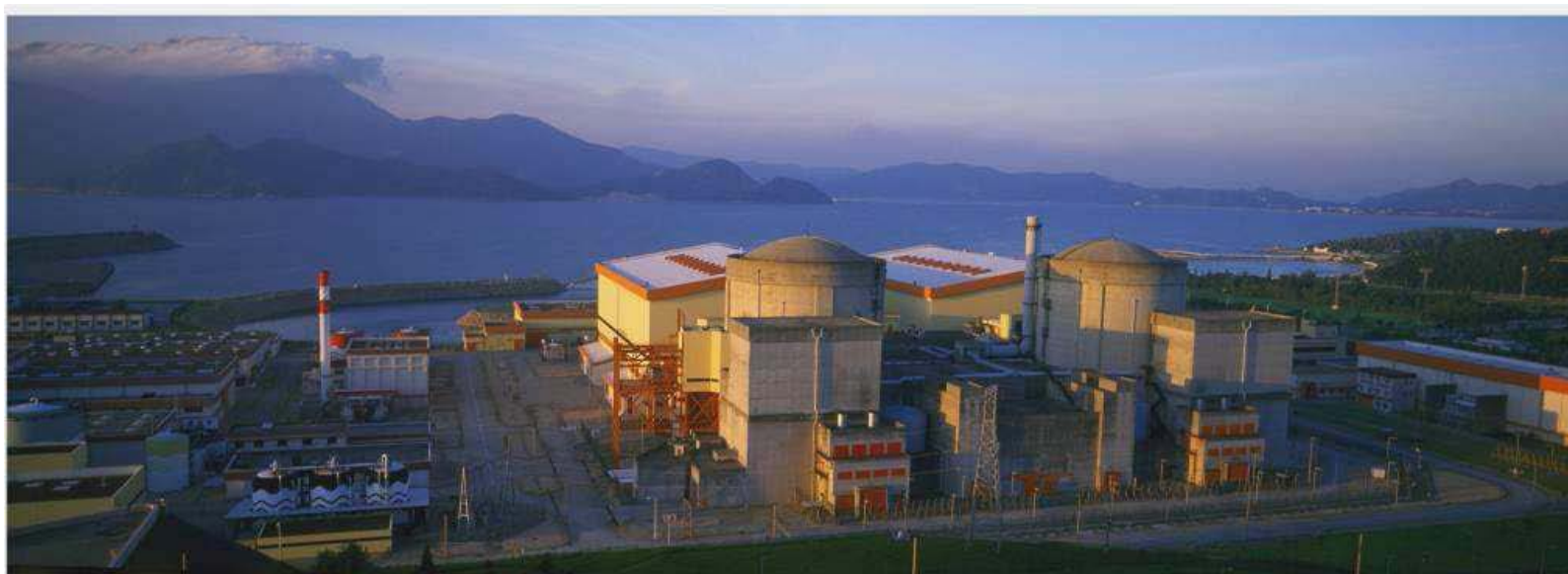

EDF IN CHINA



Daya Bay, the first nuclear power plant in China, built under a partnership with EDF that dates back to 1983.

Print only if necessary.

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1. CHINA: THE CENTRE OF GRAVITY OF THE GLOBAL ENERGY INDUSTRY

Exponential growth in the Chinese energy market

The Chinese energy market – like many other sectors of the country’s economy – is seeing strong growth, **due to increasing electricity consumption**¹ (up 7.5% in 2013) which is being driven by the country’s economic expansion. China has to boost its electricity generation capacity to meet this demand. The country’s installed generating capacity increased by 9.5% in 2013 **to a total of 1247 GW**.

The world’s largest nuclear energy market

China installs between 70 and 80 GW of new generating capacity every year on average. By way of comparison, EDF’s entire installed base in France has a total capacity of almost 100 GW. By 2020, China will have built 350 GW of coal-fired generating capacity, 140 GW of hydro capacity, 100 GW of wind capacity, and 40 GW of nuclear capacity. In addition, the transmission and distribution infrastructure installed during the same period will be ten times larger than the French electricity grid. **This huge nuclear construction programme** – currently the world’s biggest – will see nuclear occupy a central role in China’s energy policy. Half the nuclear power plants currently under construction around the world are in China. As of the end of 2014, the country has 22 nuclear reactors in operation, and 28 under construction, on track to meet the target of having a nuclear installed base of 58 GW by 2020, and at least 10 new reactors per year in the years that follow.

