

Advancing
Clean Energy & Sustainable
Energy Infrastructure
through PEER

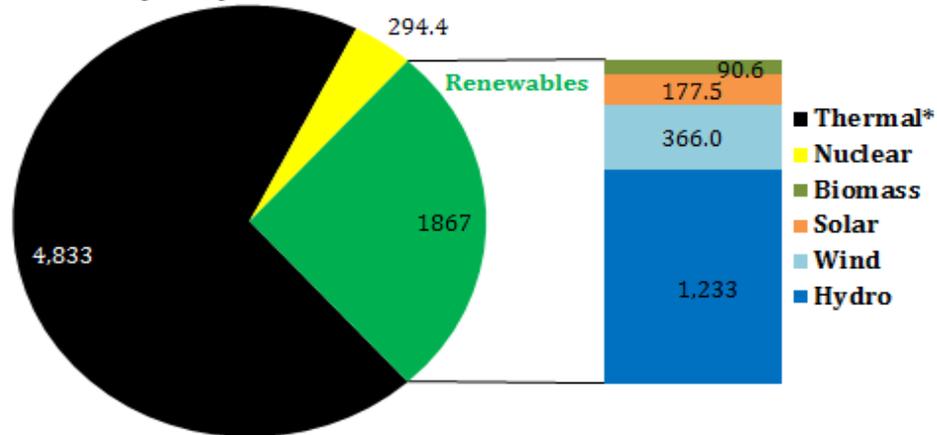
A BRIEF ON CHINA'S ENERGY INITIATIVES

MAY 2020

BACKGROUND

China's power sector services 1.1 billion consumers, supplying 6,994 TWh from more than 1.91 TW of installed capacity. Coal is the primary source of electricity generation in China. The total installed capacity of renewable energy (including hydropower) in China is more than 728 GW. At the end of 2018, China's power sector continued to be dominated by large state-owned companies.

Electricity Mix 2018 (TWh)



Source: China Energy Portal

The country's grid is owned and operated primarily by the state-owned State Grid Corporation of China (which supplies power to 88 percent of the country), while China Southern Grid, also state-owned, accounts for most of the remainder. A handful of large state-owned power generation companies are responsible for generating most electricity, including the so-called "big five" - China Datang Corporation, China Guodian Corporation, China Huadian Group, China Huaneng Group, and China Power Investment Corporation - that account for 47 percent of power capacity.

In 2016, the 13th Five-Year Plan targeted 2,000 GW of capacity to be installed by 2020 - a nearly 20 percent increase from the current capacity - and a 15 percent increase in the share of non-fossil fuel energy. Based on this five-year plan, China aims to achieve 6.5 percent annual average growth in their GDP from 2016-2020 and also plan to reduce emissions per unit of GDP by 40 to 45 percent by 2020 compared to 2005 levels.

The world's biggest energy consumer is aiming for renewables to account for at least 35 percent of electricity consumption by 2030, according to a revised draft plan from the National Development & Reform Commission (NDRC).

Source: www.bloomberg.com

CHALLENGES IN THE CHINESE POWER SECTOR

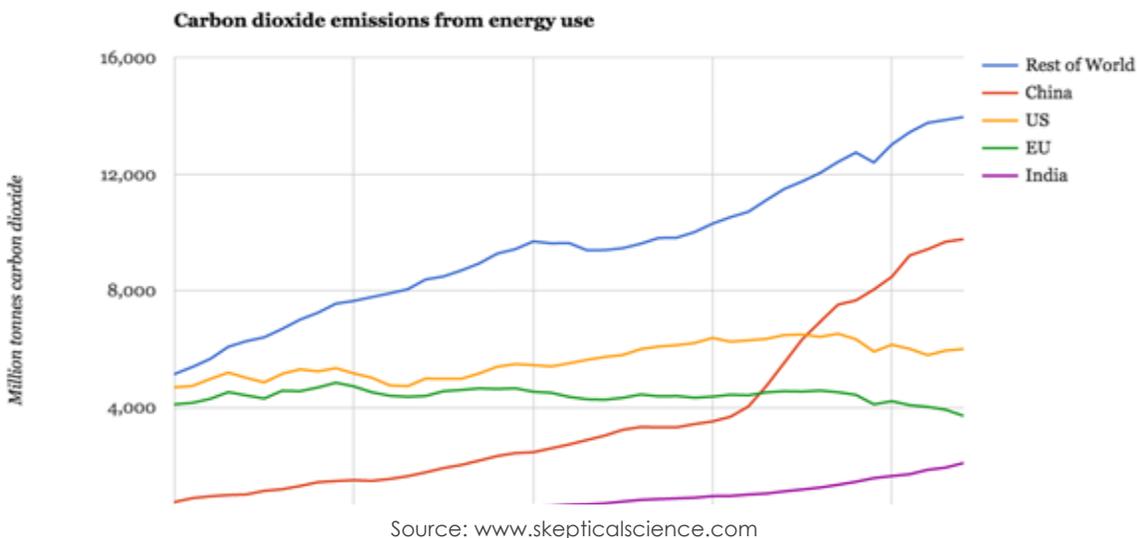
Energy security has become key to strong economic growth. Emerging as one of the fastest developing nations, China is meeting significant energy requirements through coal, hydro and renewables, but has also faced challenges with power generation, transmission and distribution.

