

Abstract

East Asia in the global market:  
An analysis of the electrical equipment industry

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1. Introduction

This paper explores the actual condition, competition, and competitive advantages of East Asia's electrical equipment industry.

The electrical equipment industry comprises the manufacturing and installation of turbines, generators, motors, transformers, switchgear, and so on. These products are supplied to the electrical grid as social infrastructure or to manufacturing industries as power systems. Therefore, the electrical equipment industry is materially important to a nation's or region's competitiveness.

The features of the electrical equipment industry are that the global market for its goods has existed since the late 19<sup>th</sup> century, and that, at the same time, related technologies have been traded internationally. Global suppliers of electrical equipment include American companies such as General Electric and Westinghouse, of which the latter's atomic power department is now under Toshiba, while some other divisions are now part of Siemens; European companies such as Siemens, Alstom, and Brown Boveri, the latter of which became part of ASEA, and then Alstom Power; Japanese companies such as Toshiba, Hitachi, Mitsubishi Heavy Industries and Mitsubishi Electric, and Fuji Electric. Although

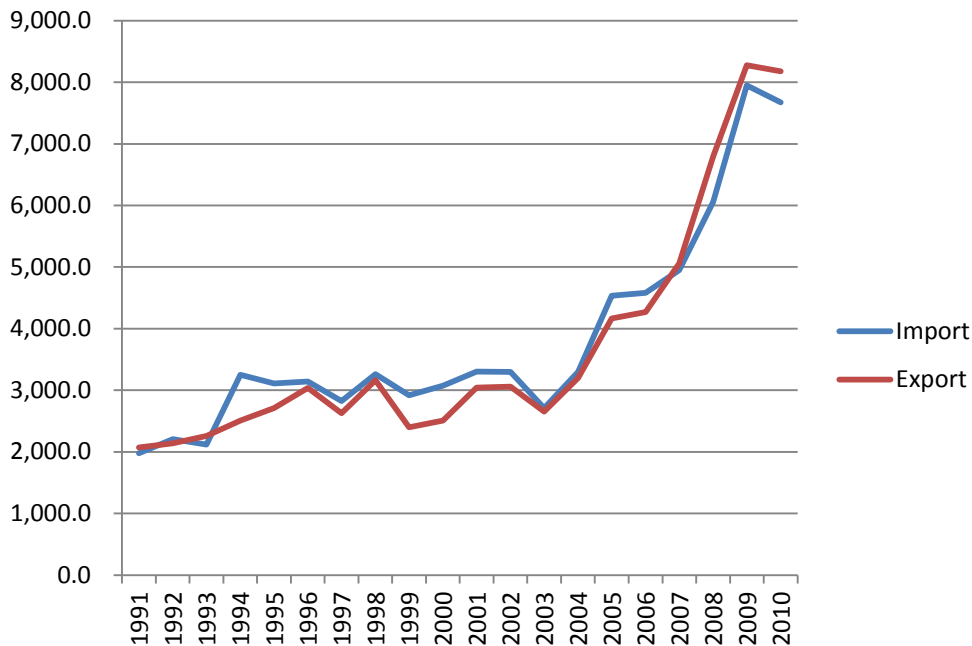
international alliances and cooperative relationships were sometimes reorganized, for the most part, electrical equipment manufacturing has been shouldered by a big global business with a history that is a century or more long. Therefore, we can say that one of the features of the industry is its internationalism. On the other hand, the electrical equipment industry exhibits characteristics of regionalism. With the exception of the “socialist” countries, steam turbine generators, for example, have been exclusively produced in the United States, several European countries, and Japan. Because it is an essential industry, almost the entire industry was greatly affected by national industrial policies introduced between WWII and the 1990s.

However, from the 1990s onward, the electrical equipment industry was reorganized globally and changed its long-term industrial structure. This paper examines the dynamics of the industry by focusing on steam turbines and steam turbine generators. In particular, it examines the dynamics of the East Asian industry by focusing on steam turbines and steam turbine generators and addressing the questions of how the East Asian electrical equipment industry developed under the industry’s global reorganization, and what causes the industry’s competitive advantage in the East Asian region.

