

A large, stylized green leaf graphic with a gradient from light to dark green, positioned centrally. The word 'SPIC' is written in white, bold, sans-serif capital letters across the middle of the leaf. To the right of the leaf, there are several thin, light green curved lines that suggest motion or a breeze. A thin red line curves across the bottom left of the leaf.

**SPIC**

BUILD A WORLD-CLASS CLEAN ENERGY ENTERPRISE  
WITH GLOBAL COMPETITIVENESS

The image features a vibrant green background with a gradient from light to dark. Overlaid on this are several wavy, layered lines in various shades of green, creating a sense of motion and depth. The text 'SPIC' is positioned in the center-right area, rendered in a clean, white, sans-serif font.

**SPIC**

# ABOUT SPIC

Established in July 2015 through the restructuring of the former China Power Investment Corporation and State Nuclear Power Technology Corporation (SNPTC), the State Power Investment Corporation Limited (hereinafter referred to as "SPIC") is a large key state-owned enterprise directly under the central government. As one of the five major power generation groups in China and the largest solar power generation enterprise in the world, SPIC ranked 316th among the Fortune Global 500 in 2020 with its businesses covering 46 countries and regions. SPIC has 130,000 employees and 62 subsidiary entities, including five A-share listed companies, one red-chip company and

two NEEQ listed ones. Entrusted with the important mission of ensuring national energy security, SPIC takes the lead in implementing two National Science and Technology Major Projects, namely, large advanced PWR nuclear power plants and heavy-duty gas turbines, acts as the leading entity for building the Energy Industrial Internet, and is also one of the pilot enterprises of state-owned capital investment designated by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC).

## BUSINESS DATA OF 2020

Total Assets  
USD  
**202.30**  
billion

Revenues  
USD  
**42.41**  
billion

Total Profits  
USD  
**3.17**  
billion

Net Profits  
USD  
**2.11**  
billion

# MAIN BUSINESS



## POWER SEGMENT

Strong Power Industry Capabilities

Covering all the power generation types: solar, wind, hydro, thermal and nuclear power generation

The world's largest solar power generation enterprise

One of the three major nuclear power operators in China



## "3N" INITIATIVE

New Industries, New Businesses and New Models

Integrated smart energy

Hydrogen energy and energy storage

Green energy-powered transportation

Comprehensive utilization of nuclear energy



## INDUSTRIAL FINANCE

Supporting the Main Business with Capital Operation

Total asset of the finance segment:  
USD 17.87 billion

Assets under management:  
USD 69.10 billion

Holds six listed companies and two NEEQ listed ones



## POWER-RELATED SEGMENTS

Integrated Development of Coal, Power, Aluminum, Railway and Port Industries

Coal production capacity: 84.3 million tons

Production capacity of electrolytic aluminum:  
2.45 million tons

Operating 627 kilometers of main railway lines, with a transportation capacity of 20.6 million tons per year

Handling capacity of ports operated by SPIC:  
30 million tons per year

# OVERSEAS DEVELOPMENT

By the end of 2020, SPIC has stretched its overseas businesses to 46 countries and regions, including 37 countries along the Belt and Road. SPIC's overseas installed power generation capacity totaled 6.058 GW, with the clean energy ratio up to 70%, and its overseas installed power generation capacity under construction reached 1.625 GW.



