Birth of the "Kameyama Model" Large-Screen AQUOS

The Kameyama Plant carried out integrated manufacturing of TVs, from panel production to final product assembly. With a state-of-the-art manufacturing process that could only be implemented in Japan, Sharp introduced popular high-quality LCD TVs that came to be known as "Kameyama models." Based on the principle that environmental technology is crucial to a company's growth, Sharp gradually expanded sales of products such as energy-creating solar cells and energy-saving LCD TVs. Sharp strove to become a company with zero global warming impact by offsetting the greenhouse gases emitted from its business activities with an equal proportion of greenhouse gas reductions through its energy-saving and energy-creating products. In overseas markets, Sharp rapidly expanded business in China.

Internal structure of an LCD, with multiple layers

1 Construction of the Kameyama Plant

Vertically Integrated Plant

Increasingly Larger and Higher-Quality Panels

Sharp knew that for LCD TVs to proliferate they must become a household's main living room TV, and that this would require an abundant supply system for large LCD panels. Digital HD (high-definition) broadcasting was coming to Japan and TVs would have to be able to support large, high-resolution images.

In October 2001, Sharp had a concept for a plant that could produce either eight 32-inch LCD panels or six 37-inch panels from one large glass substrate. These panels offered superior performance to conventional TFT panels in terms of response time, viewing angle, and contrast.

In February 2002, the decision was made to build a new plant in Kameyama City, Mie Prefecture. This would be in close proximity to Sharp's LCD development and production plants in Mie and Tenri and near a cluster of companies in the same industry.

The project required the close cooperation of Sharp partners, since large-scale equipment and new materials were needed.

Construction Starts at Kameyama

In September 2002, the ground-breaking ceremony was held for the Kameyama Plant. This plant would use sixth-generation glass substrates measuring 1,800 mm x 1,500 mm in a vertically integrated process from panel production to final TV assembly.

The path from initial equipment installation to eventual stable manufacturing was fraught with difficulties. It was no simple task to carry out highly detailed processing of huge glass substrates; nor was it easy to realize TVs with a fast response, wide viewing angle, and high contrast. There was much trial and error at first, since nobody at Sharp had experience with an integrated process covering everything from panel production to final TV assembly. Solving each problem as it arose, Sharp finally established a stable mass-production system for the plant in late 2003.

Operation Starts at Kameyama

A Model for Japanese Manufacturing

Sharp continued to improve its products and production lines by combining LCD technology and imaging technology and coordinating among its development and production divisions. Sharp's aim was to achieve Japanese-style manufacturing through a virtuous circle—what it called a "spiral effect"—of development and manufacturing strengths. After six months of operation, the plant's yield ratio for LCD panels was approximately 90%.

Sharp also successfully shielded the intellectual property of its valuable production technology, including methods and know-how. Rather than using "as is" the production equipment that it ordered from manufacturers, Sharp ensured production secrecy by incorporating proprietary modifications and firmware installations into the equipment.

Sixth-generation glass substrate (right) from Plant No. 1 and eighth-generation glass substrate (left) from Plant No. 2, which started operations in August 2006

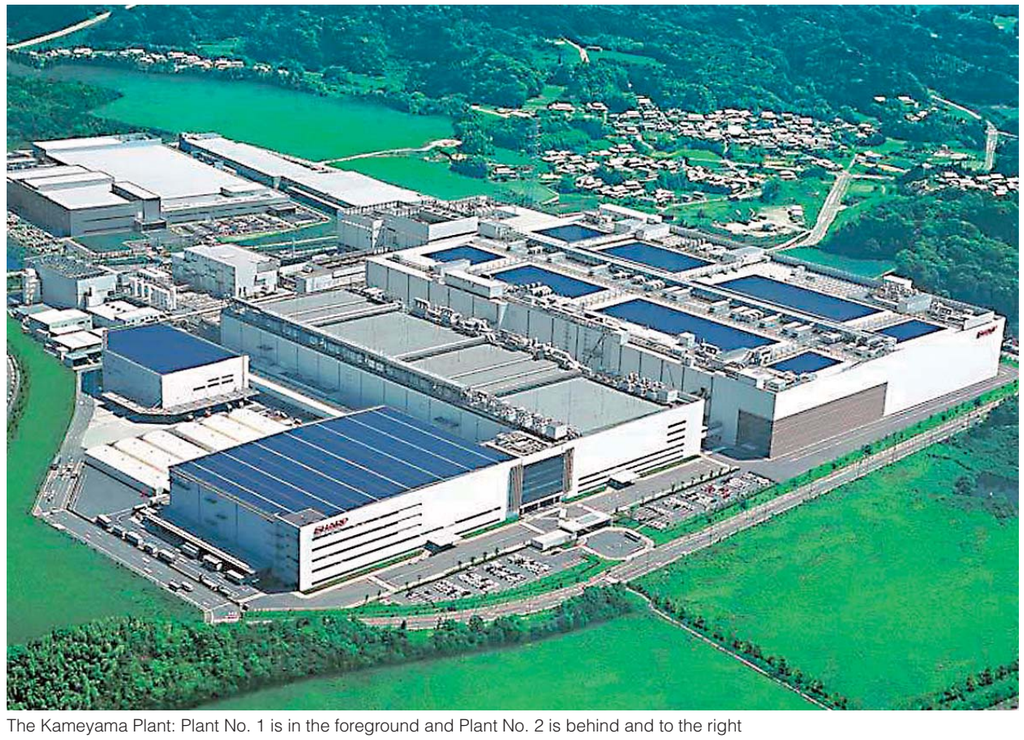
Kameyama Brand Large-Screen LCD TVs

The Kameyama Plant began shipping TVs on January 28, 2004. An unusually large contingent of journalists were on hand to cover the event, which marked something of a rebirth in Japanese manufacturing. At stores around the country, consumers began asking for Kameyama models by name. Sharp labeled each TV made here a "World-Class Kameyama Model" as part of a marketing strategy that capitalized on the factory's brand power. Kameyama became synonymous with Japanese manufacturing, and in March 2005 made-in-Kameyama AQUOS models reached a cumulative production total of 1 million sets.

