Chapter 5

Evolution of Key Industry Players
Chapter 5

Evolution of Key Players in the Electrical Equipment Industry

Chapter Objective:

The purpose of this chapter is to give a glimpse of the evolution of the electrical equipment industry by running through the history of the key players.

5.1 Industry Overview

The Global Electrical Equipment Industry consists of firms engaged in the manufacture of power generation, transmission and distribution equipment and systems, and industrial automation and control equipment. The industry size was US $173 Billion in 2004 (ABB, 2005) and has evolved over the past 150 years, characterized by numerous mergers and acquisitions. While some companies have survived the test of time, hundreds of companies in this sector have succumbed to mergers & takeovers, competitive pressures, lack of successors at the helm, world wars, inability to cope with technological advancements and unfavourable economic conditions. The electrical equipment industry being a mature industry, the ‘Rule of Three’ has been prevalent at various levels viz. domestic, continental and global. Pioneers like General Electric and Siemens have acquired several companies over the past century and have survived, grown and prospered. Ambitious companies like Schneider Electric and Eaton Electrical have grown rapidly over the past three decades through several strategic acquisitions. Key companies like the Swedish ASEA and Swiss BBC Brown Boveri merged in 1988 to become a
formidable global player. Westinghouse Electric Corporation, a pioneer in the field of electrical equipment, divested in bits and pieces and has all but vanished over time. In the developed world, most of the family owned companies and niche technology companies have been taken over by one of the larger generalists.

Schneider Electric, GE, ABB and Siemens have established themselves as the key global players over time. Each player has had its own strategy to tap individual markets. Schneider Electric and Siemens normally enter a country with high entry barriers through a joint venture or acquisition with/of a key local player and pushing their own products through the local player’s distribution channel. ABB and GE have set up their own green-field facilities and distribution channels in many countries, and normally do not depend on JVs or acquisitions for market entry.

5.2 Evolution of Key Players in the Industry

5.2.1 General Electric Company

The history of General Electric Company is a significant part of the history of technology in the United States. General Electric (GE) has evolved from Thomas Edison’s home laboratory into one of the largest companies in the world, following the evolution of electrical technology from the simplest early applications into the high-tech wizardry of the early 21st century. The company has also evolved into a conglomerate, with an increasing shift from technology to services, and with 11 main operating units: GE Advanced Materials, a specialist in high-performance engineered thermoplastics, silicon-based products, and fused quartz and ceramics used in a wide variety of industries; GE Consumer & Industrial, which is one of the world’s leading appliance manufacturers, stands as a preeminent global maker of lighting products for consumer, commercial, and industrial customers, and also
provides integrated industrial equipment, systems, and services; GE Energy, one of the largest technology suppliers to the energy industry; GE Equipment Services, which offers leases, loans, and other services to medium and large businesses around the world to help them manage their business equipment; GE Healthcare, a world leader in medical diagnostic and interventional imaging technology and services; GE Infrastructure, which is involved in high-technology protective and productivity solutions in such areas as water purification, facility safety, plant automation, and automatic environmental controls; GE Transportation, the largest producer of small and large jet engines for commercial and military aircraft in the world, as well as the number one maker of diesel freight locomotives in North America; NBC Universal (80 percent owned by GE), a global media and entertainment giant with a wide range of assets, including the NBC and Telemundo television networks, several cable channels, and the Universal Pictures film studio; GE Commercial Finance, which provides businesses, particularly in the mid-market segment, with an array of financial services and products, including loans, operating leases, and financing programs; GE Consumer Finance, a leading financial services provider, serving consumers, retailers, and auto dealer in about three dozen countries; and GE Insurance, which is involved in such areas as life insurance, asset management, mortgage insurance, and reinsurance. GE operates in more than 100 countries worldwide and generates approximately 45 percent of its revenues outside the United States. Over the course of its 110-plus years of innovation, General Electric has amassed more than 67,500 patents, and the firm’s scientists have been awarded two Nobel Prizes and numerous other honors.

Late 19th Century: The Edison Era

Thomas Edison established himself in the 1870s as an inventor after devising, at the age of 23, an improved stock ticker. He subsequently began research on an electric light as a replacement for gas light, the standard method of
illumination at the time. In 1876 Edison moved into a laboratory in Menlo Park, New Jersey. Two years later, in 1878, Edison established, with the help of his friend Grosvenor Lowry, the Edison Electric Light Company with a capitalization of $300,000. Edison received half of the new company’s shares on the agreement that he work on developing an incandescent lighting system. The major problem Edison and his team of specialists faced was finding an easy-to-produce filament that would resist the passage of electrical current in the bulb for a long time. He triumphed only a year after beginning research when he discovered that common sewing thread, once carbonized, worked in the laboratory. For practical applications, however, he switched to carbonized bamboo.

Developing an electrical lighting system for a whole community involved more than merely developing an electric bulb; the devices that generated, transmitted, and controlled electric power also had to be invented. Accordingly, Edison organized research into all of these areas and in 1879, the same year that he produced an electric bulb, he also constructed the first dynamo, or direct-current (DC) generator.

The original application of electric lighting was on the steamship Columbia in 1880. In that same year, Edison constructed a three-mile-long trial electric railroad at his Menlo Park laboratory. The first individual system of electric lighting came in 1881, in a printing plant. But the first full-scale public application of the Edison lighting system was actually made in London, at the Holborn Viaduct. The first system in the United States came soon after when Pearl Street Station was opened in New York City. In 1886 the Edison Machine Works was moved from New Jersey to Schenectady, New York.

While these developments unfolded at Edison’s company, the Thomson-Houston Company was formed from the American Electric Company, founded
by Elihu Thomson and Edwin Houston, who held several patents for their development of arc lighting. Some of their electrical systems differed from Edison’s through the use of alternating-current (AC) equipment, which can transmit over longer distances than DC systems. By the early 1890s the spread of electrification was threatened by the conflict between the two technologies and by patent deadlocks, which prevented further developments because of patent-infringement problems.

By 1889, Edison had consolidated all of his companies under the name of Edison General Electric Company. Three years later, in 1892, this company was merged with the Thomson-Houston Electric Company to form the General Electric Company. Although this merger was the turning point in the electrification of the United States, it resulted in Edison’s resignation from GE. He had been appointed to the board of directors but he attended only one board meeting, and sold all of his shares in 1894, though he remained a consultant to General Electric and continued to collect royalties on his patents. The president of the new company was Charles A. Coffin, a former shoe manufacturer who had been the leading figure at Thomson-Houston. Coffin remained president of General Electric until 1913, and was chairman thereafter until 1922. Meanwhile, also in 1892, GE’s stock began trading on the New York Stock Exchange.

In 1884 Frank Julian Sprague, an engineer who had worked on electric systems with Edison, resigned and formed the Sprague Electric Railway and Motor Company, which built the first large-scale electric streetcar system in the United States, in Richmond, Virginia. In 1889 Sprague’s company was purchased by Edison’s. In the meantime, the two other major electric-railway companies in the United States had merged with Thomson-Houston, so that by the time General Electric was formed, it was the major supplier of electrified railway systems in the United States.
One year after the formation of General Electric, the company won a bid for the construction of large AC motors in a textile mill in South Carolina. The motors were the largest manufactured by General Electric at the time and were so successful that orders soon began to flow in from other industries such as cement, paper, and steel. In that same year, General Electric began its first venture into the field of power transmission with the opening of the Redlands-Mill Creek power line in California, and in 1894 the company constructed a massive power-transmission line at Niagara Falls. Meanwhile the company’s electric-railroad ventures produced an elevated electric train surrounding the fairgrounds of the Chicago World’s Fair in 1893. Electrification of existing rail lines began two years later.

Early 20th Century: Bolstering Electrification Operations

By the turn of the century General Electric was manufacturing everything involved in the electrification of the United States: generators to produce electricity, transmission equipment to carry power, industrial electric motors, electric light bulbs, and electric locomotives. It is important to any understanding of the evolution of GE to realize that though it was diverse from the beginning, all of its enterprises centered on the electrification program. It is also worth noting that it operated in the virtual absence of competition. General Electric and the Westinghouse Electric Company had been competitors, but the companies entered into a patent pool in 1896.

In 1900 GE established the first industrial laboratory in the United States. Up to that point, research had been carried out in universities or in private laboratories similar to Edison’s Menlo Park laboratory. Initially, the lab was set up in a barn behind the house of one of the researchers, but the lab was moved in 1900 to Schenectady, New York, after it was destroyed in a fire. The
head of the research division was a professor from the Massachusetts Institute of Technology.

During the early decades of the 20th century General Electric made further progress in its established fields and also made its first major diversification. In 1903 General Electric bought the Stanley Electric Manufacturing Company of Pittsfield, Massachusetts, a manufacturer of transformers. Its founder, William Stanley, was the developer of the transformer.