## 2. Electrical equipment industry: An overview

While since the early years, big businesses in the electrical equipment industry operated globally, the electrical markets were comparatively domestic. Because large-sized steam turbines, generators, and a series of electrical products were critical components of national electrical power grids, governments procured electrical equipment from national manufacturers and protected their domestic markets, while the American market remained

**Fig. 1 World trade of steam turbines**

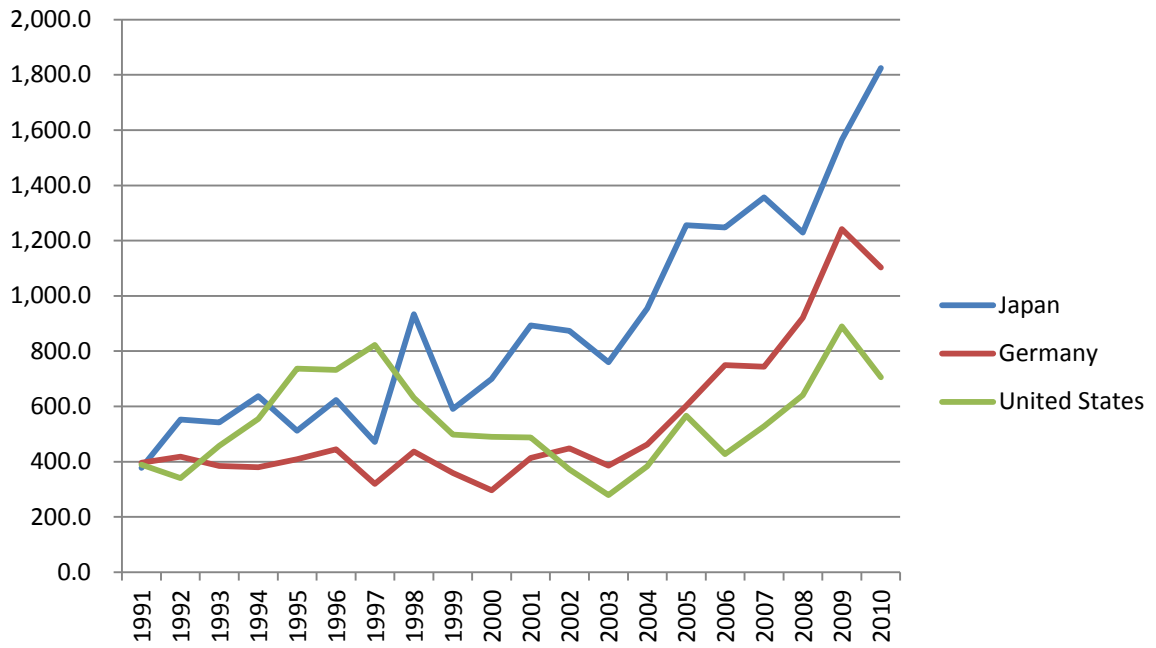


Source: United Nations

comparatively open. However, in the 1990s, privatization and liberalization of the electric power business changed domestic markets, opening them to international procurement and creating conditions for the emergence of the independent power producers. These changes in the electric power market brought about a reorganization of the electrical equipment industry.

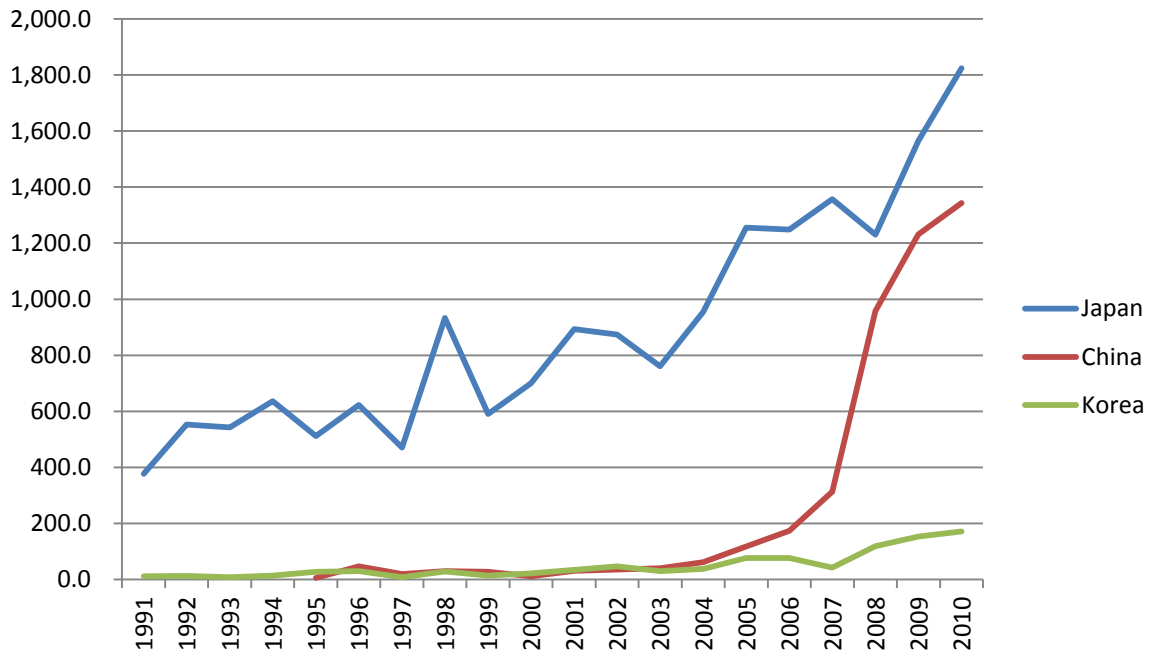
First, the industry's dynamics need to be reviewed from the perspective of the development of the world market. Fig. 1 shows the trend in exports and imports of steam turbines. While exports and imports were stabilized at approximately US\$ 3 billion during the 1990s, from 2004 onward, the value of both exports and imports soared and reached approximately US\$ 8 billion in 2010. Japan, the United States, and European countries such as Germany and France have been the main exporters of steam turbines for a long time. Among them, the exports of Japan, the United States, and Germany were approximately US\$ 0.4 billion each. In 2010, Japan's exports increased to \$1.8 billion,