POP for Sharp's Kameyama model

Start of Kameyama Plant No. 2

Kameyama Plant No. 1 was suited to producing 32- and 37-inch LCDs, but Sharp needed a system for producing the 40- and 50-inch models in demand as the primary TV in homes around the world. Kameyama Plant No. 2 began operations in August 2006, making TVs using eighth-generation glass substrates measuring 2,160 mm x 2,460 mm—at that time, the largest in the world. To make the next generation of panels, the new plant boasted production technologies such as glass substrate transport equipment, liquid crystal drop apparatus, and inkjet printing for color filters. Through revolutionized production methods, Kameyama Plant No. 2 was able to achieve double the investment efficiency of Plant No. 1. In short, Kameyama was a huge step forward in large-screen TV production.



The Kameyama Plant: Plant No. 1 is in the foreground and Plant No. 2 is behind and to the right

2 AQUOS for the World

Environmentally Friendly Plant in the Spotlight

The Kameyama Plant wasn't just a cutting-edge facility that revolutionized manufacturing. It was also Sharp's first Super Green Factory*1, achieving environmentally friendly operation through reduced CO_2 emissions and 100% recycling of wastewater. It was also specially built to withstand natural hazards such as earthquakes and lightning.

Production process wastewater recycling: Almost 100% of the water used in the LCD panel manufacturing process is purified and recycled. A wastewater collection plant using biotechnology breaks down noxious odors and reduces the amount of organic sludge.

Solar power system: A 5,201 kW-capacity solar power system produces enough electricity for about 1,300 average homes. It contributes to CO_2 emission reductions of 3,400 tons a year.

Fuel cell system: The plant has a 1,000 kW-capacity molten carbonate fuel cell that gives off almost no air pollutants such as NOx and SOx. Able to generate electricity at night and on rainy days, the system contributes to CO_2 reductions of approximately 3,000 tons a year.

Cogeneration system: This system uses LNG (liquefied natural gas) delivered by a pipeline to generate approximately 26,400 kW on site. To ensure effective use of energy, the system's waste heat is used for air conditioning and hot water heating.

Zero emissions: Right from the start of operations, the plant achieved zero landfill waste by recycling industrial waste—such as glass fragments mixed with liquid crystals—and by reusing liquid chemical waste.

There are approximately 570 seismic dampers inside the plant for absorbing earthquake vibrations

In recognition of these and other environmental measures, the Kameyama Plant has received numerous industry awards, including the Economy, Trade and Industry Minister's Prize in the 8th Japan Water Awards (sponsored by the Japan Water Award Committee).

A 10,000 kW superconducting magnetic energy storage system can counter sudden drops in line voltage (line-drops) that result from lightning strikes and other natural phenomena. Plant No. 2 has a seismic damper system that can absorb the vibration of an earthquake, and this proved effective in neutralizing an intensity-5 earthquake that struck in April 2007.

AQUOS Lineup Expands

In January 2004, the Kameyama Plant shipped its first AQUOS models: 37-inch LC-37GD1 G Series Advanced Super-V LCD TVs boasting extremely realistic images and the industry's highest resolution of approximately 1.05 million pixels. In August of that year, Sharp released the LC-45GD1, a 45-inch AQUOS with full-HD resolution of 1,920 x 1,080 pixels. Sharp engineers believed that since TV stations were broadcasting with 1,080 vertical lines, TV manufacturers should not offer receivers with fewer lines. Compared to plasma TVs, LCD TVs could offer exquisite detail and thus the ability to reproduce HD broadcasts with all their original beauty.

The LC-37GD1 G Series AQUOS: superior image quality along with energy efficiency and other environmental benefits

Sharp introduced the 65-inch LC-65GE1 in August 2005. With its huge screen sizes, full-HD quality, expansive product lineup, and environmental design, the AQUOS solidified Sharp's position as the leader in flat-panel LCD TVs.

In October 2006, Sharp introduced six models, including the 52-inch LC-52GX1W model, that used Kameyama Plant No. 2 panels and boasted the world's highest contrast ratio and fastest response (at the time)*2.