By this time GE’s first light bulbs were in obvious need of improvement. Edison’s bamboo filament was replaced in 1904 by metalized carbon developed by the company’s research lab. That filament, in turn, was replaced several years later by a tungsten-filament light bulb when William Coolidge, a GE researcher, discovered a process to render the durable metal more pliable. This light bulb was so rugged and well suited for use in automobiles, railroad cars, and street cars that it was still employed in the early 2000s. In 1913, two other innovations came out of the GE labs: Irving Langmuir discovered that gas-filled bulbs were more efficient and reduced bulb blackening. To this day virtually all bulbs over 40 watts are gas-filled.

Postwar Growth and Difficulties
When production of consumer goods resumed immediately after the war, GE promptly found itself in another antitrust battle. The government discovered that GE controlled 85 percent of the light bulb industry; 55 percent through its own output and the other 30 percent through licensees. In 1949 the court forced GE to release its patents to other companies.

In this period the first true product diversifications came out of GE’s research labs. In the 1940s a GE scientist discovered a way to produce large quantities of silicone, a material GE had been investigating for a long time. In 1947 GE
opened a plant to produce silicones, which allowed the introduction of many products using silicone as a sealant or lubricant.

During the late 1940s General Electric embarked on a study of nuclear power and constructed a laboratory specifically for the task. In 1957 the company received a license from the Atomic Energy Commission to operate a nuclear-power reactor, the first license granted in the United States for a privately owned generating station. That same year GE’s consumer appliance operations got a big boost when an enormous manufacturing site, Appliance Park, in Louisville, Kentucky, was completed.

Other innovations to come from GE labs during the 1950s included an automatic pilot for jet aircraft, Lexan polycarbonate resin, the first all-transistor radio, jet turbine engines, gas turbines for electrical power generation, and a technique for fabricating diamonds.

During the 1960s and 1970s GE grew in all fields. In 1961 it opened a research center for aerospace projects, and by the end of the decade had more than 6,000 employees involved in 37 projects related to the moon landing. In the 1950s General Electric entered the computer business. This venture, however, proved to be such a drain on the company’s profits that GE sold its computer business to Honeywell in 1971.

By the late 1960s, GE’s management began to feel that the company had become too large for its existing structures to accommodate. Accordingly, the company instituted a massive organizational restructuring. Under this restructuring program, the number of distinct operating units within the company was cut from more than 200 to 43.
When this reorganization was complete, General Electric made what was at the time the largest corporate purchase ever. In December 1976 GE paid $2.2 billion for Utah International, a major coal, copper, uranium, and iron miner and a producer of natural gas and oil. The company did 80 percent of its business in foreign countries. Within a year Utah International was contributing 18 percent of GE’s total earnings.

In the meantime, GE scientist Ivar Giaever was a corecipient of the 1973 Nobel Prize in Physics for his discoveries in the area of superconductive tunneling. Giaever became the second GE employee to be honored with a Nobel Prize.

The divestiture of its computer business had left GE without any capacity for manufacturing integrated circuits and the high-technology products in which they are used. In 1975 a study of the company’s status concluded that GE, one of the first U.S. electrical companies, had fallen far behind in electronics. As a result, GE spent some $385 million to acquire Intersil, a semiconductor manufacturer; Calma, a producer of computer graphics equipment; and four software producers. The company also spent more than $100 million to expand its microelectronics facilities.

Other fields in which GE excelled were in trouble by the mid-1970s, most notably nuclear power. As plant construction costs skyrocketed and environmental concerns grew, the company’s nuclear power division began to lose money. GE eventually pulled out of all aspects of the nuclear power business in the 1980s except for providing service and fuel to existing plants and conducting research on nuclear energy.

1981 to 2001: The Jack Welch Era
GE’s economic problems were mirrored by its managerial reshuffling. When John F. (Jack) Welch, Jr., became chairman and CEO in 1981, General Electric entered a period of radical change. Over the next several years, GE bought 338 businesses and product lines for $11.1 billion and sold 232 for $5.9 billion. But Welch’s first order of business was to return much of the control of the company to the periphery. Although he decentralized management, he retained predecessor Reginald Jones’s system of classifying divisions according to their performance. His goal was to make GE number one or two in every field of operation.

Factory automation became a major activity at GE during the early 1980s. GE’s acquisitions of Calma and Intersil were essential to this program. GE itself spent $300 million to robotize its locomotive plant in Erie, Pennsylvania.

In 1986 General Electric made several extremely important purchases. The largest in fact, the largest for the company to that date was the $6.4 billion purchase of the Radio Corporation of American (RCA), the company GE had helped to found in 1919. RCA’s National Broadcasting Company (NBC), the leading U.S. television network, brought GE into the broadcasting business in full force. Although both RCA and GE were heavily involved in consumer electronics, the match was regarded by industry analysts as beneficial, because GE had been shifting from manufacturing into service and high technology. After the merger, almost 80 percent of GE’s earnings came from services and high technology, compared to 50 percent six years earlier.

General Electric’s operations were divided into three business groups in the early 1990s: technology, service, and manufacturing. Its manufacturing operations, traditionally the core of the company, accounted for roughly one-third of the company’s earnings. Still, GE continued to pour more than $1 billion annually into research and development of manufactured goods. Much
of that investment was directed at energy conservation; more efficient light bulbs, jet engines, and electrical power transmission methods.

In 1992 GE signaled its intent to step up overseas activity with the purchase of 50 percent of the European appliance business of Britain’s General Electric Company (GEC). The two companies also made agreements related to their medical, power systems, and electrical distribution businesses. Welch said that his aim was to make GE the nation’s largest company. To that end, General Electric continued to restructure its existing operations in an effort to become more competitive in all of its businesses.

Under Welch’s leadership, General Electric in the late 1990s also adopted Six Sigma; a quality control and improvement initiative pioneered by Motorola, Inc. and AlliedSignal Inc. The program aimed to cut costs by reducing errors or defects. The company also continued to restructure as necessary, including taking a $2.3 billion charge in late 1997 to close redundant facilities and shift production to cheaper labor markets. During 1999 General Electric adopted a fourth growth initiative, e-business (globalization, services, and six sigma being the other three). Like many longstanding companies, GE reacted cautiously when the Internet began its late 1990s explosion. But once he was convinced of the new medium’s potential, Welch quickly adopted e-commerce as a key to the company’s future growth.

In late 1999 Welch announced that he planned to retire in April 2001, but he did not name a successor. At the time, General Electric was one of the world’s fastest growing and most profitable companies, and boasted a market capitalization of $505 billion, second only to Microsoft Corporation. Revenues for 1999 increased 11 percent to $111.6 billion while net income rose 15 percent to $10.7 billion. These figures also represented huge gains since
Welch took over in 1981, when the company posted profits of $1.6 billion on sales of $27.2 billion.

In October 2000 Welsh swooped in to break up a planned $40 billion merger of United Technologies Corporation and Honeywell International Inc. The Honeywell board accepted GE’s $45 billion bid, which was set to be the largest acquisition in the company’s history. Honeywell was coveted for its aerospace unit, a $9.9 billion business involved in flight-control systems, onboard environmental controls, and repair services. The addition of this unit was expected to significantly boost the GE Aircraft Engines unit, creating a global aerospace giant. Welch agreed to stay on at General Electric through the end of 2001 in order to see the acquisition through to fruition. He did, however, name a successor soon after this deal was announced. In November 2000 Jeffrey R. Immelt won the succession battle and was named president and chairman-elect. Immelt, who joined GE in 1982, had most recently served as president and CEO of GE Medical Systems, a unit with revenues of $12 billion.

In the summer of 2001 the European Commission blocked the Honeywell deal on antitrust grounds as 11th hour negotiations between the European regulators and GE executives broke down. Welch finally retired soon thereafter, with Immelt taking over as chairman and CEO in September 2001.

*The Immelt Era: 2001 and Beyond*

Meanwhile, one last major deal was initiated prior to the leadership handover. In July 2001 General Electric’s GE Capital unit agreed to pay $5.3 billion for Heller Financial Inc., a global commercial finance company based in Chicago that had total assets of about $19.5 billion. This deal, the second largest in GE history, behind only the 1986 deal for RCA, was consummated in October 2001. Also during 2001, GE Lighting had the largest product launch in its
history when it introduced the GE Reveal line of light bulbs, which were
touted as providing a cleaner, crisper light; because the bulbs filtered out the
duller yellow rays commonly produced by standard incandescent light bulbs.
GE began feeling the effects of the economic downturn that year as revenues
fell nearly 3 percent, to $125.7 billion; profits nevertheless increased 7.5
percent, reaching $13.7 billion, though that was a far cry from the yearly 13 to
15 percent increases that Wall Street came to expect from GE during the
Welch era.

Immelt began to place his imprint in earnest on GE in 2002 through major
restructurings and several significant acquisitions. The GE Appliances and GE
Lighting units were combined into a new GE Consumer Products unit. GE
Industrial Systems spent about $777 million for Interlogix, Inc, an Austin,
Texas-based manufacturer of electronic security products and systems for
commercial, industrial, and residential use. General Electric spent
approximately $9 billion on industrial acquisitions alone during 2002.