The geographic location of its Northeastern coalfields, and the quickly growing industrial load centers in the East and South has led to increased emissions, loss of power in transmission and distribution systems, and peak demand issues. Additionally, harsh weather, aging grid infrastructure, lack of market instruments and trading mechanisms further impact China's the power sector.

Some of the key impacts of the Chinese power sector:

High Emissions from Coal Power Plants

China has surplus coal generation capacity, creating at least 10 to 40 percent more than peak electricity demand. China's dependence on coal for industrial power generation has significantly contributed to urban air pollution: according to World Bank data, 71 percent of China's emissions came from coal in 2014.



Weather impacts

Weather impacts on China can frequently be predicted based on their province location. The Southern and Eastern provinces of China are often affected with typhoons. Southwest (Sichuan, Yunnan) and Northwest (Xinjiang) parts are more prone to earthquakes. Southern and Central provinces are affected by floods as they lie alongside the Yangtze river, the longest river in Asia. Each of these recurring disasters has negatively impacted the nearby power grids, and by extension, the country's economy.

In January 2008, for example, severe snowstorms hit many parts of Eastern China, freezing power lines, increasing their weight and eventually causing the power transmission tower to fall. It resulted in a \$4.5 billion hit to the economy, affecting 78 million people. Widespread power outages were reported in Chenzhou, Fuzhou and Jiangxi, where the entire city - including government buildings, hospitals, telecommunications cables and internet networks - were without power for two weeks. At one point, 17 of the 31 provinces and autonomous regions of China faced reduced power supplies.

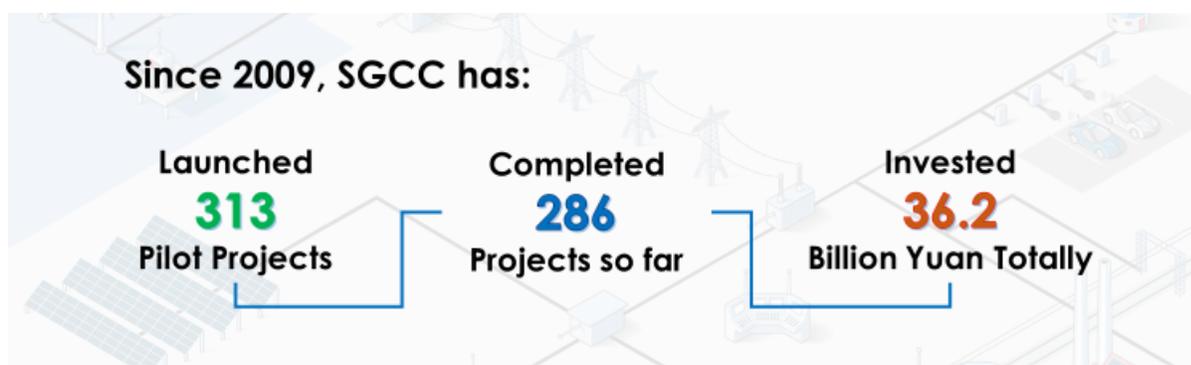
In 2017, Sichuan province faced a powerful 7.0 magnitude earthquake, triggering an estimated 1,880 landslides, and causing the entire Jiuzhaigou county to suffer a complete power failure. Sichuan and Xinjiang provinces are more prone to earthquakes than any other province in China, facing four earthquakes within the last decade.

Lack of a Trading Mechanism

A market-based pricing mechanism for power generation has not yet been fully formed: current electricity price management is still dominated by government pricing, and market transactions between power generation companies and users are limited. This system also creates competition between coal-fired power plants and renewable-energy producers, instigating severe curtailment problems in China's wind and solar sectors.