Australia Crowlands Wind Farm



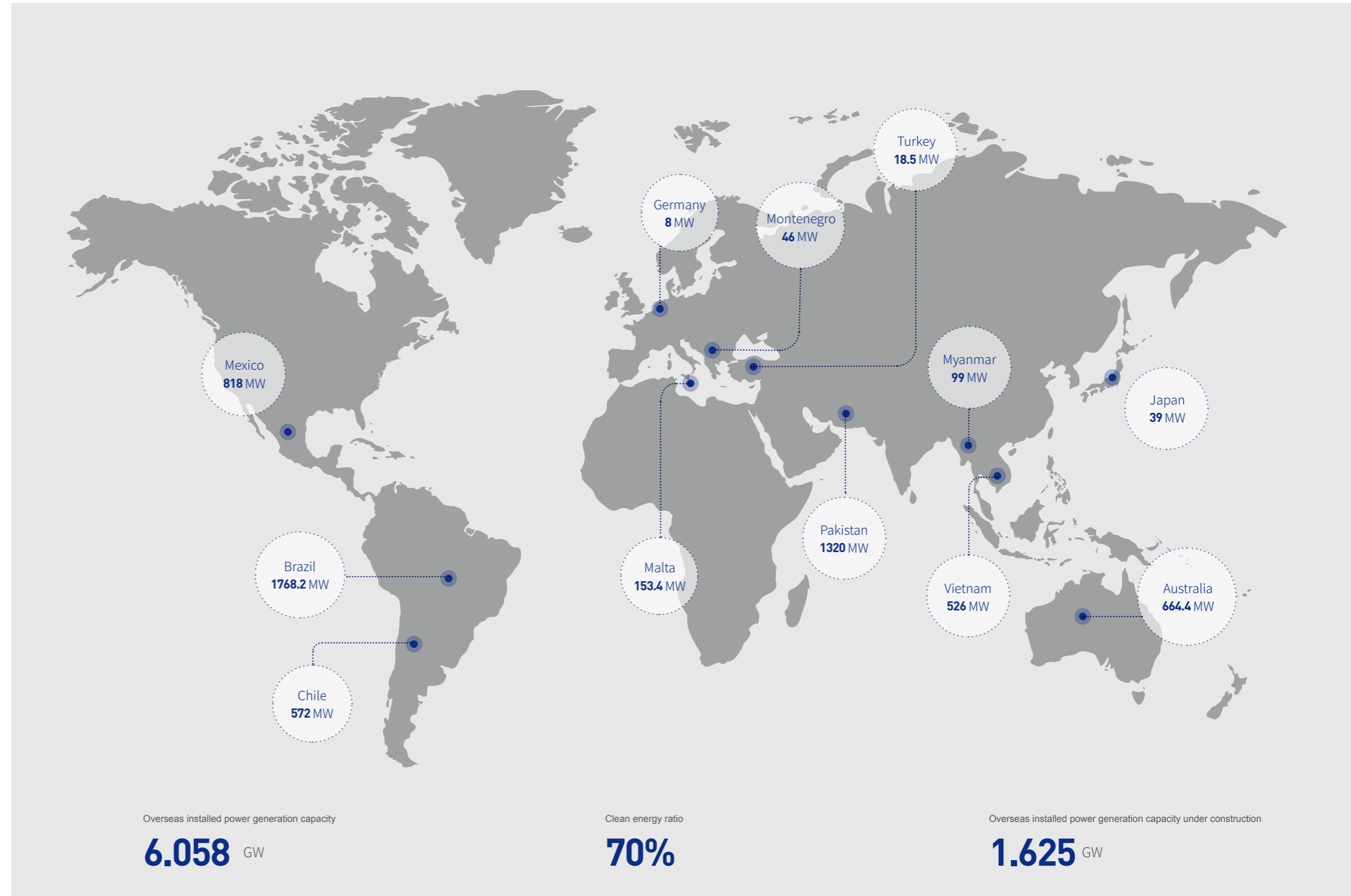
Brazil São Simão Hydropower Plant



Pakistan Hub Coal-fired Power Project



Turkey Hunutlu Power Plant Project



Overseas installed power generation capacity

**6.058** GW

Clean energy ratio

**70%**

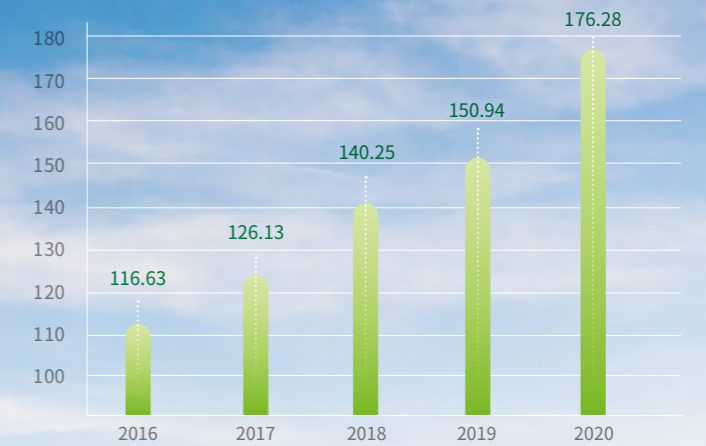
Overseas installed power generation capacity under construction

**1.625** GW

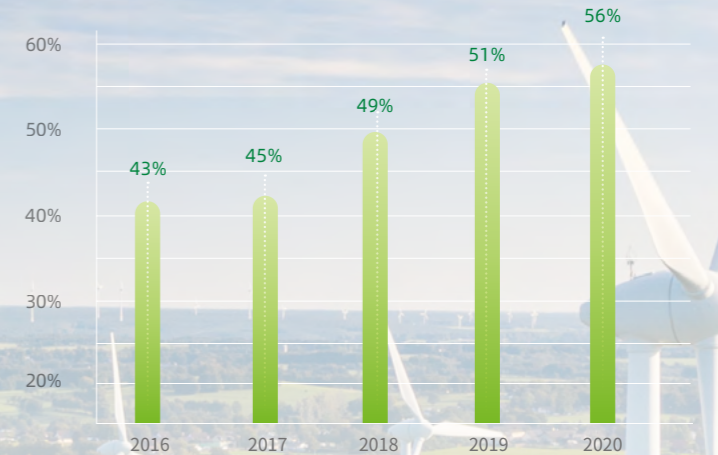
# CLEAN AND LOW CARBON DEVELOPMENT

As of the end of 2020, SPIC's total installed power capacity reached 176 GW, of which clean energy installed capacity was 98.88 GW, taking up 56.09% of the total. The installed power capacity using wind, solar and other new energy sources totaled 60.49 GW, topping the world.