Continuing his transformative leadership, Immelt reorganized GE’s 13
business units into 11 focused on specific markets and customers. The
reorganization, effective at the beginning of 2004, brought similar businesses
together in an effort to increase sales and cut costs. The most significant of the
changes included combining the firm’s aircraft engines business and its rail-
related operations in a new GE Transportation unit; merging most of GE
Industrial Systems with GE Consumer Products to form GE Consumer &
Industrial, which focused on lighting products, appliances, and integrated
industrial equipment, systems, and services; and forming GE Infrastructure
from certain operations of GE Industrial Systems and GE Specialty Materials.
Also in January 2004, GE continued disposing of its insurance operations.
Immelt was also building operations in fast-growing economies such as China. By 2005, GE was aiming to outsource $5 billion of parts and services from China and simultaneously grow sales in China to a like figure. Further divestments were also expected, and there had long been speculation that the slow-growing lighting and appliances businesses were prime candidates.

Today GE continues to flourish as one of the largest global conglomerates with consolidated revenues of $173 billion and profit of $22.5 billion.

5.2.2 ASEA (Erstwhile).

Elektriska Aktiebolaget in Stockholm was established in 1883 by Ludwig Fredholm to manufacture electrical lighting and generators based on the designs of a young engineer named Jonas Wenström. Wenström's innovative designs quickly led to financial success, and Fredholm soon wanted to expand the scope of his firm's operations. He arranged a merger with Wenström's & Granströms Elektriska Kraftbolag, a company founded by Jonas Wenström's brother Goran. Allmä-a Svenska Elektriska Aktiebolaget (whose name was later shortened to ASEA AB) was created on November 18, 1890, to provide electrical equipment for Swedish industry.

The dawning of the electrical age provided ASEA with large new markets as the industrial and residential use of electricity became commonplace in Sweden. The company quickly established itself as a pioneer in the industrial field. ASEA's installation of electricity at a rolling mill in the town of Hofors is believed to be the first of its kind in the world, and in 1893, ASEA built Sweden's first three-phase electrical transmission, between Hellsjon and Crangesberg.
Although Sweden remained neutral during World War I, the company was adversely affected by the conflict. ASEA prospered during the early years of the war because the scarcity of coal stimulated the development of electricity, including the company's first major railway electrification project. Eventually, however, the firm lost many of its European markets because of the success of German submarine warfare.

In 1926 the company provided the electric locomotives and converter equipment for the first electric trains on the Stockholm-Gothenburg line, and in 1932 ASEA built the world's largest naturally cooled three-phase transformer.

During the 1930s, company management decided to concentrate on expanding and improving its domestic operations. After several years of negotiations, ASEA and LM Ericsson Telephone Company signed a pact in 1933 stipulating that the two companies would not compete with each other in certain sectors of the electrical market. As part of the agreement, ASEA purchased Elektromekano from Ericsson, giving ASEA undisputed control over a large portion of the electrical equipment market in Sweden.

In addition to its production of electric locomotives and rail equipment for Sweden's national railway electrification program, the firm expanded into new markets. ASEA purchased AB Svenska Flaktfabriken, a firm specializing in air-freight handling technology, and a large electric-motor manufacturer in Poland to augment its domestic production.

Although Sweden remained neutral during World War II, once again war severely affected the country's economy. The Nazi occupation effectively curtailed ASEA's operations throughout Europe, and even to a significant extent in Sweden. During the immediate postwar years, domestic power
demands skyrocketed, forcing utility companies to expand rapidly. However ASEA was unable to meet this demand for electrical equipment because of shortages of material.

In 1947, ASEA broke into the American market by signing a licensing agreement with the Ohio Brass Company for the local production of surge arrestors.

In 1961, ASEA was restructured through the introduction of a new divisional organization, and relocation of some of its manufacturing facilities. The company formed an electronics division, signaling the start of ASEA's transition from a traditional heavy electrical equipment manufacturer to an electronics company in which high-technology played an increasingly important role.

In the mid-1960s, ASEA's American market expanded considerably and became more important to the company's overall sales strategy. After serving customers such as the Tennessee Valley Authority, the company firmly established itself in the United States when it was chosen to supply HVDC equipment for the Pacific Internie Project on the West Coast.

ASEA also received an order to build Sweden's first full-scale nuclear power station during this period. The company then merged its nuclear division with the state-owned Atom-Energi to form ASEA Atom in 1968. ASEA acquired the remaining 50 percent state interest in Atom-Energi in 1982.

In 1963 ASEA achieved a major technological breakthrough with the introduction of an improved thyristor able to handle substantially more electrical current than existing devices. As a result, the company began manufacturing thyristor locomotives for Swedish and European rail systems.
During the 1970s, unable to cope up with the fast pace of changing technology, a large number of utility and electrical equipment manufacturing companies, including ASEA, experienced falling profits and lackluster growth.

ASEA began to revive in 1980, when Percy Barnevik was named managing director and, eventually, CEO. Barnevik immediately began a reorganization of the company's management strategy. ASEA had previously bid on projects with low profit margins for the sake of maintaining a minimum sales level and a certain number of employees, but under Barnevik's direction the company would emphasize high profit margin projects. Barnevik's strategy began to pay off quickly.

ASEA initiated a major expansion into high-tech areas, investing heavily in robotics and other state-of-the-art electronics. The development costs of robotics at first held profits down in that sector, but Barnevik viewed robotics as a long-term, high-growth area.

Barnevik also considered ASEA's industrial controls business, with products such as large automation controls, a high-growth sector. ASEA already had a major share of the rapidly expanding market for industrial energy controls, such as those that recycle waste heat. In addition, the company positioned itself to take advantage of a growing demand for pollution controls, spurred in part by the acid-rain controversy in Europe and North America. By 1986 ASEA reported revenues of SEK 46 billion and earnings of SEK 2.6 billion, and its workforce had reached 71,000.
5.2.3 **Brown Boveri** (Erstwhile)

Charles E.L. Brown and Walter Boveri established BBC Brown Boveri in 1891 in Baden, Switzerland; it was initially known as Brown, Boveri & Cie. The company's development is interesting because it was one of only a few multinational corporations to operate subsidiaries that were larger than the parent company. Because of the limitations of the Swiss domestic market, Brown Boveri established subsidiaries throughout Europe relatively early in its history.

Brown Boveri's early activities included manufacturing electrical components such as electrical motors for locomotives and power-generating equipment for Europe's railway systems. In 1919 the company entered into a licensing agreement with the British manufacturing firm Vickers that gave the British firm the right to manufacture and sell Brown Boveri products throughout the British Empire and in some parts of Europe. The agreement gave Brown Boveri a significant amount of money and the promise of substantial annual revenue, and also helped the company expand into foreign markets at a time when protectionist policies inhibited international expansion.

In the early 1920s, Brown Boveri, already a geographically diversified company with successful operating subsidiaries in Italy, Germany, Norway, Austria, and the Balkans, suffered losses because of the devaluation of the French franc and the German mark. At the same time, in the Swiss domestic market, production costs increased while sales remained static, causing the company further losses.

During the same time, Brown Boveri's various subsidiaries grew rapidly. Industrialization throughout Europe created strong demand for the company's heavy electrical equipment. Italy's burgeoning railroad industry provided a
particularly strong boost to Brown Boveri's Italian subsidiary, and the company's German facility actually did considerably more business than the Swiss parent. For the next few decades Brown Boveri grew as fast as technological developments in electrical engineering. Each of the company's subsidiaries tended to develop individually, as if it were a domestic company in the country in which it operated, and broad geographic coverage helped insulate the parent from severe crises when a certain region experienced economic difficulties.

This sort of segmented development had its drawbacks, however. After World War II, the cold war presented a variety of business opportunities for defense-related electrical contractors, but Brown Boveri's subsidiaries were seen as foreign companies in many of the countries in which they operated, sometimes making it difficult for the company to win lucrative contracts involving sensitive technology and other government contracts. The company, nevertheless, excelled at power generation, including nuclear power generators, and prospered in this field. Electrification efforts in the Third World also provided Brown Boveri with substantial profits.

In 1970 Brown Boveri began an extensive reorganization. The company's subsidiaries were divided into five groups: German, French, Swiss, "medium-sized" (seven manufacturing bases in Europe and Latin America), and Brown Boveri International (the remaining facilities). Each of these groups was further broken down into five product divisions: power generation, electronics, power distribution, traction equipment, and industrial equipment.

Throughout the 1970s, Brown Boveri struggled to expand into the U.S. market. While Brown Boveri counted a handful of major U.S. customers as its clients, among them large utilities such as the Tennessee Valley Authority and American Electric, Brown Boveri's American market share was dismal.
considering the company's international standing (North American sales accounted for only 3.5 percent of total sales in 1974 and 1975), and the company continued to search for a means of effectively entering U.S. markets.