**Fig. 2 Export of steam turbines by 3 countries**



Source: United Nations

**Fig. 3 Export of steam turbines by East Asia**



Source: United Nations

Germany's increased to \$1.1 billion, and those of the United States increased to \$0.7 billion, although the increase in US exports was slower than the increase in exports of the other two countries (Fig. 2).

In East Asia, China's exports soared during the first decade of the 20<sup>th</sup> century. While the value of China's exports of steam turbines was US\$ 62 million in 2004, its exports jumped to US\$ 1.3 billion, by more than 20 times, in 2010 (Fig. 3). From the viewpoint of world export statistics, the globalization of the steam turbine market was caused by an expansion of China's exports, in addition to growth in exports of the traditional exporters, Japan and Germany. In all, East Asia was one of the central areas of globalization of the electrical products industry.

### 3. The dynamics in East Asia

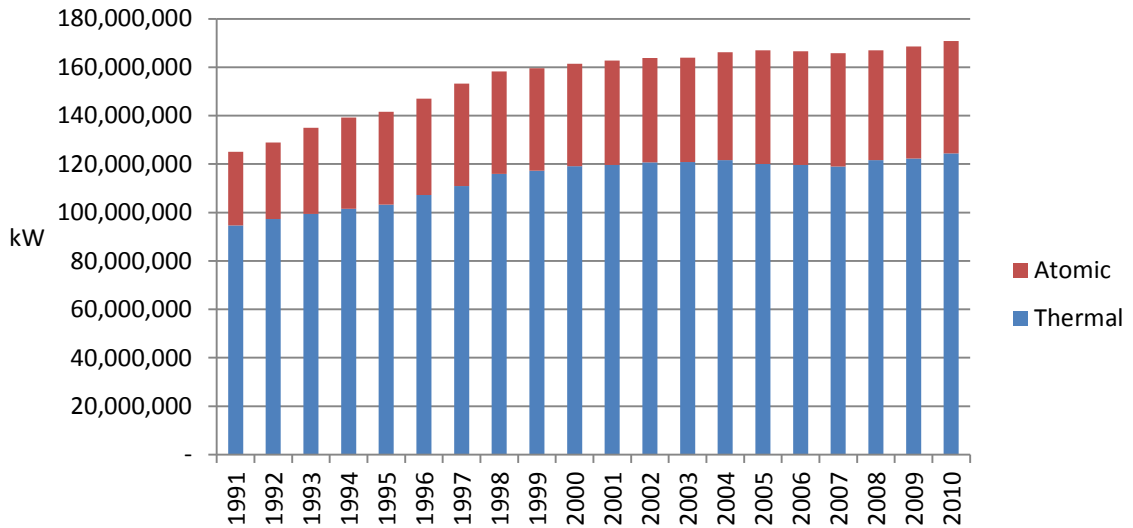
East Asia's competitive advantage in the electrical equipment industry is evidenced by its increased export share within the world market. Therefore, the change in East Asia's industrial structure should be reviewed.