Half the nuclear power plants currently under construction around the world are in China

22 reactors in operation	28 reactors under construction
4 1000-MW PWRs (French design)	17 CPR1000 reactors (Chinese reactors based on French design)
9 CPR1000 reactors (Chinese reactors based on French design)	4 AP1000 reactors (US design)
4 650-MW PWRs (French-based design)	2 VVER reactors (Russian design)
2 CANDU reactors (Canadian design)	2 EPR reactors (French design)
2 VVER reactors (Russian design)	2 650-MW PWRs (French-based design)
1 300-MW reactor (Chinese design)	1 200-MW high-temperature reactor

Against this backdrop, China has become a major global scientific hub. The country is the centre of gravity of the global electricity industry, acting as a crucible for the development of technologies, their deployment on an industrial scale, and the gathering of experience in all areas, from generation to distribution.

¹ According to national electric power industry statistics from the China Energy Council (CEC).

Other exploitable resources

Coal remains the main component of China's energy mix. In 2013, it still represented 69% of installed capacity, compared with 75% in 2012. China now accounts for more than half of global coal consumption.

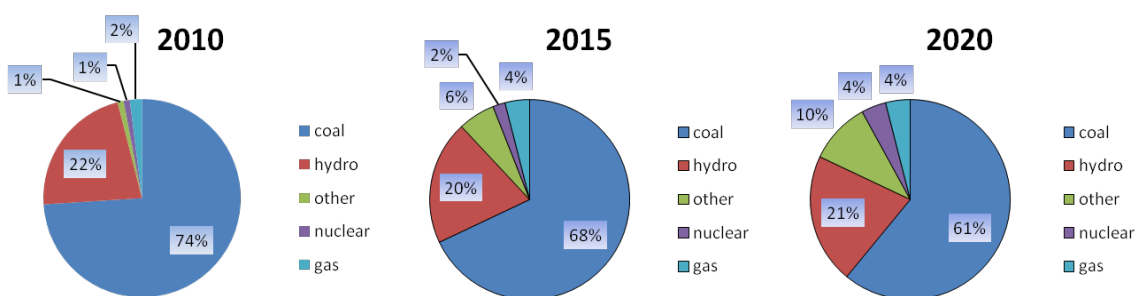
China also has enormous potential for hydro power. Current installed capacity stands at 260 GW, making China the world's leading generator of hydro-electric power. According to official statistics, the country has economically exploitable hydro power resources totalling 420 GW.

China also has significant wind and solar generating capacity. As of the end of 2014, the country has the world's largest installed base of wind power, ahead of the USA, at 100 GW. Solar power is not being left behind, however: China is the world's leading manufacturer of photovoltaic panels, and had an installed base of 20 GW in 2014. The target for installed photovoltaic generating capacity by the end of 2015 is now 35 GW, a figure increased on several occasions by the Chinese government in order to support the domestic photovoltaic industry, which had been hit by the global crisis.

China has the world's largest installed base of wind power, ahead of the USA

China therefore has to resolve the conundrum posed by strong growth combined with a fossil-based energy mix and a need to improve environmental performance.

China's energy mix by 2020



Source: NEA/China Bureau of Statistics

Investing in energy efficiency, improving environmental performance

China is the world's leading emitter of CO₂ (accounting for 25% of global emissions since 2010) and sulphur dioxide (SO₂). However, the country is committed to efforts to combat air pollution and climate change. In July 2014, for example, **new emissions standards for thermal power plants came into force**. These rules are even stricter than European and American standards (100 mg/Nm³ for NO_x, 50 mg/Nm³ for SO₂, and 30 mg/Nm³ for dust), and will be gradually strengthened up to 2020 to ensure comparable levels for coal and gas power plants.

China has also committed to **limiting its CO₂ emissions**. As early as 2009, the government set a target of reducing its CO₂ emissions by between 40 and 45% by 2020. In November 2014, President Xi Jinping announced that the country's CO₂ emissions should stop rising by around 2030. **This means that China is moving towards a less carbon-intensive energy mix**, and developing advanced "clean coal" technologies, in which it has already established a globally leading position. The twelfth five-year plan aims to promote innovative technologies, notably by directing foreign investments towards new technologies. China is investing massively in restructuring its energy mix, increasing the share of renewable energies (target for 2020: 15% renewables in the primary energy mix) and making its economy more energy efficient. A number of technological developments are expected in these fields as a result.