In 1974 Brown Boveri acquired the British controls and instrument manufacturer George Kent. The deal at first raised concern in Britain over foreign ownership of such highly sensitive technology, but Brown Boveri prevailed with the encouragement of George Kent's rank-and-file employees, who feared the alternative of being bought by Britain's General Electric Company, PLC (GEC). The newly acquired company was renamed Brown Boveri Kent and made an excellent addition to the parent company's already diverse product line.

In the mid-1970s growing demand in the Middle East for large power-generating facilities distracted the company from its push into North America. Oil-rich African nations, such as Nigeria, attempting to diversify their manufacturing capabilities, also created new markets for Brown Boveri's heavy electrical engineering expertise.

In the early 1980s Brown Boveri's sales flattened out and the company's earnings declined. In 1983 Brown Boveri's German subsidiary in Mannheim, West Germany, which accounted for nearly half of the entire parent company's sales, rebounded. In spite of an increase in orders, however, the company's cost structure kept earnings down. In 1985 the subsidiary's performance improved as a result of cost-cutting measures but price decreases in the international market and unfavorable shifts in currency exchange rates largely offset these gains. In 1986, Brown Boveri's revenues amounted to SEK 58 billion, while earnings were SEK 900 million; the company had 97,000 employees.
In the later 1980s Brown Boveri took steps to reduce duplication of research and development among its various groups. While each subsidiary continued to do some product development research for its individual market, theoretical research was unified under the parent company, making more efficient use of research funding.

5.2.4 ABB

ABB, formerly Asea Brown Boveri, is a multinational corporation headquartered in Zürich, Switzerland. ABB is one of the largest engineering companies in the world. ABB has operations in around 100 countries, with approximately 115,000 employees in 2008. ABB Ltd. has two core business segments: power technologies and automation technologies. Serving electric, gas, and water utilities, and also industrial and commercial customers, the power technologies division offers a wide array of products, systems, and services for power transmission and distribution and power plant automation. Offerings include transformers, medium- and high-voltage products, power systems, and utility automation systems. The automation technologies division specializes in manufacturing-automation and process-automation products, services, and systems.

ABB resulted from the 1988 merger of Swedish and Swiss corporations ASEA and BBC Brown Boveri (Brown, Boveri & Cie), CEO at the time of the merger was the former CEO of ASEA, Percy Barnevik, who ran the company until 1996.

In August 1987 ASEA and Brown Boveri, who had been fierce competitors in the heavy-electrical and power-generation fields, announced their intent to merge their assets for shares in a new company, ABB Asea Brown Boveri Ltd., to be owned equally by each parent company--which maintained separate stock listings in their own countries and acted as holding companies for ABB.
When the merger took effect on January 5, 1988, ASEA's Curt Nicolin and Brown Boveri's Fritz Leutwiler became joint chairmen. ASEA's CEO, Percy Barnevik, became the new operating company's CEO, while his Brown Boveri counterpart became deputy CEO. ABB's headquarters were established in Zurich.

The joint venture between the two former competitors allowed them to combine expensive research and development efforts in superconductors, high-voltage chips, and control systems used in power plants. In addition, ASEA's strength in Scandinavia and northern Europe balanced Brown Boveri's strong presence in Austria, Italy, Switzerland, and West Germany. The merger, which created Europe's largest heavy-electrical combine, was also designed to take advantage of ASEA's management strengths and Brown Boveri's technological and marketing expertise.

In 1988 and 1989, ABB reorganized its existing operations by decentralizing and ruthlessly slashing bureaucracy. The combined corporate headquarters alone went from 2,000 to 176 employees. During the same period, ABB also went on an acquisition spree in Western Europe and the United States, purchasing a total of 55 companies. Perhaps most importantly, ABB was able to gain a foothold in North America, something both halves of ABB had struggled to achieve for the previous two decades. In early 1989 ABB formed a joint venture with the American electrical firm Westinghouse Electric Corporation. ABB owned 45 percent of the new subsidiary, a manufacturer of power transmission and power distribution systems for international markets. Then, in December 1989, ABB exercised its option to buy Westinghouse out of the venture, leaving ABB the sole owner of the company. That same month, the company agreed to buy Stamford, Connecticut-based Combustion Engineering Group, an unprofitable manufacturer of power generators and related equipment, for $1.56 billion. These U.S. investments, however, were
not immediately successful for ABB, and the company, over the next few years, had to reorganize the acquired businesses, divesting $700 million in assets and trimming their payroll from 40,000 to 25,000.

With recession plaguing the markets of Western Europe and North America in the early 1990s and with the continuing maturation of those markets, ABB decided that its future lay in the emerging markets of Eastern Europe and Asia, where opportunities for growth were plentiful and where it could set up lower-cost manufacturing operations. Although the company had virtually no operations in Eastern Europe at the beginning of the decade, through a series of acquisitions and joint ventures in Eastern Germany, Poland, and Czechoslovakia, ABB had established a considerable presence in the region by 1992, employing 20,000 people in 30 companies. By the end of 1995, ABB had a network of 60 companies in Eastern Europe and the former Soviet Union, giving it the largest manufacturing operation of any Western firm in the region. Operations in Poland and the Czech Republic continued to lead the way, but significant operations had also been established in Russia (3,000 employees), Romania (2,000 employees), and the Ukraine (1,500 employees).

At the same time, ABB began to expand more cautiously in Asia, laying the groundwork for $1 billion in investments there by the mid-1990s. In 1992 an operating structure was created for the Asia-Pacific region and more than 20 new manufacturing and service operations were established in the region through acquisitions, joint ventures, and other investments. Investments in Asia continued in 1993, the year that ABB carried out another major restructuring. This one involved the reorganizing of the company's global operations into three geographic regions: Europe (including the Middle East and Africa), the Americas, and Asia; the folding of six industrial business segments into the following four: power generation, power transmission and distribution, industrial and building systems, and rail transportation; and the
streamlining of the executive committee to eight members (Barnevik, the heads of the three geographic regions, and the heads of the four business segments).

In 1994, in addition to making additional investments in Asia, ABB entered into a contract to build a $1 billion combined-cycle power plant in Malaysia. On January 1, 1996, ABB merged its rail transportation unit with that of Germany's Daimler-Benz AG to form ABB Daimler-Benz Transportation GmbH (ADtranz), a 50-50 joint venture that immediately became the largest provider of rail systems in the world. As part of the agreement, Daimler-Benz paid ABB $900 million in cash for its half share of the new venture because its rail operations were only about half the size of those of ABB.

In February 1996 the parent companies of ABB changed their names, with ASEA becoming ABB AB and Brown Boveri becoming ABB AG. At the same time, changes were made to ABB's board of directors. These changes were intended to reflect the company's increasingly global nature and to improve the relationship between the subsidiary and its parent companies. Further management changes came in October 1996 when Barnevik relinquished his position as chief executive of ABB. Assuming the position of president and chief executive was Göran Lindahl, a 25-year company veteran who had been executive vice-president for power transmission and the Middle East and North Africa region. Barnevik remained ABB chairman. In June 1997 the Wallenberg group, in need of cash for a takeover, reduced its indirect voting stake in ABB from 32.7 percent to 25.5 percent.

In June 1996 ABB was awarded a contract by the government of Malaysia to play the lead role in the building of a $5 billion-plus hydroelectric power generation plant and transmission system at Bakun on the Balui River, but this project ran into problems in the following year. As a result of the Asian
economic crisis, which hit Malaysia particularly hard, the Malaysian government was forced to announce an indefinite delay in the project in September 1997. Despite this setback, and the continuing uncertainty surrounding Asian economies, ABB did not pull back from its expansion in that region. In October 1997 the company announced yet another major restructuring in which it planned to shift thousands of jobs from Europe and the United States to Asia, cutting 10,000 jobs over an 18-month period. This was in addition to a 3,600-job cut announced just a few days earlier at ADtranz. ABB's executives were betting that the Asian economic crisis would be of relatively short duration and reasoned that, although they might lose business in the region in the short term, they could recoup some of these losses by taking advantage of the countries' weakened currencies, which brought manufacturing costs down even further. To cover the costs of the reorganization, ABB took a charge of $850 million in the fourth quarter of 1997.

From its first year of operation in 1988 through its ninth year in 1996, ABB Asea Brown Boveri Ltd. nearly doubled in size, increasing revenues from $17.83 billion to $34.57 billion. Although it failed to reach Barnevik's goal of a 10 percent operating margin for even a single year, the merged company was much more profitable than its predecessors, ASEA AB and BBC Brown Boveri Ltd., achieving a peak operating margin of 9.7 percent in 1995 before falling back to 8.8 percent in 1996. ABB was already much stronger, better managed, and more global in nature than its parent companies had been when operating independently.