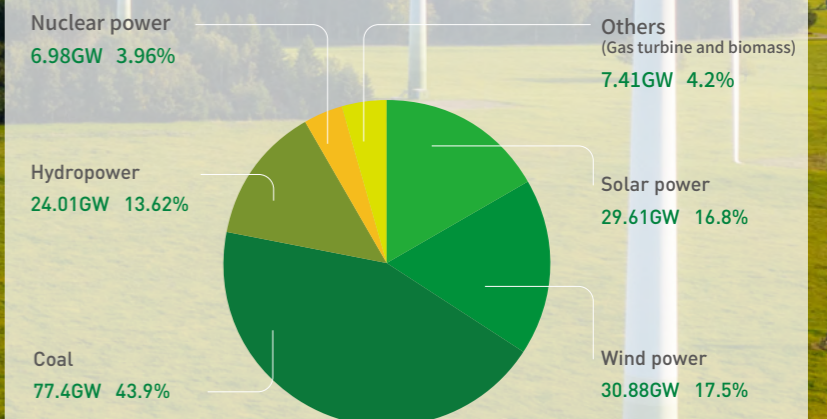
**TOTAL INSTALLED POWER CAPACITY (GW)**



**RATIO OF CLEAN ENERGY INSTALLED CAPACITY (%)**



**RATIO OF ENERGY SOURCES (%)**



# SOLAR POWER

SPIC has resolutely implemented the important instructions of “securing development in the solar power industry” made by General Secretary Xi Jinping when he inspected the Upper Yellow River Hydropower Development Co., Ltd. of SPIC in August 2016. Over the past four years, SPIC has been pushing forward quality development of the solar power industry, with a total installed capacity of 29.61 GW, ranking first in the world. SPIC has established large energy bases in Jiuquan, Gonghe, Golmud, Hami and Yancheng, with assets mainly distributed in 30 provinces and regions of China, including Qinghai, Xinjiang, Hebei, Jiangsu and Gansu. It has fostered a whole industry chain integrating R&D, design, polysilicon, PV cells, module manufacturing, engineering construction and PV generation and operation.

Total installed capacity of solar power

**29.61** GW

No. 1 in the world

## “PV+” Multi-energy Hybrid Mode

SPIC has taken the lead in implementing hydro, wind and solar energy hybrid projects, fishing and solar as well as agriculture and solar hybrid projects, and desertification control with PV power plants in China. With such efforts, it has addressed problems in ensuring safe PV power grid connection, improving the multipurpose utilization rate of lands, and environmental governance, thus charting an ecological development path of energies featuring multi-energy hybrid and intelligent coordination.



PV Power Generation Base in Hainan Prefecture, Qinghai Province



Guangxi Xing'an Yuanjiang Wind Farm

## WIND POWER

The total installed capacity of wind power reached 30.88 GW, ranking second in the world. SPIC's wind power assets are mainly distributed in China's 25 provinces and regions, including Qinghai, Gansu, Inner Mongolia and Jiangsu. SPIC is accelerating the construction of wind power bases in Inner Mongolia's Ulanqab, and those offshore bases in Jiangsu and Guangdong. In 2020, SPIC's newly added wind power installed capacity was 11.58 GW, with the operation scale exceeding the total of the previous four years.

Total installed capacity of wind power

**30.88** GW

Ranking second in the world



Offshore Wind Turbines in Jiangsu Province



# HYDROPOWER

The installed capacity of hydropower totals 24.01 GW, ranking among the top 10 in the world. SPIC's hydropower assets are mainly distributed in 14 provinces and regions such as Qinghai and Hunan. And it undertakes the construction of two (upper Yellow River and western Hunan) of China's 13 major basin hydropower bases, while developing hydropower business in Australia, South America, Myanmar and other overseas regions.

Total installed capacity of hydropower

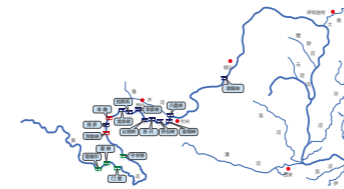
**24.01** GW

Ranking among the top 10 in the world

## Basin Hydropower Base in Upper Yellow River

16 cascades with a total installed capacity of **16.92** GW

10 cascades completed with a total installed capacity of **10.83** GW



## Western Hunan Basin Hydropower Base

13 cascades with a total installed capacity of **4.6797** GW

Yuanshui River Basin: **4.415** GW

Zijiang River Basin: **201.5** MW

Xiangjiang River Basin: **63.2** MW



Longyangxia Hydropower Station

# NUCLEAR POWER

With a total nuclear power installed capacity of 6.98 GW, SPIC is one of the three major operators of nuclear power investment and construction projects in China. It has six nuclear power units in operation, four under construction and a number of sites for the early phase of nuclear power projects. SPIC is equipped with a nuclear power industrial chain based on the third-generation passive technology, having the capability of R&D, design, engineering construction, key equipment manufacturing, operation and provision of lifetime service.