In July 2014, new emissions standards for thermal power plants came into force

2. OVER 30 YEARS OF FRANCO-CHINESE COOPERATION IN NUCLEAR POWER

In 2013, the EDF Group, the world's leading integrated electric utility, celebrated 30 years of presence in China.

A long term partner for nuclear power in China

EDF's first steps in China: the construction of the Daya Bay nuclear power plant

In 1983, EDF signed a contract with the future China General Nuclear Power Group (CGN) to design and act as prime contractor for China's first nuclear power plant, to be constructed at **Daya Bay** in Guangdong, the "pilot" province for the economic reforms initiated by Premier Deng Xiaoping. The nuclear power plant at Gravelines in Northern France served as the reference plant for the two 985-MW units. Daya Bay nuclear power plant entered service in 1994.

In 1995, EDF was contracted by CGN to provide project management assistance for the two units at China's second nuclear power plant at **Ling Ao** (also in Guangdong province). CGN was responsible for overall project ownership and engineering for Ling Ao Phase I (2 x 985 MW).

EDF: a French pioneer in the expanding Chinese nuclear market

In 2005, the signing of a long-term cooperation agreement between EDF and CGN provided the framework for continued cooperation on the Ling Ao project, with EDF supplying project management assistance to CGN for the construction of two new 1080-MW units at the Ling Ao plant.

The majority of reactors currently in operation and under construction in China are **CPR 1000 units, based on the design used for the French nuclear fleet.**

In late 2006, the proportion of French-designed reactors in the Chinese fleet was boosted further when the Chinese government approved the construction by CGN of two EPR units at **Taishan** (Guangdong province).

Following this decision, **EDF and CGN** entered a Global Partnership Agreement (GPA) in 2007, a **balanced partnership** between operators designed to formalise EDF's lasting commitment to the Chinese nuclear programme. The agreement, signed during the French President's visit to China, confirmed the long term partnership between EDF and CGN. It also paved the way for the creation of a joint venture between EDF and CGN for the construction and operation of the two EPR units at Taishan.

The Taishan Nuclear Power Joint Venture Company (TNPJVC) was set up a year later, in 2008, with CGN holding 51% of shares. EDF has a 30% shareholding, and, since 2012, 19% of shares have been held by the Guangdong

EDF thus became the first and so far only foreign investor in the field of nuclear operations in China

Yuedian electric utility. EDF thus became the first and so far only foreign investor in the field of nuclear operations in China.

Cooperation with the entire Chinese nuclear industry is very important for EDF, and for the whole of the French nuclear sector. On 29 April 2010, EDF signed a framework agreement to cooperate on design, engineering and R&D with China National Nuclear Corporation (CNNC), which operates 11 units, and is building a further 10.

Long term French partners in the Chinese nuclear industry sign agreement to design a Franco-Chinese reactor with a capacity of 1000 MW

In October 2012, EDF, CGN and AREVA signed a Memorandum of Understanding relating to the design of a new Franco-Chinese reactor known as the ACE 1000. The agreement relates to the preliminary phase of the development of the 1000-MW reactor. It also provides a framework for the negotiation of agreements between the partners for the basic design of the new reactor.

2013-2014: EDF, AREVA, CGN and CNNC strengthen their cooperation in operation and maintenance

During the visit to China by the French President in April 2013, EDF, AREVA and CGN signed a joint declaration reaffirming their commitment to successfully completing the construction of the first two reactors at Taishan and placing them into commercial service. The agreement will set the stage for the effective development of future reactors.

This enhanced cooperation will also see EDF and AREVA contributing – in their respective areas of expertise – to the improvement of the safety, maintenance and performance of CGN's reactors in operation, and to the evolution of its fleet. The three partners also referred to the possibility of cooperating on future international projects within the framework of the agreement, and on the basis of their respective nuclear industry experience.

In March 2014, on the occasion of the visit to France by Xi Jinping, President of the People's Republic of China, EDF signed a series of agreements with its Chinese partners CGN and CNNC aimed at continuing their cooperation across all their areas of expertise (operation, maintenance and engineering), with the shared objective of **ensuring the best possible level of safety**.

EDF and CGN also signed an agreement to promote industrial cooperation between EDF and its Chinese partners in the UK nuclear market.