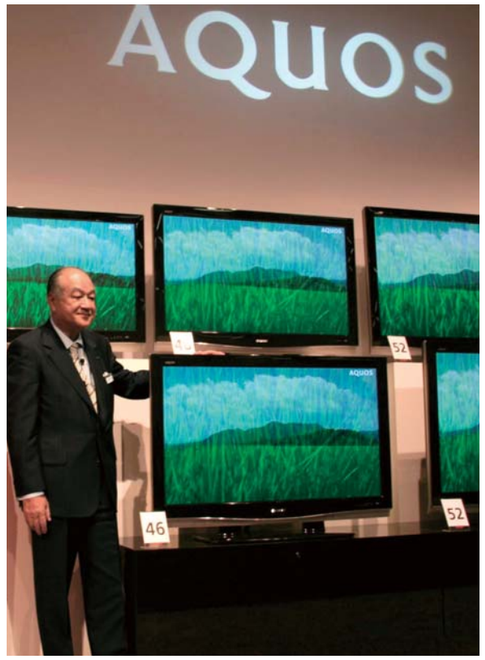
Sharp continued to stoke demand for AQUOS TVs by giving them better images, bigger screens, and greater energy efficiency. In May 2006, the cumulative production total of AQUOS TVs surpassed 10 million sets.

In August 2006, Sharp announced AQUOS FamiLink, which offered control of other products—such as a high-definition recorder—with a single AQUOS remote controller. People could now enjoy a full range of audio-visual enjoyment with AQUOS at the core.

5-Pronged Worldwide LCD Production System

AQUOS had acquired significant market share in Japan and in 2004 Sharp began a push to make it a globally recognized brand. The message of the 'More to See' campaign was that AQUOS was a high-end TV that showed viewers all the details.

To bring its extensive product lineup closer to consumers, Sharp began selling AQUOS through large-volume retailers such as Best Buy Co., Inc. in the US. As a result of these efforts, Sharp TVs held a dominant 33.5% market share (No. 1) in the first half of 2004, far outcompeting the second-place brand at 14.4%.



President Machida announces Sharp's global LCD TV strategy at the IFA trade show in Germany

On August 31, 2006, at the IFA consumer electronics and appliance show in Berlin, Germany, President Machida announced the company's global strategy for LCD TVs. The same day, it was announced that Sharp would release AQUOS models from the Kameyama Plant No. 2 simultaneously on October 1 in Japan, North America, and China. This marked the end of Sharp's previous policy of releasing products in Japan prior to releasing them elsewhere.

To execute this strategy, Sharp built a five-pronged worldwide production system that enabled the company to promptly meet LCD TV demand in different markets. Peripheral electronic components were mounted onto large LCD panels made at Kameyama Plant No. 2 and the actual TVs were assembled in the region where they were to be sold. The lines of SEMEX in Mexico were updated for delivering products to the North American market; meanwhile in Europe, Sharp established Sharp Manufacturing Poland Sp. z o.o. (SMPL) for the production of LCD modules (which started in January 2007). SMM in Malaysia and NSEC in China were also given LCD module production capabilities, thus completing Sharp's five-pronged worldwide system.

Evolution in Small- and Medium-Size LCDs

Switchable Viewing Angle LCD and Dual Directional Viewing LCD

Sharp succeeded in developing a technology for controlling the viewing angle of an LCD. In 2005, the company developed the Switchable Viewing Angle LCD, which narrowed the left and right viewing angles to prevent people nearby from seeing the screen. This technology was adapted for use in mobile phones and other products. The Dual Directional Viewing LCD, meanwhile, allowed simultaneous viewing of two different images on one screen—i.e., from the left or right angles. This was used in products such as car navigation systems.

In April 2009, Sharp released a notebook PC with a proprietary optical sensor LCD for the touchpad. This offered beautiful image display, and its touch-sensitive interface made it ideal for handwritten input and gaming.

Sharp Yonago Corporation

In June 2005, Sharp took over a factory from Fujitsu Limited and established Sharp Yonago Corporation. The plant produced small- and medium-size LCDs from 2 to 10.4 inches for use in applications such as mobile phones, car navigation systems, and digital cameras.

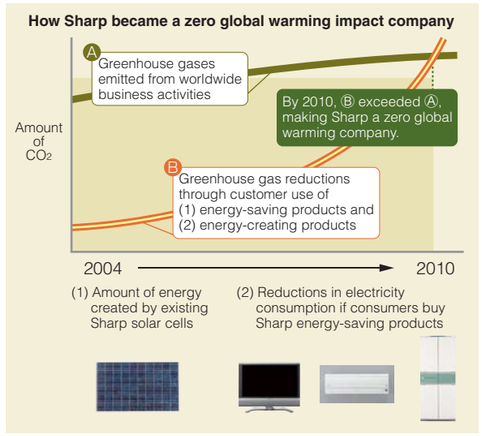
*1 A factory that has achieved in-house standards for criteria such as greenhouse gas emission reductions, proper disposal of industrial waste, and efficient use of water.
*2 For digital HD LCD TVs.

3 Continuing Efforts to Protect the Environment

Zero Global Warming Impact Company

In 2004, Sharp announced its goal of becoming a zero global warming impact company by 2010. The aim was, by fiscal 2012, to offset the greenhouse gases emitted from its worldwide business activities (Ⓐ in the illustration) with an equal proportion of greenhouse gas reductions through customer use of its energy-saving and energy-creating products (Ⓑ in the illustration). This was in line with the Kyoto Protocol (adopted in 1997) for reducing countries' greenhouse gas emissions.

In 2004, when Sharp made this announcement, it was believed that environmental protection would be costly and would hurt corporate growth. However, Sharp's position was that a company could not grow without environmental technologies.



While reducing greenhouse gas emissions from its plants, Sharp also improved the conversion efficiency of its solar cells, expanded its solar power business, and manufactured and sold more LCD TVs and other energy-saving products. The result was a dramatic reduction in greenhouse gas emissions and the achievement of its environmental vision in fiscal 2008, two years ahead of schedule.