During the late 1990s and into 2000, Lindahl left his mark on ABB through a number of significant initiatives. In August 1998 the company launched a major restructuring that did away with the group's regional reporting structure in favor of a realignment of business activities on global lines. In addition,
some existing business segments were broken up into smaller, more focused categories. For example, the industrial and building systems segment was split into three new segments: automation, products and contracting, and oil, gas, and petrochemicals—the latter being the largest of the three. The power transmission and distribution segment was divided into two covering power transmission and power distribution. Remaining unchanged were the power generation and financial services segments.

Next, Lindahl spearheaded a series of moves to shift ABB’s focus toward high-tech sectors, particularly industrial robots and factory control systems, and away from the traditional heavy engineering activities. In October 1998 ABB completed the largest acquisition in company history, buying Elsga Bailey Process Automation N.V., a Netherlands-based maker of industrial control systems, for $2.1 billion, including $600 million in debt. This deal made ABB’s automation segment the world’s leading maker of robotics and automated control systems, with annual revenues of $8.5 billion. On the divestment side, ABB in January 1999 sold its 50 percent stake in ADtranz to DaimlerChrysler AG for $472 million. In March 1999 ABB and France-based ALSTOM merged their power generation businesses into a 50-50 joint venture called ABB Alstom Power. For transferring to the venture operations that generated some $8 billion in annual revenues, ABB received $1.5 billion in cash. Then in May 2000 ABB sold its 50 percent interest in the venture to ALSTOM for $1.2 billion. That same month, ABB completed the sale of its nuclear power business to the U.K. firm BNFL Inc. in a $485 million deal.

The final step in the integration of the ABB predecessors ASEA and Brown Boveri occurred in 1999 when ABB AB and ABB AG were united under a single stock, ABB Ltd., which began trading in June on the Zurich, Stockholm, London, and Frankfurt exchanges. A listing on the New York Stock Exchange was later added, in April 2001. The now smaller ABB
reported net income of $1.44 billion for 2000 based on revenues of $22.97 billion.

Jörgen Centerman, the head of ABB's automation segment, replaced Lindahl as chief executive in end 2000. Centerman quickly launched a restructuring of his own. In January 2001 ABB reorganized around four customer-focused divisions--utilities; process industries; manufacturing and consumer industries; and oil, gas, and petrochemicals--and two divisions based on product type, power technology products and automation technology products. The new organization was intended to accelerate ABB's shift away from heavy industrial products toward new technologies and services, as well as to streamline its relationship with large corporate customers. Centerman also engineered one major acquisition during 2001, the June purchase of Entrelec Group for $284 million. Gaining Entrelec, a supplier of industrial automation and control products based in Lyon, France, strengthened ABB's position in key North American and European markets.

During the first half of 2001, operating earnings at ABB were down 21 percent and revenues were flat as the company's key markets suffered from the economic slowdown. In July ABB announced that it planned to cut 12,000 jobs, or 8 percent of its workforce, over the following 18 months, in an effort to shave $500 million off its annual expenses. Concerns about the company's performance and growing U.S. asbestos liabilities sent the company's stock sharply lower. It was in this environment that Barnevik unexpectedly announced his resignation as chairman in November 2001. Succeeding him as non-executive chairman was Jürgen Dormann, who was concurrently serving as chairman of the pharmaceuticals group Aventis S.A. and had been on the ABB board for three years. In January 2002 ABB doubled its provisions for asbestos liabilities by taking a $470 million charge against fourth-quarter 2001
earnings. ABB's exposure to asbestos lawsuits stemmed from its 1990 acquisition of Combustion Engineering, which prior to the mid-1970s was a supplier of products containing asbestos. This charge coupled with asset write-down, a change in accounting practices, and losses on certain projects led to a $691 million net loss for 2001.

Saddled with $4 billion in debt, ABB next had to repair its balance sheet to avoid a financial collapse. In April the company got some breathing room by restructuring a $3 billion loan. Then in September it reached a deal to sell its structured-finance unit to General Electric; this deal, which closed in November, generated much needed cash proceeds of about $2.5 billion.

Also in September 2002, Dormann, unhappy about the pace of restructuring, took over as chief executive, replacing Centerman. Within weeks he streamlined ABB's divisional structure, cutting its five divisions down to two core businesses: power technologies and automation. The building products and oil, gas, and petrochemicals units were placed into a discontinued operations category, slated for divestment. Through this latest reorganization, Dormann hoped to realize annual savings of $800 million. In December 2002 ABB sold its water and electricity metering business to Ruhr gas Industries GmbH for $223 million. For 2002, ABB posted a record net loss of $783 million on revenues of $18.3 billion.

In January 2003 ABB and its Combustion Engineering subsidiary announced plans for a "prepackaged" bankruptcy for the U.S. unit and an offer to resolve the unit's asbestos liability through a deal that would cap payments at $1.2 billion. This plan was soon approved by a U.S. district court, but an appeal filed by a group of plaintiffs was pending in mid-2004. On the divestment front, ABB in August 2003 sold its building systems business in Sweden,
Norway, Denmark, Finland, Russia, and the Baltic states to Helsinki-based YIT Corporation for about $233 million. In December the company agreed to sell its Sirius reinsurance business to the Bermuda-based White Mountains for about $425 million. In January 2004 ABB reached an agreement to sell the upstream portion of its oil, gas, and petrochemicals unit to a private equity consortium led by Candover Partners, a European buyout firm, in a deal estimated to be worth at least $925 million. During 2003, ABB also further bolstered its depleted capital base through a $2.5 billion rights issue, a $750 million bond, and a $1 billion unsecured credit facility.

The various initiatives undertaken in 2003 failed to prevent ABB from posting its third straight full-year net loss. The news of the $767 million loss, however, was soon followed by a report of the company's first quarterly profit in two years, during the first quarter of 2004. It appeared by then that the worst of the crisis was over, and that ABB had firmly pulled itself back from the brink of bankruptcy. There was nevertheless a measure of uncertainty in the form of the unresolved asbestos litigation. But Dormann felt confident enough about the company's future to announce in early 2004 that he would step aside as chief executive at the end of the year. Selected to succeed him was Fred Kindle, the head of Sulzer AG, a Swiss engineering group much smaller than ABB.

ABB went through a reorganization in 2005 to focus on the company's core business of power and automation technologies. The reorganization created the current structure of ABB with five business sectors (units) consisting of Power Products, Power Systems, Automation Products, Process Automation, and Robotics.
In 2006, ABB returned to financial health by settling its asbestos liability regarding claims that were filed against ABB’s U.S. subsidiaries, Combustion Engineering and Lummus Global.

5.2.5 Schneider Electric

Schneider Electric is a global specialist in energy management, and offers integrated solutions to make energy safe, reliable, efficient and productive for the Energy & Infrastructure, Industry, Data Centres & Networks, Buildings and Residential markets. Schneider Electric’s 120,000 employees in 102 countries generated revenue of €17.3 billion in 2007.

In 1836, two brothers named Adolphe and Eugène Schneider acquired the Creusot mines, forges and foundries, gaining an opportunity to participate in the great adventure of the Industrial Revolution. Their main markets were steel, heavy industry, railroads and shipbuilding.

One of the secrets of the Schneiders’ success was their system of maintaining family ownership and forging influential relations while constantly focusing on innovation. Legally, the Company was a limited partnership with the majority of shares owned by Schneider family members. Gradually other partners were brought in, including generals, politicians and businessmen. The Schneiders also built a network of powerful friends in high places.

Schneider continued to make innovation its main priority. The Company perfected the swage hammer system in 1878 and took its first steps into the nascent electricity market in 1891.

Schneider had exported for years worldwide, both in construction (bridges and railways) and weapons. At the end of the 19th century, Eugène II began taking interests in promising markets such as China (1895), or in countries identified
as potential major customers (e.g., Russia, in 1897). This period of international expansion lasted until 1914, with a wide variety of target countries and businesses: iron mines in Spain (1898), electric power in Switzerland (1898), steel works in Italy (1899), a port in Argentina (1902), and projects in Morocco and Algeria (1903), Chile (1904) and Bohemia (1904). From 1910 on, the Company stepped up its partnerships in the defense industry with such allies as Italy, Russia and Belgium. However, the financial results were mixed, with losses exceeding profits. In addition, World War I focused Schneider's energy on Europe and kept the Company from taking advantage of contracts farther afield.

Schneider became involved in electricity at the end of the 19th century. The Champagne-sur-Seine plant, which was dedicated to this new business, had 1,200 employees in 1914. The facility specialized in such equipment as transformers, generators and traction motors. By 1919, the unit was big enough to handle construction of the Chancy-Pougny dam and power plant on the Rhône river. This was Schneider and Cie's first hydroelectric project. In the 1920s, the plant manufactured electric motors, switchgear for power plants and electric locomotives. However, it was no longer large enough to compete effectively and patents became a pressing problem. As a result, Schneider decided to join forces with Westinghouse Electric International & Co. during a phase of consolidation in the French electrical equipment market. The Group enlarged its activity to manufacturing electrical motors, electrical equipment for power stations and electric locomotives.

