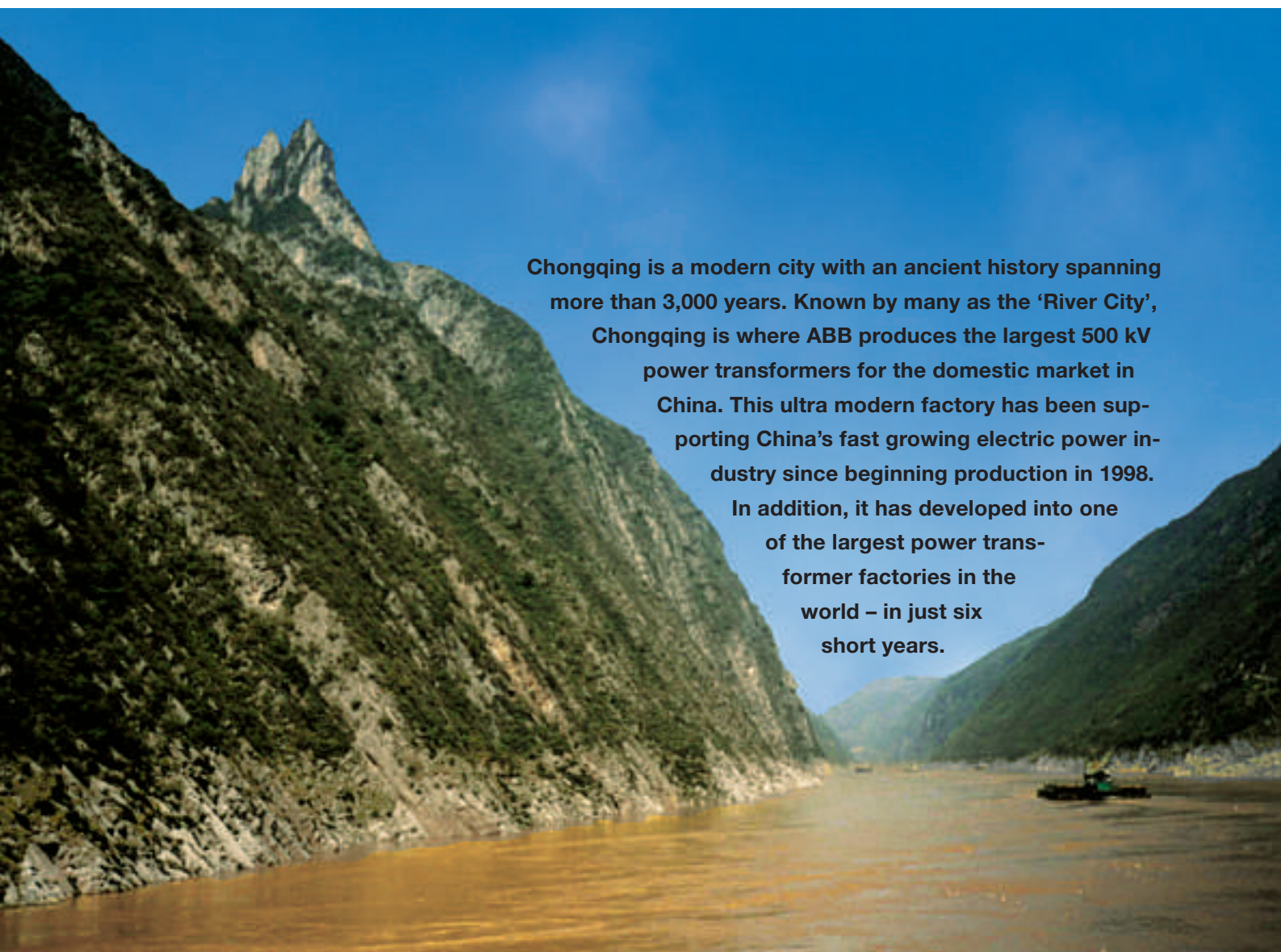




Made in China

ABB's power transformer
factory in Chongqing

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Chongqing is a modern city with an ancient history spanning more than 3,000 years. Known by many as the 'River City', Chongqing is where ABB produces the largest 500 kV power transformers for the domestic market in China. This ultra modern factory has been supporting China's fast growing electric power industry since beginning production in 1998. In addition, it has developed into one of the largest power transformer factories in the world – in just six short years.