Focus on the construction site for two EPR units at Taishan

The Taishan project currently benefits from experience gained from the other two EPR construction sites (EDF's Flamanville 3, and Olkiluoto 3, managed by AREVA), as well as the dynamic construction programme in China, where CGN is currently building 13 CPR1000 reactors.

The first concrete for Taishan 1 and 2 was poured in November 2009 and April 2010 respectively. The dome was installed on the reactor building of unit 1 on 23 October 2011.

An important new milestone in the construction of the nuclear island of Taishan 1 was reached on 6 May 2012, when the reactor vessel was transferred into the reactor building. Careful advance coordination of a range of different activities (civil engineering, commissioning tests of the polar crane, etc.) by the site owner and future operator TNPJVC, in collaboration with partners, was key to the success of the operation. (EDF has a 30% shareholding in TNPJVC).

On 12 September 2012, less than one year after the dome was installed on the unit 1 reactor building, TNPJVC performed the same operation on unit 2. Lifting operations on such a huge scale required one of the most powerful cranes in the world to be used for both units. With its dome in place, the reactor building is ready to receive the main components of the nuclear steam supply system (steam generators, reactor vessel, pressurizer, etc.).

As of the end of 2014, the construction of the buildings as well as the manufacture and supply of the main equipment have been completed for both units. Electro-mechanical assembly work continues at a brisk pace.



Installation of the reactor building dome on unit 2, 12 September 2012

The UK's Hinkley Point C EPR project: a new step in a long-term Franco-Chinese partnership

The existing long-standing cooperation between France and China in the civil nuclear sector was strengthened by the announcement, on 21 October 2013, of a strategic and industrial partnership between EDF and Chinese firms for the Hinkley Point C nuclear power plant project in the UK (involving the construction of two 1650-MW EPR



units). EDF, AREVA, CGN and CNNC have signed Letters of Intent to that effect. A new milestone was passed in October 2014 when the European Commission gave its approval for the project.

The Chinese partners CGN and CNNC boast extensive expertise in the development, construction and operation of nuclear power plants. The Hinkley Point C project will, in particular, benefit from CGN's experience of the construction of two EPR units at Taishan.

The anticipated shareholding structure – to be confirmed by EDF's final investment decision – is as follows:

- EDF Group 45-50%
- AREVA 10%
- China General Nuclear Corporation (CGN) } 30 – 40%
- China National Nuclear Corporation (CNNC)
- Discussions are also being held with a selection of interested investors, whose share could rise to 15%.

The Hinkley Point C project, which represents a major opportunity for the EDF Group, is also an opportunity for the entire French nuclear industry. The latter will benefit extensively from this investment, which will lead to thousands of jobs being created or secured in the coming years, and – following on from the Taishan project – will further strengthen global recognition of the industry.



Focus

The nuclear market in China: an opportunity for the entire French nuclear industry

EDF has become a key partner for China, where it enjoys a strong reputation.

Cooperation between France and China in the nuclear industry involves not only the major groups (EDF, AREVA and ALSTOM), but also a whole raft of French companies, such as the 90 members of the France-China Electricity Partnership (PFCE). Set up at the initiative of EDF in 1996, the Partnership aims to promote the sustainable involvement of French small and medium-sized companies in the Chinese nuclear programme, in particular via the establishment of entities in China, and the creation of partnerships between French and Chinese companies in the fields of design, manufacturing, construction, commissioning and maintenance of nuclear power plants.

Thanks to the use by CGN of French standards and technical specifications, the members of PFCE have already secured contracts worth over 1.5 billion euros in China. A second association, France Worldwide Electricity Partnership (PFME), was set up in 2012.

PFME will pursue the same objectives of promoting safety and competitiveness in nuclear generation, allowing French SMEs to partner countries wishing to develop and implement a nuclear industrial policy.

For EDF and the entire French nuclear sector, China currently represents a unique opportunity to consolidate and sustain its expertise in nuclear power.



Members of the France-China Electricity Partnership

3. A PRESENCE ACROSS ALL DOMAINS

The partnership, which began in the nuclear industry in 1983, has expanded over the years as the Group has diversified into hydro power, thermal power, research & development (R&D) and energy services. From the 1980s to the early years of the new century, EDF deployed its expertise in support of Chinese projects, signing twenty or so cooperation agreements in the nuclear industry, as well as in the thermal and hydro power sectors and in R&D.