To address these challenges, China announced several programs that concentrate on reducing emissions from power plants and increasing renewables use and distributed generation. [Deepening Reform of Power Sector](#) calls for effective, market-based pricing for electricity and emphasizes demand side management in balancing the grid. The [Energy Supply & Consumption Revolution Strategy](#) policy has set targets on achieving 15 percent more natural gas and 20 percent more non-fossil fuel in the energy mix. It also aims at meeting the new energy demands by clean energy generation by 2030.

The State Grid Corporation of China (SGCC) has developed a Smart Grid Mission with defined plans for the period of 2009 - 2020. Since 2009, SGCC has published **220 Corporate standards** and formulated **97 Industrial and 30 National standards** for smart grid development.



SGCC has demonstrated projects on advanced metering infrastructure (AMI), distribution automation, integration of distributed PV and microgrids, demand response and application of energy storage among others. China has also adopted various cost sharing policies and tax incentive programs in accordance with the Renewable Energy Law to support the deployment of renewables-based distributed generation.

China faces a unique turning point: major government-backed energy policies and smart grid programs are pushing the market forward, while the power sector's aging infrastructure struggles to keep up.

A possible solution comes in the form of the Performance Excellence in Electricity Renewal (PEER) rating system from Green Business Certification Inc. (GBCI), which is dedicated to the development of efficient, reliable and clean electrical infrastructure.

Performance Excellence in Electricity Renewal (PEER) is the first comprehensive, consumer-centric, data and market-driven system for evaluating power system performance.

PEER addresses a number of China's energy concerns, including CO2 emissions and weather impacts, in order to build a more sustainable, resilient power system that focuses on renewable energy technologies at a large scale. PEER establishes global best practices, supports programs working toward national goals and creates a common language between the electricity consumer, power distribution companies and energy professionals.

OBJECTIVES

This policy brief details how PEER can complement the Chinese government's work to achieve their targets and holistically support grid modernization efforts. It describes how PEER can accelerate the sustainable power market transformation in China and support national energy policies.

CHINA'S ENERGY INITIATIVES: AN OVERVIEW

The government of China has several major energy initiatives:

- ❖ [Energy Supply and Consumption Revolution Strategy \(2016-2030\)](#)
- Targets the national energy mix to achieve more than 50 percent non-fossil fuel-based power generation and 15 percent natural gas-based generation.
- ❖ [Renewable Portfolio Standard 2030 \(RPS\)](#) - Focuses on increasing the consumption of renewable energy and increasing the share of non-fossil fuels to 20 percent of China's primary energy consumption by 2030.
- ❖ [Energy Internet \(2016-2025\)](#) - Focuses on a new form of energy industry development, the integration of Internet and energy production, transmission, storage, consumption and energy markets.
- ❖ [13th Five Year Plan \(2015-2020\)](#) - Sets overall electricity percentage targets for coal (55 percent), hydropower (17 percent), wind (10.5 percent), solar (5.5 percent), gas (5.5 percent) and nuclear (2.9 percent).

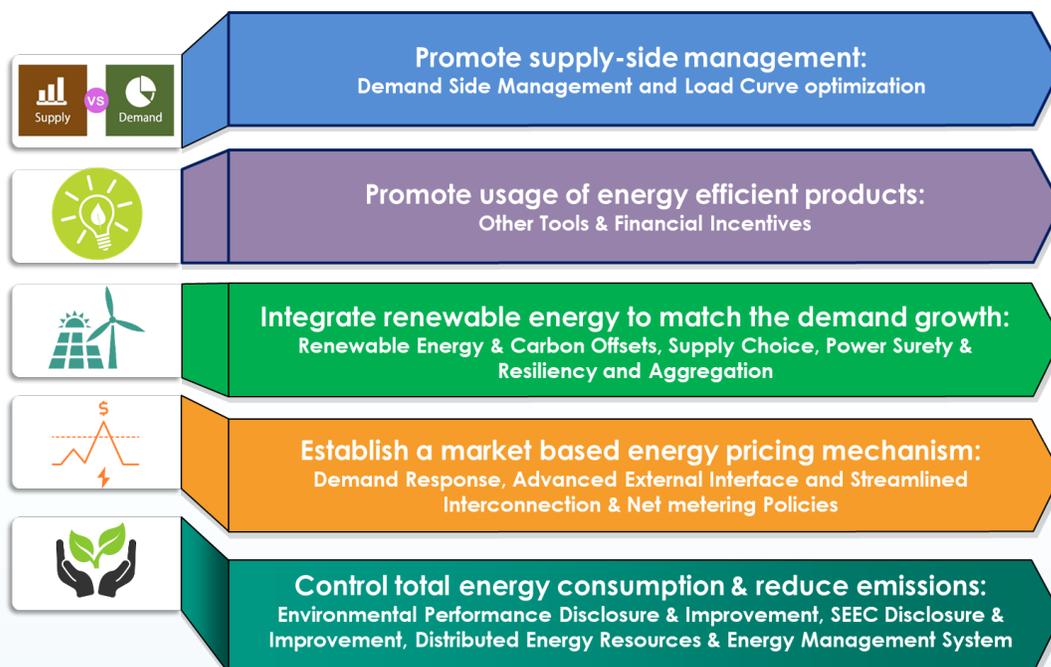
A detailed mapping of how PEER strengthens the Energy Supply and Consumption Strategy and Energy Internet program, their convergence and beyond is discussed beneath.