Environmental and Social Contribution Activities

Sharp launched the Solar Academy (environmental education program) in 2004, and in 2006 it teamed up with the Weathercaster Network, a Japanese NPO, to conduct eco-education in elementary schools. From 2009 onwards, Sharp added manufacturing-themed programs for elementary schools and eco-education at schools for the hearing impaired. Sharp bases in China, the US, and other countries also began educational programs for schools.

In June 2003, the Sharp Green Club (SGC) was established as a joint labor-management organization for conducting environment-related activities in the community. Its first outing, in July 2003, drew around 1,300 participants and involved a cleanup of Mount Wakakusa in Nara Prefecture.

Sharp continues to run a number of in-house eco initiatives. Employees carry out green driving practices and took part in Team Minus 6%, an initiative of the Japanese Ministry of the Environment. Since 2005, employees have been dressing lightly in summer and more heavily in winter, so that offices use less electricity for air conditioning.

In October 2008, Sharp established a department to plan and carry out social action programs. Since then, the company has striven to be a good corporate citizen by expanding activities focusing on the environment, education, and social welfare.

4 Focus on Health and Environment Products

Increased Capacities for Solar Cells

The 2004 amendment of Germany's FIT*1 (feed-in-tariff) policy led to a sharp rise in solar cell demand, but there were signs of a shortage in the supply of the silicon used to make these cells. Sharp proceeded to secure access to raw materials and develop new solar cell technologies.

One of these was a technology for thin-film silicon solar cells. Although they had the advantage of using only about 1/100th as much silicon as conventional crystalline solar cells, these amorphous (non-crystalline) silicon thin-film solar cells had a conversion efficiency of 7% to 8%—only about half that of crystalline silicon cells. Sharp thus developed a double-layer crystalline tandem thin-film solar cell in which short wavelength light is absorbed by the amorphous thin film and long wavelength light is absorbed by the micro-crystalline thin film. This made it possible to increase conversion efficiency to 11%, 1.5 times the rate of amorphous silicon thin-film cells. Sharp began production of tandem thin-film solar cells in 2005, and by 2008 the initial annual capacity of 15 MW had increased to 160 MW.

Sharp strove to ensure a stable supply of the silicon raw material. For example, it signed a long-term supply contract for silicon wafers with a raw material producer; and in 2007 it opened its Toyama Plant for producing approximately 1,000 tons of silicon raw material annually.

In 2004, Sharp began a joint research project with NEDO—the New Energy and Industrial Technology Development Organization—under which solar power systems were installed at Sharp's main plants.

Meanwhile, Sharp continued to aggressively develop solar products and increase sales of its solar power systems. In 2004, it released a residential module system that integrated with metal roofs. In 2005, it developed new software for helping consumers find a suitable residential solar power system. With this software, the salesperson would input data on the shape and measurements of a customer's roof, and the software would use this data to design a solar power system ideal for that particular home.

Integrated solar power system for use with metal roofs

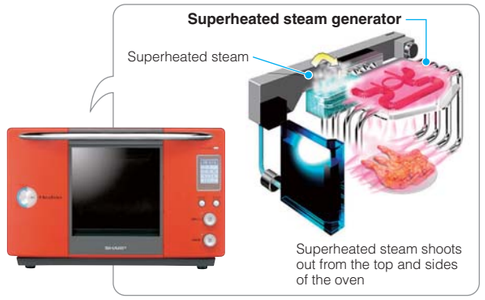
21st Century Appliances Gain Attention

Sharp began offering consumers a kitchen for the 21st century under the development theme of 'health, environment, and peace of mind' for home appliances.

Superheated Steam Oven: "Roasting" with Water

The AX-HC1 superheated steam oven, released in September 2004, was representative of this new group of products. Developed to give consumers healthy, delicious food, the superheated steam oven surrounded food with superheated steam at around 300°C. By generating about eight times*2 the heat content of standard Sharp convection ovens, the steam ovens effectively roasted food with water.

Development of the superheated steam oven began with the idea of taking a commercial superheated steam cooker, which was used for things like drying fish overnight, and adapting it to household use. As Sharp engineers conducted cooking tests, they were excited to discover that cooking with superheated steam allowed food to maintain vitamin C and other nutrients, and that it melted away excess fat and salt content. They succeeded in producing a commercial product by developing a proprietary superheated steam generator that efficiently created superheated steam using a 100 V power source. This clearly distinguished Sharp's superheated steam oven from other companies' models, earning it instant popularity and accolades from health-conscious consumers.



The functional, beautifully designed AX-HC1 and how it worked

In 2004, Sharp released the QW-SV1 dishwasher/dryer, which used salt to make ion-rich hard water for washing dishes. The product earned praise as a powerful and environmentally friendly dishwasher. In 2005, Sharp released the SJ-HV46J, the first refrigerator in the industry with a special compartment that could be turned into a 55°C food warmer. The product was the talk of the industry for its ability to keep dishes in the refrigerator warm and ready to eat.

Ever More Plasmacluster Ion Products

Sharp developed its Plasmacluster Ion technology in 2000, and in the following years, the technology came to be used not just in Sharp air purifiers and air conditioners but also in products from other companies in other industries—for example, in toilets, gas fan heaters, and car air purifiers. In its "academic marketing," Sharp used the results of studies conducted by universities and research institutes to show that, for example, Plasmacluster Ions inhibit the action of airborne viruses*3 and airborne mite allergens*4. In the process, the mechanism*5 of Plasmacluster Ions was also discovered.