Hydro power

In hydro power, the Group contributed in particular to the design and commissioning of the major pumped storage hydroelectricity stations at Cong Hua, Tian Huang Ping and Zhang He Wan.

Thermal power

EDF has also had a presence in the Chinese coal-fired power generation sector since 1997, when the Guangxi regional government signed and approved the concession contract for the Laibin B power plant. The plant entered service in 2000, under a BOT (Build, Operate, Transfer) contract, according to which the plant is to be transferred to the Guangxi government in 2015. EDF owns 100% of the project. The Group also holds a 19.6% share in a company which operates coal-fired power plants in Shandong province, with a total capacity of 3060 MW.

In 2009, EDF expanded its thermal power generation business in China by acquiring a 35% share in the Sanmenxia supercritical coal plant (2 x 600 MW), alongside leading Chinese electric utility China Datang Corporation (60%) and the city of Sanmenxia (5%).

In 2014, the cooperation between EDF and Datang was stepped up when the partners signed an agreement for EDF to take a 49% shareholding in Datang International Fuzhou Power Generation Company Ltd (FPC). This joint company is building, and will operate, an ultra-supercritical coal-fired power plant with two 1,000-MW units at the Fuzhou site in Jiangxi province, South-Eastern China.



Fuzhou construction site

Scheduled to enter service in 2016, Fuzhou will be the first ultra-supercritical coal-fired power plant to be operated by EDF. The technology ensures high efficiency while reducing environmental impact. EDF's involvement in the project also provides an opportunity for the Group to boost its expertise and experience.

R&D

In addition, to support the international growth of the EDF Group, and provide a fertile breeding ground for innovative development projects, an R&D centre was opened in Beijing in 2011. The centre provides a platform for involvement in Chinese projects on smart networks, sustainable cities, energy efficiency, concentrated solar power, and CO2 capture and storage. It also supports R&D at EDF Group level by sharing experience on innovations in China and Asia. It plays host to researchers from French laboratories and the European Institute for Energy Research (EIFER) in Germany, as well as French and Chinese research students. The centre's academic partners include Tsinghua University, Ecole centrale de Pékin, and the Ecole des Mines in Paris.

R&D will also be a growth area for the Group's business in China

R&D will also be a growth area for the Group's business in China, supported by the R&D centre based in Beijing. Given the Chinese government's wish to improve its environmental performance, R&D has a key role to play, and a wide range of opportunities are available. Concepts for sustainable low-carbon cities and energy efficiency feature increasingly prominently in the Chinese authorities' development objectives. In the light of the scale of the market, and its vast potential, Chinese codes and standards may become established as the norm at global level, particularly in the electric vehicles market. EDF's R&D centre in Beijing is poised to exploit these opportunities, and has already entered into a number of cooperation agreements with leading Chinese institutes and universities.

EDF and the Chinese Academy of Sciences are collaborating on the pilot concentrated solar power plant project at Badaling, near Beijing (capacity: 1.5 MW), the first demonstrator facility on this scale anywhere in Asia. The aim of the project, scheduled to run until 2016, is to optimise the generation of electricity using reflecting mirrors and



The solar concentrator tower at Badaling, surrounded by 100 reflecting mirrors.

thermal energy stored in the form of oil and steam. The EDF Group's digital simulation tools will play a key role in the work. This innovative technology allows fluctuations in power generation to be smoothed out, thereby combating problems associated with the intermittent nature of solar energy.

Did you know?

EDF was in China for the first race in the Formula E world championship under an agreement with the Fédération Internationale de l'Automobile (FIA). A team of experts* from the research centres at Les Renardières (France) and EDF R&D China (Beijing) conducted an audit of electric power supplies, charging systems and safety procedures relating to this innovative competition.



Energy services

The EDF Group is also developing its energy services business. The aim is to provide innovative solutions for manufacturers and eco-districts, based on capabilities already developed by EDF in Europe, in particular gas-fired combined heat and power generation (CHP), waste heat recovery, and decentralised renewable energies (such as heat pumps, urban solar power, biomass, and geothermal energy).