Energy Supply and Consumption Revolution Strategy

In April 2017, the National Development and Reform Commission (NDRC) and National Energy Administration (NEA) publicly released “Energy Supply and Consumption Revolution Strategy (2016-2030)”, which sets out the main targets and strategies of the Chinese energy sector through 2030. Viewed as an ambitious commitment to support China’s Nationally Determined Contribution, it includes comprehensive policies and measures to:

- Control total energy consumption and reduce emissions,
- Integrate renewable energy to match the demand growth,
- Establish a market-based energy pricing mechanism,
- Promote supply-side management and
- Promote usage of energy efficient products.

PEER directly supports the sectors (Designated Consumers - DCs) that work toward these goals, including energy utilities, energy intensive industries, industrial subsectors, small- and medium-sized enterprises (SMEs), and residential and commercial sectors. PEER stands as an established mechanism to improve the energy consumption and environmental performance of the identified DCs of this program through these 16 credits:



Energy Internet

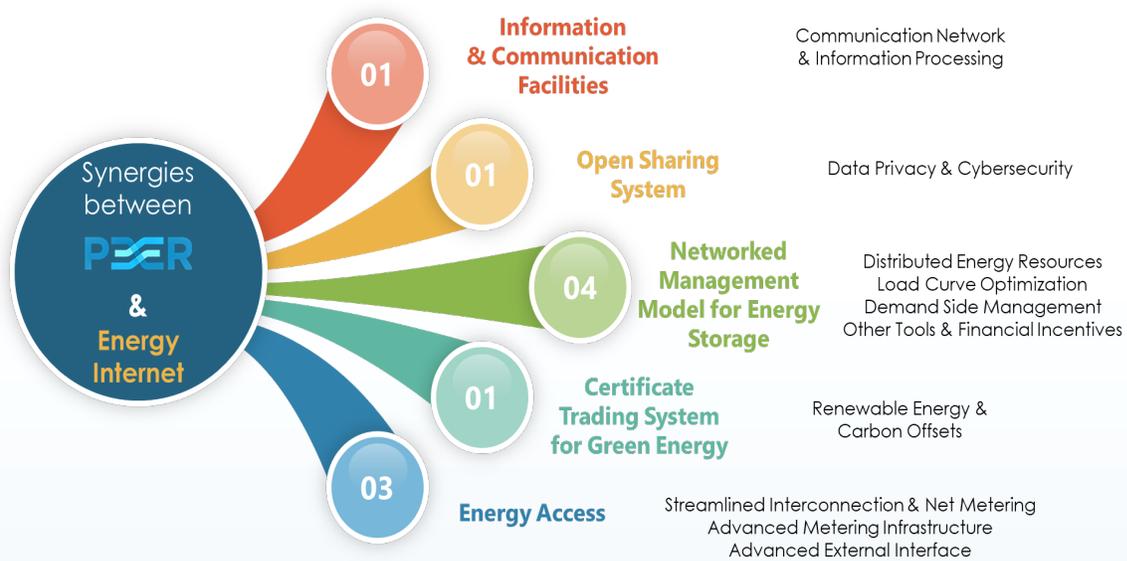
China's next phase of development is characterized by digital transformation. To kickstart this transformation, China launched "Internet Plus Smart Energy", also known as Energy Internet. As a new form of energy industry development, it focuses on the integration of internet and energy production, transmission, storage, consumption and energy markets.