*1 FIT: A system for spreading the use of renewable energy by guaranteeing to purchase such energy at a fixed price over the long term.
*2 Compared to the heating capacity of a convection oven per 1 m^3 when cooking at 230°C. Heat energy of 1 m^3 of superheated steam (230°C): 298 kcal; heat energy of 1 m^3 of convection oven (230°C): 35 kcal.
*3 Based on studies conducted in 2002 by the Kitasato Research Center of Environmental Sciences.
*4 Based on studies conducted in 2003 by the Graduate School of Advanced Sciences of Matter, Hiroshima University.
*5 Based on studies conducted in 2004 at Aachen University of Applied Sciences, Germany (airborne bacteria, airborne viruses).

5 Expanding Information and Communications Business

Rocketing Mobile Phone Business

Sharp Becomes Leading Mobile Phone Supplier in Japan

Despite entering the mobile phone market late, by fiscal 2005 Sharp was shipping more phones than any other company in the Japanese market (according to MM Research Institute, Ltd.). Factors contributing to this success included the development of products with appealing new functions and the delivery of them to the market up to six months earlier than rival products.

Behind this strategy were proprietary device technologies such as LCDs and CCD/C-MOS cameras; vertical integration, in which technologies and their application products moved in an upward spiral of evolution; and lateral integration, whereby the most effective use was made of information-processing and imaging technologies fostered in Sharp's other company departments. Also crucial to creating attractive products was the application of high-density mounting technologies.

The area of LCDs is one such example. By equipping its phones with TFT color LCDs in place of earlier STN color LCDs, Sharp earned a reputation for being light years ahead of the competition in terms of image quality. It then cemented its reputation in 2004 when it began giving its phones Mobile Advanced Super-V LCDs, which boasted high contrast and wide viewing angles. Developments in phone camera technology allowed Sharp to come out with ever-more advanced products: 1-megapixel cameras in 2003, 2× optical zoom in 2004, and 5-megapixel cameras with 3× optical zoom in 2006.

Sharp began supplying KDDI Corporation with the W41SH mobile phone in 2006. Having already supplied products to Softbank Mobile and NTT DoCoMo, Sharp now delivered its products to all three mobile phone companies in Japan. In 2005, Sharp made the W-ZERO3 mobile communication tool for Willcom, Inc., a PHS provider.

(1) (2) (3)

(1) SH505i equipped with a megapixel CCD camera and System LCD (2003)
(2) W-ZERO3 WS003SH equipped with a 3.7-inch Mobile Advanced Super-V LCD and a slide-out QWERTY keyboard (2005)
(3) W41SH used Mobile Advanced Super-V LCDs for the main and sub displays (2006)

AQUOS Phone for One-Seg TV

April 2006 in Japan heralded the start of One-Seg, a technology using a segment of each terrestrial digital television channel's bandwidth to carry broadcasts for mobile devices. Sharp began developing compatible mobile phones to coincide with the start of this service.

Sharp first had to develop a proprietary One-Seg TV tuner that was ultra-compact, energy-efficient, and extremely sensitive. The company also developed its unique "cycloid" style swiveling screen for natural TV watching. The LCD could rotate 90° to a landscape orientation for natural TV viewing. Sharp also applied AQUOS technologies to create a phone with a high-quality TV screen. These development efforts were rewarded when the Vodafone 905SH AQUOS Phone was released in May 2006 to an enthusiastic reception from the market. The company reaped the rewards of this run of new models by shipping more than 10 million phones in Japan in fiscal 2006.

The "cycloid" style of the Vodafone 905SH allowed it to rest stably on a flat surface

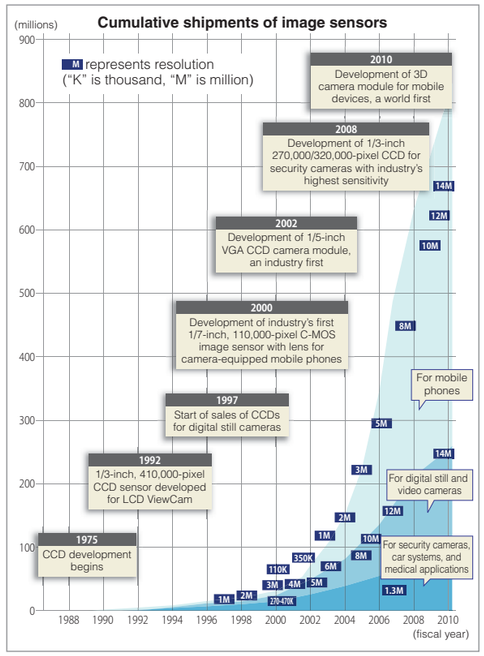
Sharp's Personal Communication Systems Division, which handled the mobile phone business, enjoyed skyrocketing sales, going from 20 billion yen in fiscal 1998 to 560 billion yen in fiscal 2006.

CCD/C-MOS Image Sensors Exceed 100 Million Units in Cumulative Sales

Since 1980, Sharp has been continuously expanding its lineup of CCD and other image sensors with ever-higher image quality. Demand jumped suddenly in November 2000 when these image sensors were adopted for camera-equipped mobile phones. In January 2004, Sharp CCD/C-MOS image sensors reached the 100-million plateau in cumulative sales.