After the French defeat in 1940 in World War II, Le Creusot was in the zone occupied by Germany. Despite pressure from the Germans, Eugène II decided to slow down production and devote as much capacity as possible to civilian orders in France. The occupying forces conducted numerous inspections and limited civilian production to a minimum. Little by little, the Resistance
movement took hold in Schneider's plants, and many employees were deported for their convictions. Schneider paid dearly for its past as a weapons manufacturer. The Allied forces bombed the Creusot plants twice so that they would be useless to the Germans.

Post World War II, Schneider gradually abandoned armaments and turned to construction, iron and steel works and electricity. The company was completely reorganized in order to diversify and open up to new markets. Schneider withdrew from weapons manufacturing when the defense industry was nationalized and focused on civilian activities that were to become flagship businesses (notably electricity and nuclear power).

In the 1960s, the steel industry seemed to spin uncontrollably into decline. Lacking sufficient financing, the Creusot site had to reduce its modernization investments and it gradually fell into debt. Exports, notably to eastern Europe, kept production running as the workforce was gradually reduced. Construction also ran into trouble, and base costs had a serious impact on the Company's profitability. Lastly, the shipbuilding business was severely hit by recession when the government refused its support, as was the case in Dunkirk. Schneider responded to the decline of its key businesses with limited financial and leadership resources.

Edouard-Jean Empain wrested management control of Schneider in 1969. Established in 1902 by Empain, Société Parisienne pour l'Industrie des chemins de fer et des tramways Electriques (SPIE) enjoyed great success in the industrial piping market after 1945. Spie merged with SCB in 1968 to attain international status. Following the combination of Empain and Schneider, Spie Batignolles took over CITRA. The new company's activities were organized into three divisions: Electromechanical Equipment, Building and Construction. The oil crisis contracted the domestic market but created
tremendous opportunities in oil-producing countries. This prosperity ended as the 1980s drew to a close. Spie Batignolles gradually developed its electrical activities and achieved very good results. In 1989, Spie’s sales totaled FF 24 billion, of which a third from outside France. Electrical equipment accounted for 48%, building and development 22%, construction 13% and industrial engineering 12%.

In the early 1970s, Empain-Schneider was deeply mired in heavy industry, even though the dominance of these activities in the business portfolio had been questioned at the end of the 1960s. In 1981, Edouard-Jean Empain was asked to turn over the chairmanship of Empain-Schneider to the new CEO, Didier Pineau-Valencienne.

When Didier Pineau-Valencienne took charge in 1981, he began rationalizing the Company by divesting non-strategic or unprofitable businesses. Negotiations were undertaken with the French government to find solutions for the segments in decline, such as steelmaking and shipbuilding, which led to serious crises, notably at Creusot-Loire. After consolidating its financial base by bringing in new shareholders and simplifying its organizational structure, Schneider began to redeploy in the late 1980s.

Schneider reached a crossroads in 1984. After withdrawing from its historical businesses of steel and shipbuilding, the Company had to choose a new direction. One option was to liquidate the group and reorganize the viable businesses in a new enterprise. Another was to continue pruning, and to rebuild an international group out of Jeumont-Schneider, Merlin Gerin and Spie-Batignolles.

Management chose the second solution and successfully identified a number of new shareholders. These included Paribas, nationalized in 1981; Axa, led
by Claude Bébèar; Bruxelles-Lambert France, which later became Parfinance; and AGF. In 1986, these four core shareholders owned 60% of SPEP, the group's holding company.

Didier Pineau-Valencienne brought Merlin Gerin firmly into the group in 1986 and then launched an ambitious acquisitions strategy, capped by the integration of Telemecanique (1988) and Square D (1991). The strategic refocusing on electricity was completed in 1996, with the divestment of Spie Batignolles. In 1997 Schneider acquired Modicon, an industrial control and automation giant. The merger of Merlin Gerin, Telemecanique, Square D and Modicon created a tight network of subsidiaries in 130 countries. In just ten years, a company that looked headed for bankruptcy transformed itself into a worldclass manufacturer of equipment for Electrical Distribution, Automation and Control.

A sustained acquisitions drive has enhanced Schneider's leadership by broadening the product lineup in fast growing regions. The development of new products is being quickened by strategic alliances, such as Schneider Toshiba Inverter in speed drives, MGE UPS in UPS systems, VA Tech in the high voltage business and Thomson multimedia in power line carrier technology. To strengthen its final low voltage distribution operations, Schneider Electric acquired Scandinavia's Lexel. In 1998 and 1999, the Company acquired Schyller in Italy (industrial plugs), Mafelec in France and Veris Industries, Electrical Switchgear and Power Distribution Services in the United States. In 2000, Schneider Electric acquired fourteen companies across the world in the areas of low and medium voltage switchgear, and industrial control and automation.

In the new millennium, Schneider Electric has identified new growth platforms such as specific industrial automation segments, building
management & security systems, secured power and energy management & services and has acquired several companies worldwide in order to establish itself as a major player in these areas.

5.2.6 Siemens

German electrical equipment manufacturer formed on Oct. 1, 1966, in the merger of Siemens & Halske AG (founded 1847), Siemens-Schuckertwerke AG (founded 1903), and Siemens-Reiniger-Werke AG (founded 1932). Operating manufacturing outlets in some 35 countries and sales organizations in more than 125 countries, it engages in a wide range of manufacturing and services, with groups for electrical components, computer data systems, power engineering, microwave devices, telegraph and signaling systems, electrical installations, medical engineering, and telecommunications. Headquarters are in Munich.

The first Siemens company, Telegraphen-Bau-Anstalt Von Siemens & Halske ("Telegraph Construction Firm of Siemens & Halske"), was founded in Berlin on Oct. 1, 1847, by Werner Siemens (1816-92), his cousin Johann Georg Siemens (1805-79), and Johann Georg Halske (1814-90); its purpose was to build telegraph installations and other electrical equipment. In 1848, the company built the first long-distance telegraph line in Europe; 500 km from Berlin to Frankfurt am Main. In the 1850s, the company was involved in building long distance telegraph networks in Russia. In 1855, a company branch headed by another brother, Carl von Siemens, opened in St Petersburg, Russia. In 1858, the company opened a branch in London for English lines, headed by Werner's brother William (1823-83). In 1867, Siemens completed the monumental Indo-European (Calcutta to London) telegraph line. As the firm grew and introduced mass production, Halske, who was less inclined toward expansion, withdrew (1867), leaving control of the company to the four Siemens brothers and their descendants.
Meanwhile, the company's activities were enlarging to include dynamos, cables, telephones, electrical power, electric lighting, and other advances of the later Industrial Revolution. In 1881, a Siemens AC Alternator driven by a watermill was used to power the world's first electric street lighting in the town of Godalming, United Kingdom. The company continued to grow and diversified into electric trains and light bulbs. In 1890 it became a limited partnership, the senior partners being Carl Siemens (Werner's brother) and Arnold and Wilhelm Siemens (Werner's sons); in 1897 it became a limited-liability company, Siemens & Halske AG (S&H).

In 1903 S&H transferred its power-engineering activities to a new company, Siemens-Schuckertwerke GmbH (having absorbed a Nürnberg firm, Schuckert & Co.); from 1919 on, the two companies were usually chaired by the same officer, always a member of the Siemens family. In 1919, S&H and two other companies jointly formed the Osram lightbulb company. A Japanese subsidiary was established in 1923. In 1932, after seven years of collaboration, an Erlander firm, Reiniger Gebbert & Schall, merged with the Siemens interests to form Siemens-Reiniger-Werke AG, engaged in producing medical diagnostic and therapeutic equipment, especially X-ray machines and electron microscopes.

S&H expanded greatly during the Third Reich (1933-45), all plants running to full capacity during the war and dispersing throughout the country to avoid air strikes in 1943-44. At the end of the war, Hermann Von Siemens (1885-1986), the head of the group, was briefly interned (1946-48), and Siemens officials were charged with recruiting and employing slave labour from captive nations and associating in the construction and operation of the death camp at Auschwitz and the concentration camp at Buchenwald. As much as 90 percent of the companies' plants and equipment in the Soviet-occupied zone of
Germany was expropriated. The Western powers also removed and destroyed some facilities until the Cold War sparked Western interest in West Germany's economic reconstruction and co-operation.

In the 1950s and from its new base in Bavaria, S&H started to manufacture computers, semiconductor devices, washing machines, and pacemakers. S&H gradually expanded its share of the electrical market in Europe and overseas, and by the 1960s it was again one of the world's largest electrical companies. In 1966 all constituent companies were merged into the newly created Siemens AG. Since then Siemens AG has maintained its position as one of the largest global electrical companies, and has also established itself in areas such as industrial automation, building technologies, medical devices, information & communications, and transportation.

Siemens Building Technologies is an Operating Group of Siemens AG and was founded on October 1, 1998, through the acquisition of the industrial activities of Electrowatt Ltd. (Zurich, Switzerland), thus integrating and combining several decades of experience in building automation and fire safety.