The electric power industry in China has grown impressively since the 1980's. In particular, economic development in the area around the Pearl River and Yangtze River Deltas has contributed enormously to the quick expansion of the electric power grid. The eastern and southern coastal areas continue to consume the largest amount of electricity, while abundant energy resources are located in northern and western China. It is this that is driving the construction of 500 kV power transmission lines between those regions.

As power transformers are key equipment in any electric power systems, the demand for exceptionally good quality products is naturally high to support the extension of power grids and power plants. This became especially evident at the start of the Three Gorges project in the Yangtze River in 1992 where large, high voltage power transformers with high reliability were needed.

In a region with huge market potential, the necessity of creating an advanced transformer factory in an area with river and sea access soon became clear in or-

der to meet the demands for these types of large power plant projects.

As a renowned supplier of transformers, coupled with its reputation and experience in transferring transformer technology – for example to Canada and Brazil – ABB was selected as one half of a partnership, or joint venture, to set up a 500 kV power transformer factory in the city of Chongqing, in southwest China.

Chongqing is situated on the upper branch of the Yangtze River and is one of the most important industrial centers in western China. In choosing Chongqing as the location for this big transformer factory, manufacturers are well positioned to supply large power transformers to the coastal areas via the Yangtze River as well as to hydropower stations in southwestern China.

Formation of the joint venture

ABB, with the help and support of the Chinese government, set up a production base for 500 kV power transformers in Chongqing to support the Three Gorges project and other big power generation and transmission projects in China. Now known as ABB

Chongqing Transformer Company Ltd., it is the only joint venture for the manufacture of 500kV transformers approved by the Chinese central government, and is owned by ABB and Chongqing Transformer Company Ltd.

In operation since January 1998, the plant utilizes the land and buildings of a former state-owned local transformer factory in Chongqing.

Transfer of technology and training of employees

Perhaps the biggest factor that has contributed to the overall success of the company has been the successful training of employees and the subsequent transfer of technology. Most of this work, together with internal support for this project came from ABB's transformer factory in Ludvika, Sweden.

Training was carried out in Ludvika in parallel with investments in factory upgrades in Chongqing. An intensive and effective training program, based on the manufacturing of transformers from design to final testing for Chinese customers, was used as a learning tool for managers, engineers and operators from

1

ABB's power transformer factory in Chongqing, China



2

A high voltage test hall for 500 kV and 750 kV class products





ABB Chongqing. The Chinese personnel, under the guidance of Swedish experts, completed the program in a '100 percent ABB atmosphere'. The exercise was known as 'CPiL', an abbreviation for 'Chinese Production in Ludvika'.

As training progressed in Sweden, the old workshops in Chongqing were being revamped to bring them into line with the latest ABB specifications. A 500 kV transformer assembly workshop was added to the existing factory buildings and a high voltage test hall, with modern equipment to test 500 kV and 750 kV class products, was erected **2**. All manufacturing facilities were upgraded with state-of-the-art manufacturing equipment and tooling, and the workshops were equipped with air conditioning and humidity control. All this work was completed in 2000. In 2001, the road to Chongqing harbor was prepared for heavy transport and the harbor was equipped with a 400 ton floating crane to support the shipment of products to the customer **3**.

The final part of the CPiL program was completed in the upgraded facilities in Chongqing. In addition to CpiL, many other training programs, managed by ABB, have helped the employees in the Chongqing factory adopt ABB management principles and processes.

From 800 to 25000 MVA annual transformer production

In December 1998, the design, manufacture and testing of the first 110 kV TrafoStar transformer in Chongqing was completed. The following year saw the delivery of the first six 220 kV transformers, and in 2000 the first four 500 kV transformers were delivered. After that, volumes started to rapidly increase.