Camera modules for mobile phones were required to be increasingly more compact and higher in resolution. In response to these market needs, in 2006 Sharp released the LZOP3953, the industry's smallest 1/3.2-inch (optical sensor size), 2-megapixel C-MOS camera module; and the LZOP3954, the smallest camera module offering an auto-focus function.

Sharp also ventured outside mobile phones, achieving success in image sensors for products such as digital cameras and security cameras. In fiscal 2010, cumulative shipment of image sensors hit 800 million.



The Advance of Information Products

Sharp Announces Color Renaissance Concept

In March 2005, the Document Systems Group announced the Color Renaissance concept. With offices gradually moving from monochrome to color document products, digital MFPs were becoming more than just tools to make offices more efficient; they were increasingly incorporating features such as environmental performance and information security, and they were offering customers color capabilities, high image quality, and business solutions.

The development of Sharp's Mycrostoner dramatically improved image quality and environmental performance. Document devices used about 30% less of the toner, and its grains were approximately 50% finer than those of Sharp's previous products. The toner could also faithfully reproduce intermediate colors, such as skin tones, and produce copies with crisp, clear text and graphics. In November 2005, Sharp released the MX-2700FG and other models using Mycrostoner. Since then, Sharp has been spurring a new era in office documents as it markets products under its ECOLUTION slogan. This represents three elements: ecology (the environment), a revolution of new technologies, and solutions for open systems.

The MX-2700FG provided options for protecting users' data

Birth of the Information Display

Major growth was occurring in the market for commercial information displays—LCDs that played the role of bulletin boards and posters. In 2005, Sharp released the PN-455, a 45-inch display that reduced glare from exterior and fluorescent lighting and that provided a high-resolution screen with high image quality that was easy to view even in bright settings. Sharp promoted this product for use in show windows and as LCD posters. With the 2006 release of the PN-655 65-inch display, commercial users could give powerful business presentations, several designers could check a CAD drawing on the same monitor, and videoconference participants felt like they were all in the same room.

The PN-655 information display with a full-HD panel (1,920 x 1,080 pixels)

6 Boosting Corporate Value and Stressing Social Responsibility

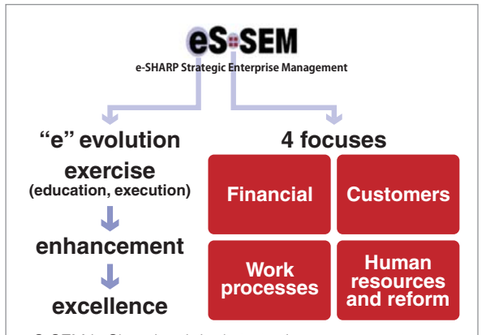
Reforming Management

Strengthening Corporate Governance

Sharp has striven over the years to improve corporate governance through management that is more transparent, objective, and sound. One measure to this end was taken in June 2003, when the company shortened the director appointment term from two years to one year. This was done with the aim of boosting management mobility and flexibility and clarifying management responsibilities for each new fiscal year. Sharp has also built an internal control* system to ensure compliancy with Japanese laws such as the Companies Act (enacted in 2006) and the Financial Instruments and Exchange Act (2007). In July 2006, Sharp's Advisory Board was established to reflect opinions from outside experts in company management decisions. This system was dropped in June 2009 in favor of the appointment of outside directors.

eS-SEM Strategic Management System

In 2004, Sharp introduced the eS-SEM (e-Sharp Strategic Enterprise Management) system—based on a balanced scorecard concept—to ensure it could achieve sustainable growth. eS-SEM was a means to incorporate company-wide strategies into the action plans of all Sharp divisions and individual employees. It was also a way of ensuring that those strategies would be steadily implemented. All work would be implemented in a strategic manner, and this would lead to the creation of greater corporate value. There were four strategic focuses to eS-SEM. The first was financial success in the form of increased profits and sales. The other three represented the roads to achieving this success: customers, work processes, and human resources and reform. How well company divisions and individuals did in these four focus areas was reflected in their respective performance evaluations.



eS-SEM is Sharp's original strategic management system based on the BSC (balanced scorecard) concept developed by Dr. Robert S. Kaplan of Harvard Business School. BSC emphasizes a balance among factors like long- and short-term goals, as well as the factors that give rise to results and performance. BSC covers all business processes from strategy building to performance evaluation.

Becoming a Trusted Company

Company-Wide Focus on CSR

In October 2003, Sharp established the CSR Promotion Division to be in charge of all matters related to CSR (corporate social responsibility). Sharp's CSR concerns go beyond the Sharp Group to cover all business partners and all aspects of the value chain, from materials procurement to final sales to end users. Sharp also holds employee training to ensure that corporate ethics and compliance are firmly rooted in corporate culture.

As a result of these efforts, in 2005 Sharp was No. 1 overall in *Nikkei Business* magazine's CSR survey of the 2,178 companies listed on the first and second sections of the Tokyo Stock Exchange.

As part of its compliance program, Sharp has also strengthened its system for managing information security and protecting personal information.

Aiming to be No. 1 in Customer Satisfaction

In October 2005, the name of the Reliability Control Group was changed to the CS Promotion Group. That same year, Sharp also initiated a quality-innovation strategy for creating No. 1-quality products, and a CS-innovation strategy for becoming No. 1 in customer satisfaction. These strategies were a major reason that Sharp was, for three consecutive years from fiscal 2009, ranked No. 1 in a *Nikkei Business* magazine survey of after-sales service in key product categories such as flat-panel TVs, Blu-ray Disc/DVD/HDD recorders, washer/dryers, and air conditioners.