Electrowatt’s history dates back to its foundation in 1895 with a focus on power generation and distribution and respective engineering services. Its industrial arm was built in the second half of the 20th century by the acquisition of Cerberus Ltd. (Männedorf, Switzerland), a world leader in fire safety founded in 1940, and of Staefa Control System Ltd. (Stäfa, Switzerland), a leading European player in building automation, founded in 1962. In 1996, Electrowatt acquired Landis & Gyr Ltd. (Zug, Switzerland), founded in 1896, and merged this company’s building automation activities with Staefa Control System under the new name of Landis & Staefa.
Today, Siemens Building Technologies with its four divisions Building Automation, HVAC Products, Fire Safety & Security Products and Security Systems combines offerings for building security, life safety and building automation within one company as a service and system provider and as a manufacturer of respective products. By virtue of the unique combination of these business sectors, the company occupies a leading position worldwide.

5.2.7 Eaton Electrical

Eaton Corporation is a diversified industrial manufacturer with 2007 sales of $13.0 billion. Eaton is a global leader in electrical systems and components for power quality, distribution and control; fluid power systems and services for industrial, mobile and aircraft equipment; intelligent truck drivetrain systems for safety and fuel economy; and automotive engine air management systems, powertrain solutions and specialty controls for performance, fuel economy and safety. Eaton has more than 81,000 employees and sells products to customers in more than 150 countries.

In 1911 Joseph O. Eaton, brother-in-law Henning O. Taube and Viggo V. Torbensen incorporated the Torbensen Gear and Axle Co. in Bloomfield, New Jersey. With financial backing from his mother, the company was set to manufacture Torbensen's patented internal-gear truck axle. In 1914, the company moved to Cleveland, Ohio, to be closer to its core business, the automotive industry.

In 1916, The Torbensen Axle Company was incorporated in Ohio, succeeding the New Jersey Corporation. A year later, Republic Truck Company, Torbensen's largest customer, bought out the company. But, Eaton and Torbensen were not content and bowed out of Republic to form the Eaton Axle Company in 1919. A year later, in 1920, Eaton Axle Company merged with Standard Parts. Standard Parts went in receivership later the same year
and was later liquidated. In 1923, Eaton bought the Torbensen Axle Co. back from Republic and changed the name to The Eaton Axle and Spring Company.

Eaton believed the quickest way to grow the business was through acquisitions and began buying companies in the automotive industry. By 1932, the diversified company changed its name to Eaton Manufacturing Company. In 1937, Eaton went international with a manufacturing plant in Canada. The company name changed once again in 1966 to Eaton Yale & Towne, Inc. after the acquisition of Yale & Towne Manufacturing Co. in 1963. Stockholders approved the change to the company’s current name in 1971.

Eaton Corporation is divided into 5 groups: Electrical, Automotive, Truck, Fluid Power and Aerospace.

Eaton Electrical is a $4.8 billion division of Eaton Corporation. It manufactures low and medium voltage switchgear, secured power products, wiring accessories, switchboards and panel boards.

In 2003 Eaton Electrical (formerly known as Cutler-Hammer) acquired the European Delta PLC’s electrical division for $350 million which held the following brands: HOLEC, MEM, TABULA, BILL, ELEK and Westinghouse to get a hold of the IEC standards (European, Middle East and Asia Pacific markets), one of the steps to get Global and grow more into a worldwide standard.

Not too long after that acquisition Eaton Electrical agreed to a JV with Caterpillar Inc. and purchased more than half of I & S operations (now known as Intelligent switchgear organization, LLC.), which followed several years later with the acquisition of Powerware.
In 2007 Eaton Electrical entered the data center power distribution market, releasing a line of power distribution under their Powerware brand called ePDU. They acquired Aphel Technologies Ltd., Coventry UK based manufacturer of power distribution product for data centers. Shortly after Pulizzi Engineering Inc., Santa Ana CA based manufacturer of mission critical power distribution was acquired. In late 2007 Eaton acquired the MGE Office Protection Systems division from Schneider Electric. A Taiwanese manufacturer, [Pheonix Tec], was also acquired giving the company the highest share in the Chinese single phase UPS market.

The Westinghouse Distribution and Controls Business Unit was acquired by Eaton Electrical in 1994. The acquisition included all of the Westinghouse electrical distribution and control product business and also included stipulations that the Westinghouse name cannot be used by anyone else on these types of products for years. Today, Eaton Electrical manufactures electrical distribution and control products branded "Eaton" or "Cutler-Hammer" which can replace Westinghouse products in commercial and industrial applications.

Eaton Corporation continues its founder's philosophy of growth through acquisition along with divesting businesses that no longer fit the corporate vision.

5.2.8 Cooper Industries

Cooper Industries is an American company based on Houston, Texas. It produces transformers, tools and electrical equipment in general. It employs 29,000 staff around the world and had revenues in 2007 for $5.9 billion dollars.
Cooper Industries origins extend back more than 170 years to a small iron foundry in Mount Vernon, Ohio, started by brothers Charles and Elias Cooper in 1833. The company had been a foundry powered by a horse, but it bought its first steam engine in 1842 and was soon making engines itself. A leading producer of Corliss steam engines in the 19th century, it switched in the early 20th century to making compressors, and became Cooper-Bessemer Corporation in a 1929 merger, before continuing diversification led to the Cooper Industries name being adopted in 1965.

For the first 125 years of its history, Cooper was primarily a one-market company, manufacturing power and compression equipment for the transmission of natural gas. In the 1960s, Cooper began to diversify, eventually broadening its product lines to include petroleum and industrial equipment, electrical products, electrical power equipment, automotive products, tools and hardware.

In 1967 the company entered the hand tool business by acquiring Lufkin Rule, a maker of measuring instruments, and subsequently added a large number of other hand tool businesses. In the 1970s the company entered aircraft maintenance, but subsequently sold off Cooper Airmotive. In 1979 it bought Gardner-Denver Company, its largest acquisition up to that point, extending its range of products serving the energy industry, which had been a key market since it started making compressors and a catalyst for its move of corporate headquarters to Houston in 1967.

The acquisitions of Crouse-Hinds Company in 1980 and McGraw-Edison in 1985, as well as the buyout of Westinghouse's lighting division in 1982, made electrical products the largest part of the company, which has remained the case ever since.
In the 1990s first Gardner-Denver was spun off and then the entire remaining Petroleum & Industrial Equipment segment was separated out as Cooper Cameron Corporation, including all remaining product lines from the company's first 134 years and more recent acquisitions in that area such as Cameron Iron Works. Cooper Cameron subsequently sold the Mount Vernon operations to Rolls-Royce plc. Today the company operates in the electrical equipment and tool industries.

5.3 Industry Developments in the Last Decade
The global electrical equipment industry is in a state of consolidation. The big players are getting bigger and bigger, and are increasing their market share either organically or through JVs and acquisitions.

Schneider Electric has identified its growth platforms viz. specific industrial automation segments, building management & security systems, secured power and energy management & services, and has embarked on an aggressive acquisition campaign to complete its product range in these areas. It has also identified areas where it wants to expand its geographical coverage for e.g. Ultra Terminal and Industrial Automation.

To strengthen its final low voltage distribution operations, Schneider Electric acquired Scandinavia's Lexel in 1999. In 1998 and 1999, the Company also acquired Schyller in Italy (industrial plugs), Mafelec in France and Veris Industries, Electrical Switchgear and Power Distribution Services in the United States. In 2000, fourteen companies were acquired, adding an aggregate 500 million to sales. In low voltage switchgear, Schneider acquired Metesan Lexel Elektrik in Turkey, Prodax in Hungary, Crompton Greaves (Low Voltage Business) and S&S Power Switchgear in India, May & Steffens in Germany, Conlog in South Africa, Infra + in France and EFI Electronics in the United States. In medium voltage switchgear, it acquired Bardin in France
and Nu-Lec in Australia, with power grid reliability solutions. In industrial control and automation, it acquired Steeplechase Software and Quantronix in the United States, Crouzet Automatismes (a subsidiary of Thomson CSF) in France, and Positec in Switzerland, which strengthened the product lineup for machinery manufacturers.

Since 2002, Schneider Electric has pursued an assertive strategy of organic growth and acquisitions to enhance its geographic coverage, strengthen performance in its core business and broaden its lineup to offer ever-more innovative and integrated solutions. The Group made important acquisitions while reorganizing its production base, thereby strengthening its leadership in electrical distribution and automation and gaining significant positions in new businesses with high potential such as energy efficiency, critical power, building automation and security and value-added services.

In 2004, Schneider Electric became the European leader in critical power with the acquisition of MGE UPS Systems in France. In October 2006, it made a friendly offer to purchase all outstanding shares of American Power Conversion (APC), the global market leader. The transaction, which was approved by competition authorities and by APC’s shareholders, was finalized in February 2007.