**Table 1 Production of steam turbines**

		1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010
Steam turbine	(Million yen)	1,268,121	993,955	1,522,443	1,442,194	1,147,147	1,449,391
for general use	(Number)	2,450	1,856	2,085	1,874	1,574	1,654
	(MW)	60,012	43,881	46,360	60,417	64,311	79,919
	(Million yen)	834,112	582,590	923,851	908,846	630,140	718,552
less than 250MW	(Number)	2,357	1,781	2,028	1,806	1,479	1,558
	(MW)	15,595	12,979	15,113	24,878	22,527	26,318
more than 250MW	(Number)	93	63	57	68	95	96
	(MW)	44,419	30,895	31,247	35,539	41,790	53,601
Parts and accessories	(Million yen)	410,713	401,888	566,369	503,847	437,113	645,966

Source: *Yearbook of Machinery Statistics*

**Fig. 4 Power generating equipment of 10 power companies**



Source: The Federation of Electric Power Companies of Japan

One of the causes for Japanese export expansion was the change in its domestic market. The production of steam turbines in Japan stabilized from 1981 to 2010. In addition, while domestic demand peaked in 2000, there were some fluctuations during the period (Table 1). For 10 power companies, production of thermal and atomic power generating equipment (in output capacity) increased with each year until the 1990s; however, the capacity leveled off from 2000 onward (Fig. 4). Although Japanese electrical equipment companies exported their products mainly to Asian countries, they expanded their exports beyond this region and successfully confronted the limitations of the domestic market.

From the 1990s onward, and as a consequence of its rapid economic growth, demand for power generating equipment in China was tremendous, and Japanese electrical equipment companies aggressively exported steam turbines to this market. On the other hand, from 2007, China expanded her exports of steam turbines and became one of the world's leading producers and exporters, followed by Japan. Three big electrical equipment manufacturers in China are the Shanghai Electric Group, Dongfang Electric Corporation, and Harbin

Electric Group. These Chinese companies not only supply electrical equipment to the Chinese electric power company and industrial enterprises but also export to foreign markets.

In East Asia, in addition to the Japanese and Chinese companies, Hyundai Heavy Industries and Doosan Heavy Industries are two Korean companies that produce steam turbines and large-sized power generating equipment. Korea increased its exports of steam turbines in recent years, although the amount in dollar of these exports was considerably less than that for either Japan or China.

#### 4. Competitive advantages in East Asia

To comprehend East Asia's competitive advantage, the regional development of the Japanese electrical equipment industry and the manner in which Japanese companies' competitive advantages have been reorganized in East Asia should be reviewed.

Japanese companies maintain a domestic manufacturing capability for large-sized steam turbines and steam turbine generators. Hitachi Limited manufactures steam turbines in Hitachi City for long periods, Toshiba manufactures in the Keihin Complex, Mitsubishi Heavy Industries operates in the Takasago Factory (Mitsubishi Electric produces turbine generators but not turbines), and Fuji Electric manufactures in the Kawasaki Factory. These companies continue to manufacture turbines at their respective sites for long periods in order to maintain and improve production techniques and technological skills. Furthermore, these companies research and develop new technologies for an efficient steam turbine in their respective R&D centers located in Japan.

On the other hand, Japanese electrical companies have entered the expanding Chinese

market through technological tie-ups with Chinese steam turbine manufacturers. In 1991, Hitachi Limited tied-up with Dongfang Electric Corporation to produce a steam turbine for thermal power plants in China. Furthermore, Hitachi and Mitsubishi Heavy Industries each separately supplied the licensed technology to the Harbin Electric Group. The structure of Japanese companies with technological tie-ups with Chinese companies, producing electrical equipment in both countries, and exporting them to the world market is emerging.

In the latter half of the first decade of the 21<sup>st</sup> century, Japanese electrical equipment companies began establishing manufacturing facilities in India. Toshiba, Hitachi, and Mitsubishi Heavy Industries ventured into India and built factories with local partners. In 2008, Toshiba established the Toshiba JSW Turbine and Generator Private Limited as a joint venture with a local company and installed a manufacturing facility for the supercritical pressure-type steam turbines that range from 600 to 1,000MW (this factory was completed in 2012). Toshiba regards its Indian facility as one of its global manufacturing sites for the steam turbine and steam turbine generators for thermal power plants, second only to its Keihin complex in Yokohama, Japan. The East Asian electrical equipment market will be developed by expanding into the major Asian region.

Note: Although this abstract focuses on and is limited to the steam turbine, the scope of this paper will be extended to gas turbines and generators.