Sharp service engineers' goal is to keep customers waiting for product repairs for as little time as possible

* Internal control: An in-house system of proactive measures by a company to avoid and eliminate management risk and scandals. Under Japan's Companies Act (enacted May 2006), the boards of directors of large corporations (companies capitalized at more than 500 million yen, or with debts totaling more than 20 billion yen) were obligated to pass resolutions on basic policies for the establishment of internal control systems. Starting in fiscal 2010, the Financial Instruments and Exchange Act obligated listed companies (including consolidated subsidiaries) to submit internal control reports and undergo internal control audits by outside auditors.

7 Growth of the Chinese Market and International Business Measures

Growth of Business in China

China's real GDP grew at a rate of more than 10% in 2003, as the country rapidly became a global economic force. Sharp sought to achieve brand appeal among China's wealthy consumers with the market introduction of LCD TVs and other one-of-a-kind products in Beijing and in coastal cities like Shanghai and Guangzhou.

In 2004, with digital broadcasting about to take off, Sharp released the G Series AQUOS LCD TVs in Shanghai and Beijing. AQUOS represented a new generation of TVs and soon became a status symbol. Sharp also released the Ag+ (silver) ion washing machine that year. This product was a huge hit in China, because it effectively eliminated odors from laundry items—a big plus in a country where many people hang up clothes on closed balconies.

130 dealers showed up at a negotiation gathering held after the press announcement for the G Series AQUOS in Shanghai

SOCC, Sharp's production subsidiary for copiers, was working to educate its dealers about Sharp products. The company earned respect by doing everything possible to boost dealer profits through events such as joint product sales fairs and product exhibitions. At the same time Sharp expanded its sales network by utilizing its advantage of having factories in China—which allowed the company to promptly supply parts—and by establishing a nationwide service network to carry out prompt maintenance. As a result, despite Sharp's late entry into China's copier market, it earned not just a large market share but also a stellar reputation in the field of copiers.

In October 2005, Sharp Electronics Sales (China) Co., Ltd. (SESC) was established to consolidate the marketing functions previously conducted by three companies: SSEC (appliances), SOCC (copiers), and NSEC (AV products). SESC came about after laws were passed in China in 2004 allowing for the establishment of integrated sales companies. In 2004, Sharp established Sharp Technical Components (Wuxi) Co., Ltd. (STW) for the manufacture of LCD TV backlights.

Restructuring of Overseas Business

Sharp was hard pressed to reorganize itself to keep up with major changes in the international business environment: the rise of manufacturers in Korea and Taiwan, greater purchasing power by major distributors, and growth in newly emerging economies.

One measure that Sharp took was reorganization of its sales system in Europe. In 2007, SEEG in Germany was split into sales companies in charge of appliances, information products, and solar power systems. The year before that, SUK moved its headquarters from Manchester to London, where key business partners were concentrated. Reorganization at SEC in the US included creating separate divisions to market each product group and implementing a direct-sales business model for document products and other Sharp offerings.

Sharp also focused its overseas business on copiers, LCD TVs, and solar cells. In fiscal 2006, these three product categories accounted for approximately 70% (about 574 billion yen) of all Sharp overseas sales on a monetary basis—sales figures were up approximately 1.7 times over fiscal 2004.

Sharp made a foray into the European mobile phone market with the October 2002 release of the GX10 mobile phone with color LCD for carrier Vodafone Group Plc. In September 2004, T-Mobile USA, Inc. released the PV-100 smartphone, nicknamed the Sidekick II. Young people responded especially favorably to this phone's communication capabilities for e-mail and instant messaging. The Sidekick III was released in June 2006 and sales figures of about 1 million attested to the popularity of this Sharp phone.

The PV200, or Sidekick III, was lauded for a design that included a trackball for ease of operation

Evolution of LCD Technology and Application Products

1970s | 1980s | 1990s | LCD technology today (2000 and beyond)

Representative application products


LCD calculators


Thin-profile calculator


Electronic translator


Japanese word processor


Electronic organizer


Portable TVs

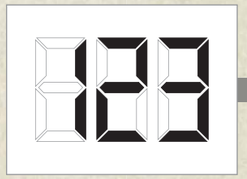

LCD projectors

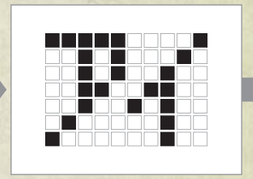

LCD videocameras

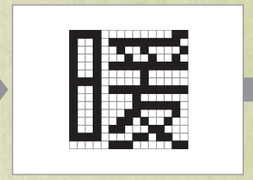

Car navigation systems


Laptop and notebook computers

Type of information displayed







Major LCD technologies

DSM LCD

DSM (dynamic scattering mode) displays use the fact that light is scattered when a voltage is applied to liquid crystal.

The advantage of a simple design was offset by high operating voltages and sluggish response in cold environments.

TN LCD

Passive matrix type

TN (twisted nematic) displays use the fact that previously aligned liquid crystal molecules change their alignment when a voltage is applied.

TN LCDs solved the problems with DSM designs but suffered from deteriorating contrast as the number of pixels was increased.

STN LCDs Color STN LCDs

Passive matrix type

STN (super twisted nematic) displays use liquid crystal molecules that twisted to a much higher degree than those in a TN LCD, yielding superior contrast.