Total installed capacity of nuclear power

**6.98** GW

One of the three major operators of nuclear power investment and construction projects in China



Guohe One Demonstration Project



Haiyang Nuclear Power Plant



Hongyanhe Nuclear Power Plant

# NATIONAL SCIENCE AND TECHNOLOGY MAJOR PROJECT — GUOHE ONE

Guohe One is one of China's 16 national science and technology major projects. It took SPIC, the leading entity of the project, 12 years to complete the R&D and design of Guohe One in coordination with over 600 units and more than 31,000 technical personnel nationwide, achieving fully independent intellectual property rights. Independent design and domestic manufacture have been realized in key equipment and materials of Guohe One, with the overall localization rate surpassing 90%. Guohe One has contributed over 7,000 intellectual property achievements and enabled 590 novel products, materials, technologies, equipment and software. It is widely recognized for its high safety factor, good economic performance and multiple innovative achievements. Currently, with the technology R&D completed, the demonstration project proceeds as scheduled.

The load factor goal:

**93%**

Standardized design, factory-like precast components, modular construction, top-cut construction and integrated supply have been adopted, shortening the construction cycle of nuclear power projects to **56** months after putting into mass construction

The passive system allows the reactor to automatically ensure safety without manual intervention within

**72** hours of any accident in the case of power failure

Reducing CO2 emissions

by **9** million tons per year

Equivalent to planting **1,470** square kilometers of forest

The output power of a single unit:

about **1500** MWe

Optimization of the system and parameter design: **20%** higher than AP1000

Nuclear-grade valves reduced by: **50%**

The number of aseismic structures, pumps, valves, pipelines and cables greatly reduced for better economy

Lifespan of the overall plant and main equipment up to

**60** years

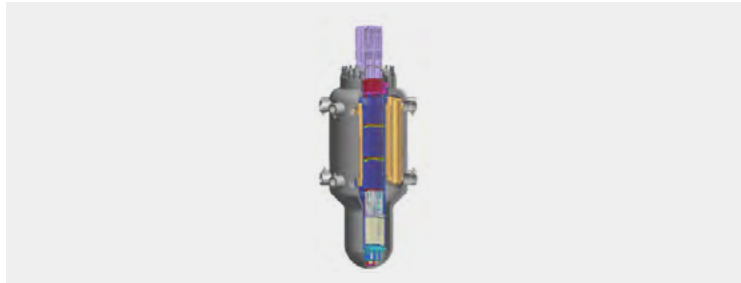
Equipment easy to operate and maintain



# COMPREHENSIVE UTILIZATION OF NUCLEAR ENERGY

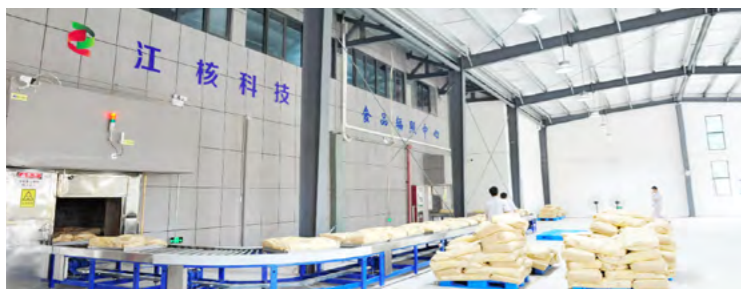
## Integrated SMR

The 200MWt integrated nuclear heating reactor, independently developed and designed by SNPTC (Shanghai Nuclear Engineering Research & Design Institute), is featured with integration, full natural circulation and boron-free core design. The maximum steam supply of a single unit reaches 250t/h, or its heat supply can cover up to 4 million square meters, which ensures environmental friendliness and safety with “nearly zero emission”, “nearly zero risk” and “low carbon without pollution”, reaching a leading level in the world while topping domestic projects. Now the project site selection, preliminary design and feasibility study of the first integrated nuclear heating reactor have been completed, with proper conditions for the preliminary work. It will secure both heat supply for the residents and steam supply for industrial purpose.



## Application of Nuclear Technology

On June 29, 2020, Ruichang Irradiation Center of Jiangxi Nuclear Power Co., Ltd. was officially put into production.