Schneider Electric gained world leadership positions in human-machine interface (HMI) with the 2002 acquisition of Digital Electronics Corporation in Japan, and in automation solutions for packaging machines with the 2005 acquisition of Elau AG in Germany. In 2006, it expanded its lineup of high power speed drives with the acquisition of Austria’s VA TECH ELIN EBG Elektronik. The Group also broadened its industrial automation portfolio with the acquisition of Citect, an Australian manufacturer of Supervision Control and Data Acquisition (SCADA) solutions and Manufacturing Execution
Systems (MES). Schneider Electric offers the most comprehensive lineup of customized sensors in the market after bringing in Hyde Park Electronics, the North American leader in ultrasonic sensors, in 2003; Kavlico and Dinel, manufacturers of sensing and optoelectronics devices, in 2004; and US based BEI Technologies, in 2005.

Schneider Electric now ranks second worldwide in installation and control due to the acquisitions of Clipsal, the Asia-Pacific market leader, in 2003; Juno Lighting, America’s leading manufacturer of track and recessed lighting, in 2005; and Clipsal Asia, Merten (Germany), OVA Bargellini (Italy), AEM S.A. (Spain) and GET (UK), in 2006. In 2007, the Group enhanced its presence in Germany and expanded its lineup in by acquiring Ritto GmbH & Co KG.

Schneider is a major player in the building automation and security market. In 2003, it acquired Sweden’s TAC, which was joined in 2004 by Tour Andover Control and Abacus Engineered Systems in the US. ABS (Advanced Buildings Systems) EMEA, which operates in Europe and the Middle East, came on board in 2005, followed by IBS (US and Asia) in 2006. In 2007, Schneider Electric enhanced the security side of the business by acquiring Pelco Inc., the world leader in video security systems.

In the area of energy management, Schneider Electric acquired Canada’s Power Measurement Inc., a leader in metering systems, software and services for managing energy supply and consumption in 2005. In 2007, the Group finalized the creation of Delixi Electric, a 50-50 joint venture with Delixi Group that manufacturers, markets and distributes low voltage products in China. Schneider Electric China now has more than 10,200 employees, 32 regional offices, 18 production facilities, 4 distribution centers, a training center, 2 R&D centers, 500 distributors and a large nationwide sales network. The Group generated revenue of €1.2 billion in China in 2007.
ABB has had a topsy-turvy ride over the last decade. In October 1998 ABB completed the largest acquisition in its history, buying Elsag Bailey Process Automation N.V., a Netherlands-based maker of industrial control systems, for $2.1 billion, including $600 million in debt. This deal made ABB's automation segment the world's leading maker of robotics and automated control systems, with annual revenues of $8.5 billion. On the divestment side, ABB in January 1999 sold its 50 percent stake in ADtranz to DaimlerChrysler AG for $472 million. In March 1999 ABB and France-based ALSTOM merged their power generation businesses into a 50-50 joint venture called ABB Alstom Power. For transferring to the venture operations that generated some $8 billion in annual revenues, ABB received $1.5 billion in cash. Then in May 2000 ABB sold its 50 percent interest in the venture to ALSTOM for $1.2 billion. That same month, ABB completed the sale of its nuclear power business to the U.K. firm BNFL Inc. in a $485 million deal. In June 2001, ABB completed the purchase of Entrelec Group for $284 million. Gaining Entrelec, a supplier of industrial automation and control products based in Lyon, France, strengthened ABB's position in key North American and European markets.

However, ABB’s financial condition was consistently deteriorating, and in 2001 ABB got saddled with the asbestos liability claim. The building products and oil, gas, and petrochemicals units were placed into a discontinued operations category, slated for divestment. In December 2002 ABB sold its water and electricity metering business to Ruhr gas Industries GmbH for $223 million. For 2002, ABB posted a record net loss of $783 million on revenues of $18.3 billion.

On the divestment front, ABB in August 2003 sold its building systems business in Sweden, Norway, Denmark, Finland, Russia, and the Baltic states
to Helsinki-based YIT Corporation for about $233 million. In December the company agreed to sell its Sirius reinsurance business to the Bermuda-based White Mountains for about $425 million. In January 2004 ABB reached an agreement to sell the upstream portion of its oil, gas, and petrochemicals unit to a private equity consortium led by Candover Partners, a European buyout firm, in a deal estimated to be worth at least $925 million.

ABB returned to profits by 2005 through a sustained restructuring drive of focusing on its core businesses on power and automation products & systems, and divesting its non-core activities. ABB has since then formulated its strategy for 2009, which talks of focusing on its core automation & power businesses through a mix of organic growth and focused acquisitions. Till date, ABB has not made any acquisition since 2002, however it has put together a sizable war chest for acquisitions.

Siemens has focused its efforts on becoming No.1. and No.2 in all the geographies that it operates. It has followed a combination of organic and inorganic means to do so. In 1998, Siemens acquired Westinghouse’s fossil-fuel power plant operations to become a premier player in the field of non-nuclear power generation. Siemens also acquired Landis & Gyr Utilities which catapulted it to the industry leadership position in the metering business. In fiscal 2005, the Company acquired, in several steps, the Austrian engineering group VA Technologie AG (VA Tech) which is now a wholly owned subsidiary of Siemens for preliminary acquisition costs of approximately €1,049 million (including €535 million cash acquired). In July 2005, the Company completed the acquisition of all shares of Flender Holding GmbH, Germany (Flender), a supplier of mechanical and electrical drive equipment, focusing on gear technology. The primary reason for the acquisition was to enable the Company to offer a full drive train (motor, inverter, gear) to customers. Preliminary acquisition costs amounted to €702 million. Siemens
also acquired substantially all of the assets of Robicon Corporation, USA, a manufacturer of medium voltage drives and power controls.

In fiscal 2006, Siemens acquired Electrium Limited, UK, a vendor of electrical installation systems at A&D and Bewator, Sweden, a supplier of products and systems for access control solutions at Siemens Building Technologies (SBT).

On May 4, 2007, Siemens completed the acquisition of U.S.-based UGS Corp. (UGS), one of the leading providers of product lifecycle management (PLM) software and services for manufacturers. The acquisition enabled Siemens to provide an end-to-end software and hardware portfolio for manufacturers encompassing the complete lifecycle of products and production facilities. The estimated purchase price, including the assumption of debt, amounted to €2.7 billion (including €75 million cash acquired).

General Electric has been less active on the acquisition front as far as electrical equipment business is concerned in the last decade. GE has acquired a few companies for expanding its product range in power generation space. However it is rumoured that GE is about to put its consumer & industrial business, as well as the non-American part of its power distribution equipment business on the selling block.

Eaton Electrical has acquired some major companies to establish itself as a serious threat to the global biggies. In 2003 Eaton Electrical acquired the European Delta PLC’s electrical division for $350 million which held the following brands: HOLEC, MEM, TABULA, BILL, ELEK and Westinghouse to get a hold of the IEC standards (European, Middle East and Asia Pacific markets), one of the steps to get Global and grow more into a worldwide standard. Eaton Electrical also entered into a JV with Caterpillar Inc. and
purchased more than half of I & S operations (now known as Intelligent switchgear organization, LLC.).

In 2007 Eaton Electrical entered the data center power distribution market, releasing a line of power distribution under their Powerware brand called ePDU. They acquired Aphel Technologies Ltd., Coventry UK based manufacturer of power distribution product for data centers. Shortly after Pulizzi Engineering Inc., Santa Ana CA based manufacturer of mission critical power distribution was acquired. In late 2007 Eaton acquired the MGE Office Protection Systems division from Schneider Electric. A Taiwanese manufacturer, [Phoenix Tec], was also acquired giving the company the highest share in the Chinese single phase UPS market.

In September 2008, Eaton Electrical completed the acquisition of Germany based Moeller Group, supplier of controls for industrial equipment applications. Moeller has 15 global production facilities and sales offices in more than 90 countries. This acquisition, coupled with the acquisition of Phoenixtec Power Company Ltd., Taiwan solidified Eaton’s position as a global supplier of electrical power distribution and control products and power quality equipment and systems.

Cooper Industries has been another aggressive acquirer in the past decade. Mainly US based, it derives two-thirds of its revenue from the US. Cooper has made acquisitions mainly in the US, and a few in the UK, to bolster its product range. Some of its key acquisitions in the last decade are:- Menvier-Swain Group, UK for entry into Europe, Australia and Fast East in 1997; Regent Lighting, US to expand its offerings in the home automation & security segment in 1999; B-Line, US to broaden the portfolio of electrical products and gain exposure into communications/data markets in 2000; and Eagle Electric Manufacturing Co, US for residential wiring devices in 2000.
It can thus be concluded that the global players are continuing on the move as far as expanding their product range and geographical coverage is concerned. The coming years are likely to see more consolidation with the major players spreading their wings in fast developing geographies like China and India.

**Going forward**

*The next chapter will analyze the data collected through various sources. Statistical techniques used to analyze the data will be discussed in this chapter. Research findings and results will be discussed in detail.*