STN displays were characterized by a yellow-green or blue tint. Later designs eliminated the tint and introduced color capability.

Color TFT LCDs

Active matrix type

TFT displays use thin-film transistors (TFTs) to switch pixels on and off.

TFT displays provide dramatically improved contrast and response compared to TN LCDs, even when the number of pixels is increased.

Mobile


Tablets


Mobile phones

PDA

IGZO*1

CG-Silicon*2

Mobile Advanced Super-V LCDs Advanced TFT LCDs

Reflective/transflective type

A reflector inside the LCD's pixels reflects incident light from the surface of the display to increase ease of viewing.

This technology makes possible displays that can be viewed in bright light.

Note: Some mobile products use transmissive LCDs.

Large LCDs


Large-screen LCD TVs

Full-HD*3 panels

Double-speed Advanced Super-V LCDs*4


Touchscreen displays

Advanced Super-V LCDs

Advanced Super-V

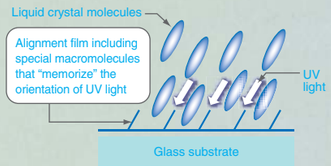
This new display technology incorporates innovations in liquid crystal molecule alignment and pixel structure.

Advanced Super-V LCDs provide excellent viewing angles in all directions, fast response, and no image persistence, even when displaying fast-motion video. Moreover, they can display high-contrast images.

Advanced technology for large LCDs

UV²A* technology

This photo-alignment technology allows liquid crystal molecules to be aligned with a high degree of precision. It also allows high contrast of 5,000:1 (1.6 times better than previous technologies), fast response (2 times better than previous technologies), and high light utilization efficiency (with an aperture ratio that is at least 20% higher than previous technologies) for vivid colors and reduced energy use. Moreover, the simple design affords a high level of production efficiency.



Once the orientation of the alignment film is determined by irradiating the substrate with ultraviolet (UV) light during the manufacturing process, the liquid crystal molecules are aligned in the same direction.

* UV²A: Ultraviolet induced multi-domain vertical alignment

Four-primary-color technology

This technology adds yellow to the conventional three primary colors of red, green, and blue to implement four-primary-color pixels. This enhancement allows displays to vividly reproduce colors such as glittery gold and emerald-green, which are difficult to create with the conventional three primary colors.

Note: Sharp's four-primary-color concept was designed for use with LCDs; it differs from the conventional three-primary-color concept of light and color.

Ultra-high-resolution LCD technology

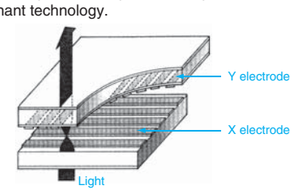
Ultra-high-resolution LCDs can display extremely realistic images with smooth edges at resolutions far in excess of standard high-definition broadcasts.

ICC 4K LCD TV (3,840 × 2,160 pixels)
Combining Sharp's large-screen, high-resolution LCD control technology with signal processing technology from I-cubed Research Center Inc., the ICC 4K LCD TV reproduces depth and texture at a level of detail that approaches the natural world.

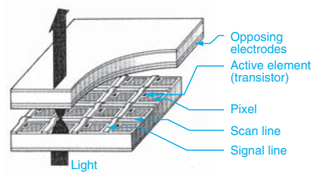
85-inch direct-view LCD compatible with Super Hi-Vision (ultra high definition) (7,680 × 4,320 pixels)
The first display of its kind in the world, this UHDTV was developed jointly by Sharp and NHK in 2011. The device reproduces video with overwhelming presence and intensity.

■ From passive matrix to active matrix

As the size and resolution of displays increased, manufacturers were unable to resolve contrast and response speed inadequacies with passive matrix designs, and active matrix LCDs became the dominant technology.

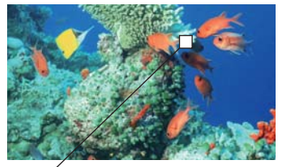


Passive matrix drive design
When a voltage is applied to X and Y electrodes forming a matrix along the display's X- and Y-axes, the potential difference created in the point (pixel) at their intersection causes the orientation of the LCD molecules there to change.



Active matrix drive (TFT) design
Transistors attached to individual pixels serve as switches, turning elements on and off.

■ Principle of color LCDs



Pixels are divided into three sub-pixels, and color filters are used to create the three primary colors of red, green, and blue. A range of colors can then be reproduced by varying the lightness and darkness of the three primary colors.

*1 IGZO

In IGZO displays, the silicon in the TFT material is replaced with an oxide of indium (In), gallium (Ga), and zinc (Zn) to more readily facilitate the flow of electrons. This technology allows smaller TFTs while increasing screen brightness and lowering energy use.

*2 CG-Silicon

CG-Silicon (continuous grain silicon) incorporates innovations in the crystalline structure of TFT silicon to more readily facilitate the flow of electrons. It can be used to create high-definition LCD panels into which peripheral functionality has been integrated.

*3 Full-HD panels

Full-HD panels with a resolution of 1,920 (horizontal) × 1,080 (vertical) pixels can reproduce the high-definition signal format (1080i) used for digital broadcasts at their native resolution.

*4 Double-speed Advanced Super-V LCDs

Double-speed Advanced Super-V LCDs create an intermediate frame between each frame sent in TV broadcasts to display 120 frames per second, enabling them to reproduce motion more smoothly.