## Nuclear Heat Supply & Combined Heat and Water

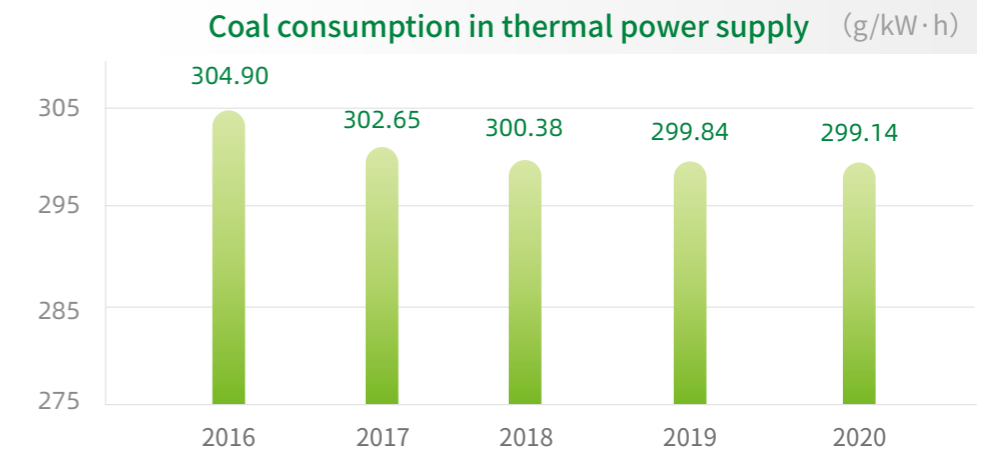
On November 25, 2020, Haiyang Nuclear Power Plant witnessed two breakthroughs in the comprehensive utilization of nuclear energy. First, China's first zero-carbon urban heat supply project, Phase II of Haiyang Nuclear Power Plant welcomed its official commencement, covering 4.5 million square meters. Second, the world's first combined heat and water project, the Combined Heat and Water Innovation Demonstration Project of Haiyang Nuclear Power Plant was officially put into operation. The Phase II nuclear heat supply project has clear advantages in raising energy utilization efficiency and reducing carbon emissions. When completed and put into operation in 2021, it will secure “full coverage” of nuclear heat supply in the urban area of Haiyang, making it the first city achieving zero-carbon heat supply in China.



# THERMAL POWER

SPIC's total installed capacity of thermal power reaches 84.81 GW, including 77.4 GW of coal power generation and 7.41 GW of gas turbine and biomass power generation. Thermal power assets are mainly distributed in 20 provinces and regions of China as well as in Pakistan, Turkey and other countries. SPIC is committed to the clean development of thermal power and continues its efforts on ultra-low emissions, cutting coal consumption of thermal power units.

Total installed capacity of thermal power  
**84.81** GW



The 2×1000MW Unit with Ultra-Low Emission in Caojing, Shanghai

# POWER-RELATED SEGMENTS

SPIC has a well-established and complete industrial pattern of “coal, power, aluminum, railway and port” integrated development, generating remarkable cluster and synergistic effect. As a vital support for the clean development of China’s power investment industry, the energy conservation and environmental protection has greatly contributed to the country’s determined battle to prevent and control pollution.

## COAL

With coal reserves of 16.2 billion tons and a production capacity of 84.3 million tons per year, SPIC possesses 9 coal mines, mainly distributed in Inner Mongolia, Xinjiang and Guizhou.



Baiyinhua Green Energy Base

### Open-pit Coal Mines

There are five 10-million-ton super large open-pit coal mines in Inner Mongolia, namely, the South Open-pit Coal Mine, North Open-pit Coal Mine, Zahanao'er Open-pit Coal Mine and Baiyinhua No. 2 and No. 3 Open-pit Coal Mines, boasting a production capacity of 81 million tons/year.

## THE ALUMINUM INDUSTRY

SPIC boasts an aluminum production capacity of 2.45 million tons per year, mainly distributed in eastern Inner Mongolia, Ningxia and Qinghai. The production capacity of alumina comes to 2.9 million tons per year, mainly distributed in Shanxi Province. And there are about 1.9 billion tons of bauxite reserves, mainly distributed in Guinea, Guizhou and Shanxi Province.



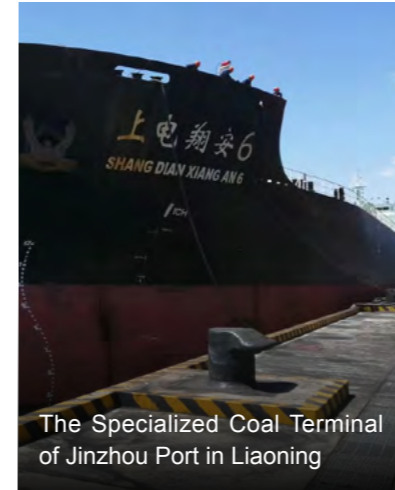
An alumina plant of Shanxi Aluminum Co., Ltd. with an annual capacity of 2.9 million tons per year



The 400kA electrolytic aluminum production line in Ningdong, Ningxia

## RAILWAYS & PORTS

SPIC has two railways and two ports in operation. The Jinbai Transport Corridor, which consists of the Chifeng-Daban-Baiyinhua Railway, Jinzhou-Chifeng Railway and the specialized coal terminal of Jinzhou Port, is an important part in SPIC’s coal, power, aluminum, railway and port industrial chain.