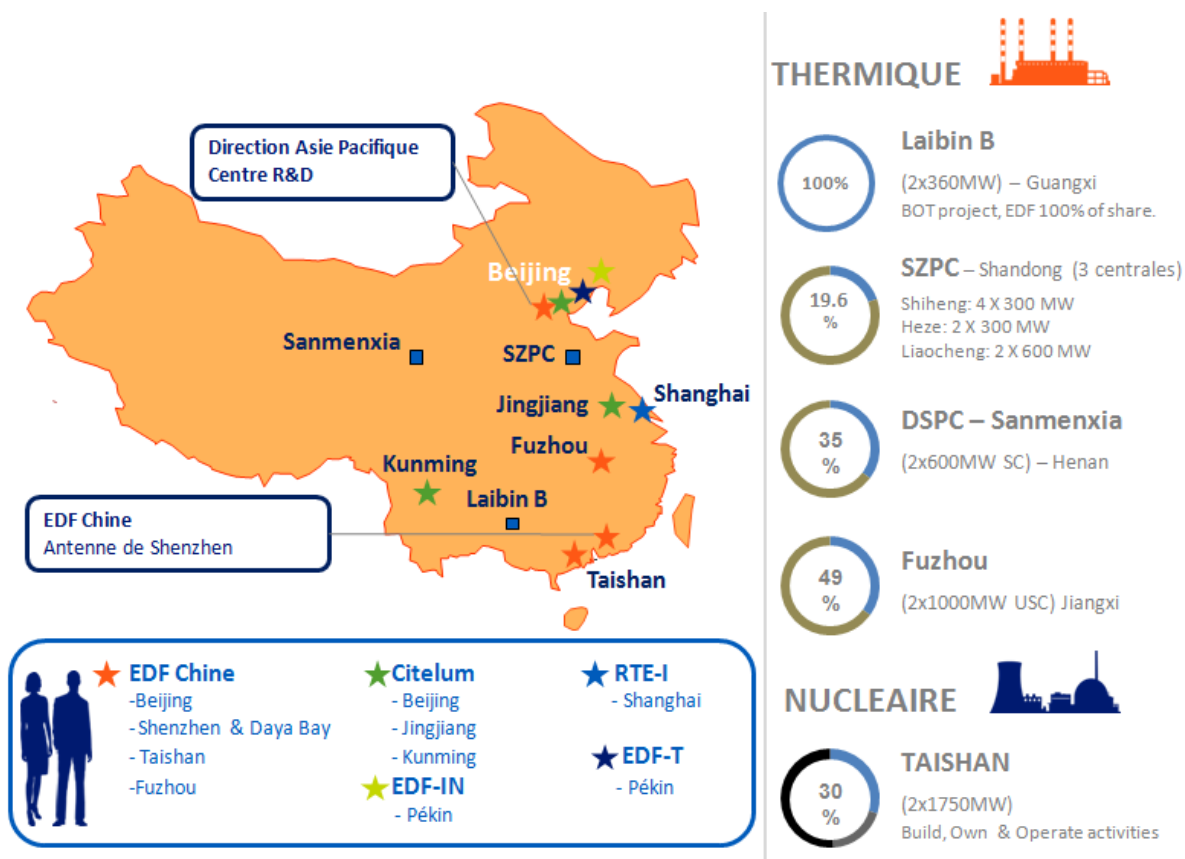
Under a cooperation agreement on energy efficiency with Dongfeng Peugeot Citroën (DPCA), EDF upgraded over 70,000 light points in the firm's plant at Wuhan in 2013 and 2014.

Smart control tools (sensors) used in combination with low-power LED lighting have allowed the customer to reduce its electricity consumption by 50%, resulting in savings of 9 GWh per year, and avoiding the production of 9,000 tonnes of CO₂. EDF is paid on the basis of the electricity savings made by the customer. Other energy efficiency projects are also in development.

The Group aims to provide innovative solutions for manufacturers and eco-districts

Finally, in line with Group policy, **EDF International Networks (EDF-IN)** is also aiming to grow its business in China. The Group's distribution subsidiary, which has had a presence in Beijing since September 2011, aims to provide the very best of its capabilities and expertise to support the management and performance of China's electricity network. In 2014, EDF-IN signed several technical support contracts designed to improve the performance of the distribution network in the Chinese provinces.

4. EDF CHINA LOCATION MAP



Key figures

More than **30** years of cooperation

517 employees and many business units

Total gross installed capacity of **10420** MW

1 new generation coal-fired power plant under construction

2 EPR reactors under construction