric Grid; Red: Investment in Generation; Blue: Investment in Distribution Grid;

Summary:

China's Smart Grid Development & Expansion (Energy Internet) provides solution of Clean Energy Integration into grid and aims to Achieve Environmental Sustainability !

Note:

Exchange rate
 1(USD): 6.7(RMB)



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