The Specialized Coal Terminal of Jinzhou Port in Liaoning



The Chifeng-Daban-Baiyinhua Railway

## ENVIRONMENTAL PROTECTION

SPIC’s environmental protection business includes the general contracting of desulfurization, denitration and dust removal projects, concessional operation of desulfurization and denitration, manufacturing and regeneration of denitration catalyst, dust remover manufacturing, water treatment, Low Level Waste Disposal (LLWD) and construction of nuclear waste disposal sites, and energy conservation, covering most parts of the country and other countries such as India and Turkey.



The raw flue gas comprehensive experimental base in China and the capture device of CO2 in the flue gas from coal-fired power plants, with an annual output of 10,000 tons.

# HYDROGEN ENERGY

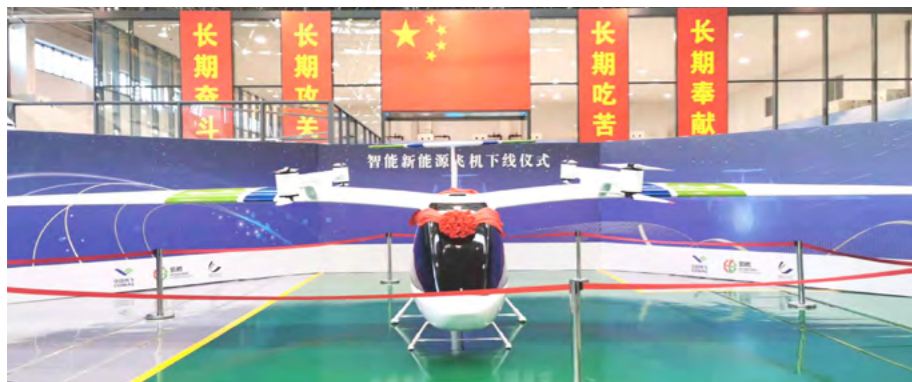
## Product Line

### Hydrogen Fuel Cell Stack

On September 27, 2020, SPIC released Hydrogen Forerunner FC-ML80 vehicle fuel cells and FCS65 vehicle fuel cell engine systems. Full independence has been realized in key technologies and product materials, with the indicators reaching the international advanced level. These two products have been popularized and implemented for industrial purposes successfully.



### Hydrogen-powered Drone

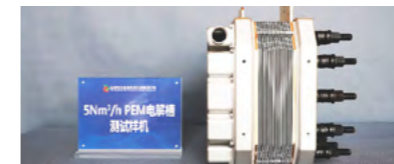


The ET480 smart new energy aircraft equipped with the air-cooled fuel cell power system independently developed by SPIC has been officially rolled off the production line. Currently, about 1kg of hydrogen filling will enable a range of 80 kilometers and last for nearly 40 minutes, which will double after capacity expansion.

## Energy Production Line

### PEM Hydrogen Production

SPIC has carried out research and development on hydrogen production technology of proton exchange membrane (PEM) electrolysis in pure water with high durability, low iridium content and high current density. SPIC has completed the development of PEM hydrogen production electrolyzer with 300-square-centimeter membrane electrode and of the 5Nm<sup>3</sup>/h electrolyzer prototypes.



PEM Electrolyzer Prototype

### Hydrogen-enriched Compressed Natural Gas (HCNG)

In September 2020, Chaoyang Demonstration Project of Hydrogen Production with Renewable Energy started the one-year hydrogen blending tests. The HCNG combustion trial operation officially kicked off, which was the first of its kind in China and has achieved the "zero breakthrough" HCNG combustion projects.



Chaoyang HCNG Demonstration Project

### Hydrogen Energy Industrial Park

The Hydrogen Filling Station in Yanqing Park, Zhongguancun is capable of providing 35Mpa & 70Mpa high-pressure hydrogen filling service, with a hydrogen filling capacity of about 500kg/day, which can fill up about 30 hydrogen-powered buses every day.



Hydrogen Filling Station in Yanqing Park, Zhongguancun

### Hydrogen-powered Bus



The hydrogen-powered urban buses equipped with the hydrogen fuel cell stack and power system independently developed by SPIC have been rolled off the production line. The buses boast a range of 600 kilometers and they will serve the Boao Forum for Asia and the Beijing Winter Olympics.

# ENERGY STORAGE

## Ronghe One



As one of the most promising energy storage technologies, Fe-Cr redox flow battery can improve grid stability and is the optimal energy storage technology with renewable energy sources. Besides, the cost will be as low as that of pumped storage after produced at scale. SPIC has developed 2kW, 10kW, 30kW and 250kW energy storage product series, and realized localization in all the components. Ronghe One, the 31.25kW Fe-Cr redox flow battery stack independently developed by SPIC, boasts the maximum power output of its kind around the globe.