China believes that the energy internet will change the relationship between energy providers and users. The biggest change expected is that every energy consumer will be able to become an energy seller by trading extra electricity or other forms of energy through the internet.

Through this Energy Internet initiative, China plans to:

- Promote the construction of intelligent energy production and consumption infrastructure,
- Strengthen the construction of multi-energy collaborative integrated energy network,
- Create an open and shared energy Internet ecosystem and
- Cultivate a green energy flexible trading market model.

With its structured framework, PEER could accelerate and drive energy utilities toward these intended objectives. These 10 PEER credits directly complement the corresponding Energy Internet indicators are mapped below:



KEY VALUE ADDITIONS

PEER provides a forward-looking tool to build China's intelligent energy infrastructure through its power system evaluation for cities, utilities, campuses and transits.

PEER's Key Performance Indicators (KPIs) help with the following:

- Flattening the load profile through **load curve study and optimization**,
- Quantifying and benchmarking the environmental performance and efficiency of electricity generation through **Energy Efficiency indices**,
- Drawing the **renewable energy roadmap** for the nation,
- Facilitating consumer adoption of local energy generation and storage through establishment of **Net Metering Policy** and
- Building a **reliable and resilient grid** infrastructure to avoid power outages.

BENEFITS OF PEER

PEER helps electricity leaders, professionals, operators and energy stakeholders:

- Provide more transparency and create a common language between consumer, utilities, operators and energy stakeholders,
- Define key performance metrics, benchmark against industry standards and verify measurable outcomes,
- Demonstrate competitive advantage and comparative differentiation and
- Build a comprehensive, continuous improvement process based on industry best practices to maximize returns and minimize risks, thereby increasing trust, credibility and customer satisfaction.

HOW IS PEER TRANSFORMING UTILITIES?

THE STORY OF GLASGOW EPB, KENTUCKY

The Electric Power Board of Glasgow, Kentucky, USA supplies reliable power to its 15,000 residents. For over thirty years, EPB had been pushing to evolve its century-old electric utility model into something more sustainable and beneficial to the community it serves - and was able to demonstrate and achieve this through PEER certification.

Beginning in 1988, EPB invested in the construction of a robust broadband network in parallel to its electric grid, with the vision that a modernized electric grid would require a broadband grid as well. The ability to move massive amounts of data among all elements of the Glasgow grid enabled Advanced Metering Infrastructure and high-speed communications between all grid devices and the coming Internet of Things (IoT), making all electric load on the Glasgow grid monitorable and controllable in real time.

Glasgow EPB discovered that load shape can be altered through the use of modernized retail rates (made possible by AMI) and Wi-Fi based control of various appliances and storage devices. In an effort to flatten the load demand on EPB, the team engaged in customer awareness programs asking users to reduce energy consumption and peak power demand through the redesign of retail electric rates and integration of energy efficient equipment. Through these practices, EPB saved customers over **\$354,000 per year in reduced peak demand charges.**

Through the PEER EE Index (Energy Efficiency and Environmental Performance Index) evaluation, Glasgow EPB learned that by associating the hourly generation mix and emissions data with every wholesale bill from TVA (Tennessee Valley Authority), EPB could alter the customer portal to reflect individual environmental impact for each customer in real time.

Thus, through the EE index, Glasgow EPB was able to identify a pathway to further educate their customer base and progress toward a truly sustainable electric utility. **TVA closed its first two coal-burning units in 2017, replacing them with a large natural gas power plant - a significant step toward greener energy production for the area.**

PEER ROADMAP FOR CHINA

China is witnessing a transformational change in the energy sector through the mandated policy interventions, including:

- The Smart Meter rollout by the State Grid Corporation of China,
- 100 Smart City projects,
- 4000 MW microgrid projects in the next five years and
- 39 new planned metros.

PEER could drive these programs at a community and utility scale through its integrated framework and data-driven approach. Through support for a smart grid roadmap and focus on achieving Energy Internet targets, PEER helps guide utilities toward a successful conversion to China's new energy infrastructure. PEER provides directions and new pathways for improvement for DISCOMs, which are frequently prone to natural calamities. Through the PEER reliability and resiliency parameters, projects can reduce their exposure to vulnerability and extreme events of distribution grid infrastructure.

CONCLUSION

GBCI is a leader in third party validation and global certification, with a long history in the evaluation of energy infrastructure. Through PEER, GBCI provides utilities with means to modernize their grids, adhere to stricter standards, improve their sustainability and provide more reliable and resilient power for users.