Table 1 details the annual production volumes during the short history of the company.

In 2003, high voltage shunt reactors were added to the production program

3 A 400 ton floating crane at Chongqing harbor to support the shipment of customer products.



and the first twelve 500 kV reactors were manufactured. Over the last six years, the company has developed into the largest power transformer manufacturing company, counted in MVA production volume, within the ABB group.

year	Production volume MVA	Production volume units	500 kV units
1999	842	14	-
2000	3665	50	4
2001	5540	53	9
2002	10183	70	29
2003	16807	89	56
2004	25104*	105*	69*

* According to production plan 2004.

Quality

The focus for ABB Chongqing was to establish a factory that manufactures large power transformers to the highest

international quality level. Quality control has therefore been of top priority during the investment and technology transfer phases. In 1999, ABB Chongqing passed a quality audit performed by the international auditors Det Norske Veritas, and in December of the same year the company was awarded its ISO 9001 Quality System Certificate. Since then ABB Chongqing has also been certified according to the environmental standard, ISO 14001, as well as to the Chinese occupational health and safety standard, OHSAS 18001.

Like all ABB power transformer factories, ABB Chongqing is using the Six Sigma methodology to measure and control the quality of its operations. Using this methodology:

- The quality of the product is measured in a large number of the production steps.
- The measured quantities are compared against target values to deter-

mine the given tolerances and the DPMO-value (defects-per-million-opportunities).

■ These DPMO-values can then be converted into Sigma values to give an overall measure of the quality level of the product.

4 shows the development of the Sigma value for ABB's Chongqing operations from 2000 to 2003. With an industrial standard value of typically 3.5, it can be seen that the quality level of the ABB Chongqing operations shows very good improvement over time and is currently well on par with other industrial leaders.

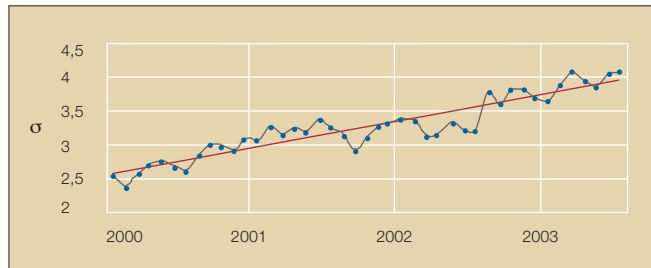
The real test of product quality is of course its performance during operation. To date, all power transformers manufactured at ABB's Chongqing factory have and continue to perform very well in Chinese power plants and various substations. Producing high quality and high performance products means that ABB Chongqing now has an excellent reputation within the Chinese Electric Supply Bureaus and grid companies.

Customer confidence

Transformers from the Chongqing factory are installed in many key substations. One of these is the 500 kV substation in the fast growing Pudong economic developing zone in downtown Shanghai. This substation is equipped with two 1000 MVA banks of single-phase autotransformers. The transformers are rated at 334 MVA, 510/230±2*2,5%/36 kV. In order to meet strict environmental requirements, the cooling of the transformers is designed as ONAN/ONAF, ie, self-cooling

4

Development of Sigma value for ABB Chongqing operations



by air up to 67 percent of full load and thereafter forced air-cooling by fans. ABB Chongqing completed this order, from the contract right through to commissioning, within just one year.

Steam turbine generators produce more than three-quarters of the electricity in China today. Together, 600 MW generators and 720 MVA generator step-up transformers are commonly used in thermal power. Three phase transformers are preferred when transport facilities permits. ABB Chongqing was awarded a contract to deliver 4 units of this type of transformer to a new power plant in the city of Jiaxing, which is situated on the border between Shanghai

and the Zhejiang province. Using this project as a reference, ABB Chongqing has received more orders for similar transformers, thus making it one of the major suppliers of large generator transformers in China.

These examples show that, within only six years, ABB Chongqing is now capable of manufacturing transformers of the *highest* quality up the *highest* ratings required in the Chinese power system, using the *highest* ABB quality level.

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