## 20MW Energy Storage Project in Support of the National Solar Power Generation Test Base



In December 2020, the “20MW Energy Storage Project in Support of the National Solar Power Generation Test and Validation Base” of Gonghe Solar Power Industrial Park in Hainan Prefecture was enlisted as one of the first eight Sci-tech Innovation (Energy Storage) Pilot Demonstration Projects of National Energy Administration (NEA). It is the first project to cover all the mainstream PV and energy storage technology routes. Operation analyses have been conducted on energy storage technologies operating with varied photovoltaic power generation systems under different deployment circumstances, with which the configuration schemes, equipment performance, control strategy and operation effect of the “PV + energy storage” system have been verified. This has constituted a practice basis for the establishment and operation control of the “new energy + energy storage” system for the whole industry.



## Energy Storage Demonstration Project with Fe-Cr Redox Flow Battery Technology of the Zhanshigou Solar Power Station in Zhangjiakou

On December 23, 2020, China’s first Fe-Cr redox flow battery demonstration project, the 250kW/1.5MWh Energy Storage Demonstration Project with Fe-Cr Redox Flow Battery Technology of the Zhanshigou Solar Power Station in Zhangjiakou was officially put into trial operation. This marks that the energy storage technology independently developed by SPIC has been put into use officially, which has a milestone significance for verifying the effects of the new energy storage technologies in clean energy consumption. The eight 30kW cell stack modules employed in this project are Ronghe One, the Fe-Cr redox flow battery stack independently developed by SPIC with the world’s largest power output. It is capable of ensuring 6 hours of charge and discharge and operating in parallel with solar power stations. It is a key project for securing the long-term and stable operation of the solar power storage system, contributing to the profits, power supply stability and PV power generation quality of solar power stations.



# INTEGRATED SMART ENERGY

On April 1, 2020, on the basis of the National Nuclear Power Planning and Design Institute Co., Ltd., SPIC set up the Integrated Smart Energy Technology Co., Ltd., which serves as a platform for the development of integrated smart energy industry.

On July 1, 2020, SPIC held a promotion meeting on the integrated smart energy technology solutions, on which it released smart energy brands and promoted innovative business models such as “+electricity card”, “three-in-one network”, “AI synergy” and “friend circle”. One-stop integrated smart energy solutions were put forward for 24 typical scenarios of smart cities, industrial parks, energy bases and cluster buildings.



Integrated smart energy refers to industries that focus on digital and smart energy production, storage, supply, consumption and service, pursue horizontal coordinated supply of multiple energies such as electricity, thermal and cooling, gas, water and hydrogen, realize the interaction and optimization of vertical links including the power sources, grids, loads, storage and consumption, and establish an energy network seamlessly connecting the IoT and the Internet in order to provide integrated energy services to end-users.



### SMART CITIES

This scenario mainly concentrates on the development of new urban areas, the expansion and renovation of old urban areas or counties and towns. Meanwhile, it seeks to roll out integrated energy construction and services in accordance with the requirements for developing new smart cities.



### INDUSTRIAL PARKS

Cluster buildings mainly refer to industrial parks, high-tech parks or independent buildings (including special areas). Parks may accommodate a single industry or multiple industries.



### CLUSTER BUILDINGS

Industrial parks mainly mean building clusters, usually in the form of “main building + podium structures” with a certain scale. This scenario would be able to address problems in constructing smart buildings, increasing energy efficiency, improving the comfort and raising the energy self-sufficiency rate.



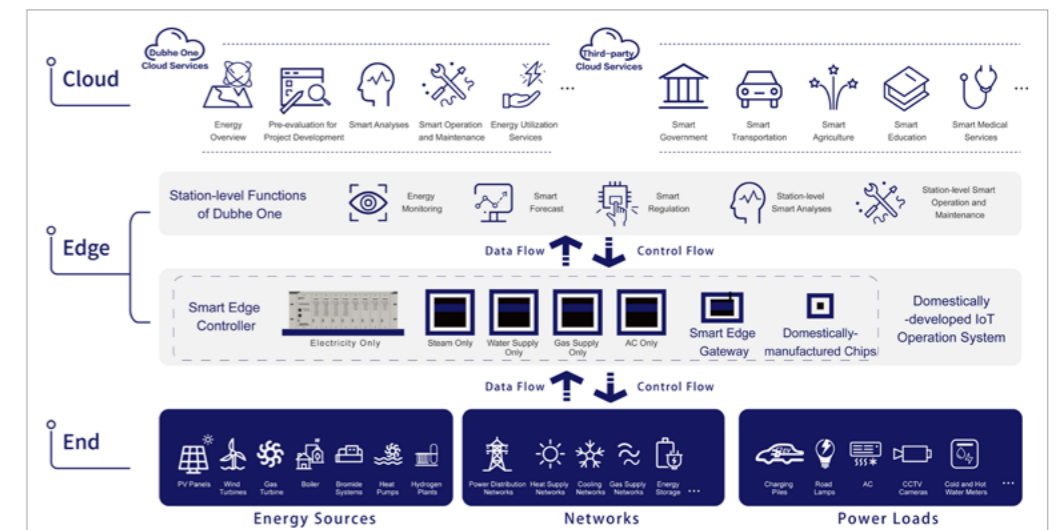
### ENERGY BASES

Energy combinations, such as wind-solar-energy storage, wind-solar-hydro and wind-solar-thermal, will be leveraged together with energy storage and hydrogen energy to implement electricity replacement at the consumption side and facilitate comprehensive energy utilization. In this way, local consumption or outbound transmission of energy will be promoted, enhancing the friendliness of power grids and upgrading the efficiency of UHV channels.

SPIC's Dubhe One Integrated Smart Energy Management and Service Platform, designed on a digital and open basis, integrates 9 functions of energy monitoring, forecast, regulation, analysis, operation and maintenance, services, etc. It will enable the smart management of integrated energy, optimal allocation of multiple energy types, synergistic and complementary operation, offering intelligent and efficient “one-stop” integrated energy services to the users. The platform will be able to generally save 10% to 20% of energy and over 30% of the cost, with the comprehensive energy utilization efficiency exceeding 75%, and the consumption rate of renewable energy up to 98%.

### DUBHE ONE

INTEGRATED SMART ENERGY MANAGEMENT AND SERVICE PLATFORM



# GREEN ENERGY-POWERED TRANSPORTATION

On May 12, 2020, the smart battery-swap heavy-duty trucks developed by CPI Ronghe Financial Leasing Co., Ltd. have achieved a milestone breakthrough of 1-million-km safe operation at the first green base of sandstone for building in Beijing, the Highway & Railway Green Chain Project. This marks the remarkable results of the large-scale application of SPIC's smart battery-swap heavy-duty trucks. And the new mode of green and clean transportation has stood the test of the market. On September 4, CPI Ronghe Financial Leasing Co., Ltd. launched an entirely new battery-swap wide-bodied mining dump truck, with a container volume of 36m³, 58% larger than similar wide-bodied mining dump truck in the market. Its rated maximum load is up to 75 tons, with its transport capacity 50% higher than the average level, saving about 41% of the economic cost. As a new generation product of the "Magic Cube" Series, the battery-swap mining dump trucks will take the lead in improving the green, low-carbon and circular development of transportation system and facilitating the "electricity replacement".



Now, SPIC's "Magic Cube" Series have covered 34 types of battery-swap heavy-duty trucks and construction machinery products, which are able to fully satisfy the electric application needs in all kinds of short-distance connection scenarios. Furthermore, contracts have been signed on 66 charging stations distributed around the country, 8 of which have been completed, and the other 58 are under construction, site selection or planning.

## Urban Scenarios



Urban construction sandstone and muck transportation, concrete mixing and transportation, urban sanitation transportation and other urban short-distance transportation, as well as highway & railway multimodal transportation scenarios.

## Mining Scenarios



Transportation within large open-pit mines and short-distance connection for the external transportation of mineral products.

## Power Plant Scenarios



The transportation of electricity coal, coal ash, coal cinder and gypsum within a 100KM distance around thermal power plants.

## Port Scenarios



Short-distance connection inside the port, or short-distance barge from the terminal to the yard outside the port.

## Heavy Industry Scenarios



Closed transportation of raw materials and finished products inside the plant and short-distance barge outside the plant.

## Highway & Waterway Scenarios



Short-distance transshipment of goods queuing up to pass through the lock, which happens between the upstream port and downstream port of the lock.

# LOOKING TO THE FUTURE

At the China Brand Forum 2020 hosted by People's Daily on December 8, 2020, Mr. Qian Zhimin, Chairman of SPIC, delivered a speech titled "The Era of Green and Smart Energy Mega Brands Has Come". In the speech, he announced that by 2023, SPIC would achieve the carbon peak in China, becoming the first central state-owned enterprise to announce the time for realizing carbon peak.

中国二氧化碳排放力争2030年前达到峰值  
努力争取2060年前实现碳中和

“中国3060”

## In 2020

Becoming a leading clean energy enterprise in China

Total installed capacity	The proportion of installed power generated from clean energy exceeding
<b>179<sub>GW</sub></b>	<b>50%</b>

## By 2025

Becoming a clean energy enterprise with international influence

Total installed capacity	The proportion of installed power generated from clean energy increasing to
<b>220<sub>GW</sub></b>	<b>60%</b>

## By 2035

Basically developing into a world-class clean energy enterprise with global competitiveness

Total installed capacity	The proportion of installed power generated from clean energy rising to
<b>270<sub>GW</sub></b>	<b>75%</b>





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