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A Network of Expertise — A Global Partner for Innovations

# Patents, Standards, and Norms at Siemens

Corporate Intellectual Property and Functions



Prof. Winfried Büttner is Head of Corporate Intellectual Property and Functions (CT IP).



Patents on Siemens' own inventions have always been among the company's most important assets — even back in the 19th century.

# Why Intellectual Property Represents Siemens' Future

The number of inventions registered at Siemens has risen substantially since the early 1990s — from 2,000 per year at the beginning of this period to around 8,800 per year today. Patent registrations have also increased significantly — from 2,000 per year in the 1990s to about 4,300 per year today. Are inventions and patents more important now than they were 15 or 20 years ago?

**Büttner:** In this era of globalization and growing international competition, a company's future depends on its intellectual property. That's much more the case today than ever before. Employee knowledge is the most important component of added value for a company like Siemens, which is striving to be a technological trendsetter. Patents are also one of the few elements that can be used to gauge the effectiveness of investment in research and development. R&D investment has also risen since the 1990s, and inventors can now share in the success of their new ideas to a greater extent than they used to. Both of these factors have led to an increase in the number of inventions registered. The global significance and value of patents has also grown greatly. Our patent portfolio today is very valuable, in terms of the licensing agreements we reach with other companies as well as in patent disputes.

But it's not just the number of patents in the portfolio that counts, is it?

**Büttner:** The quality of the patents is the most important factor, of course. For example, a key

patent that serves as one of the foundations of an international standard — or a must-use patent that cannot be circumvented by any other solution — is worth much more than an average patent. We therefore pay very close attention to the value of our patents — because international patent registrations are costly, if for no other reason.

What's your strategic approach here?

**Büttner:** Once the Siemens operating units have determined what their trendsetting technologies will be, we work with them to define the focus of their subsequent patent approach with regard to aspects such as international standards and strategic R&D projects. This enables us to assign a specific value to each patent. For example, we assess how important the patent is with regard to the competition. We also examine what our competitors are doing, of course. If we find, for example, that they're registering a lot more patents in a certain area than Siemens is, we use this information to determine the potential risks facing our business; it may also cause us to take a closer look at the research fields involved.

Can you provide some examples of especially valuable patents?

**Büttner:** Take the Healthcare Sector. Here we have X-ray machines equipped with a so-called C-arm. The latter is guided by a robot in a process that makes it possible to carry out more precise and more rapid X-ray examinations. Siemens holds key patents that enable the

practical implementation of this technology. In fact, we're currently the only manufacturer to have launched such a device on the market, and our constantly growing patent portfolio continues to safeguard this competitive edge. Another example is our new computer tomograph with two X-ray tubes and two detectors, which is protected by numerous patents.

Are there similar examples from other Siemens sectors?

**Büttner:** Yes — in the Energy Sector, for example, with regard to gas turbines, wind power facilities, electrical power grids, control systems, and low-emission power plants. And our Industry Sector has contributed significantly to the establishment of standards. For instance, consider the field bus used in factory communication systems or the Simatic system in the realm of industrial automation. And of course we mustn't forget the ETCS — the European standard for railroad control systems.

What goals does Siemens pursue when it serves on international standardization bodies?

**Büttner:** As a company that is active in around 190 countries, we are committed to the development of global markets and the principle of global competition. Globally valid standards open up markets and make it easier for all companies to compete. They also benefit customers because they make products from different manufacturers compatible and make it

possible to use such products in the same way in different countries.

What will be the biggest challenges in the patent sector in coming years?

**Büttner:** For one thing, there are still no standard international regulations with regard to what's patentable or not in the software, biotechnology, and genetic engineering sectors. The rules in these fields are still different in the U.S. and Europe, for example. Another especially big challenge facing Western companies is certainly the huge attempt being made by Asian firms — especially companies based in Korea and China — to catch up with the West. Chinese companies, for example, are now also trying to protect their own developments by registering patents, for reasons of self-interest. There's a benefit for us here, however, because these efforts on their part will make it easier for us to enjoy effective patent protection in China.

What impact do Siemens' numerous research partnerships have on patents?

**Büttner:** It's true that the trend toward open innovation is bringing new challenges with it. Siemens launches more than 1,000 new research partnerships around the world every year. It's important to precisely define beforehand how the partners will deal with jointly developed intellectual property. We pursue a fair-partnership approach here — and patent policies are an important element of every partnership agreement.



## Patented Inventions Are the Foundation of Siemens' Success

Company founder and famous inventor Werner von Siemens shaped Siemens as a firm that aims for technological leadership. "I believe that one of the main reasons why our factories are flourishing is that most of what they produce is based on our own inventions," he once said. Werner von Siemens was very much occupied by the issue of patents. In 1876 he even published a paper in which he explained why it was necessary for Germany to introduce a national patent law, as the only patent laws in existence at that time were those of the individual German states. Such a law was passed the following year, accompanied by the establishment of the Reichspatentamt (German Patent Office).

- Werner von Siemens actually registered a patent in the state of Prussia for an easily operated pointer telegraph just one week after founding his company in October 1847. This invention made it possible to send messages over great distances.



- Siemens' dynamo patent in 1866 ushered in the age of large-scale electrical power generation, which also played a major role in the advent of electrical engineering.



- The invention of the electric railroad and the tantalum lamp were the driving forces behind the further development of mass mobility and electric lighting systems.



- The traffic light control system patented by Siemens & Halske in 1928 monitored the electric circuits in multi-colored traffic light lamps and created the basis for today's complex traffic guidance systems.



- Most of the silicon production techniques for semiconductors are based on a Siemens patent from 1953 for producing the purest silicon. Other inventions in the last 60 years include Simatic (the foundation of industrial automation), thyristors (used as high-performance power network switches), and EWSD (a rapid digital telephone switching system). All pregnant women today are familiar with the result of a patent registered in the 1960s for real-time ultrasound.



- Key patents have been registered in recent years for new computer and magnetic resonance tomography procedures, energy-saving and resource-conserving industrial processes, a completely new bogie and drive system for trains, and innovative power plant concepts that enable CO<sub>2</sub> separation.



- Ideally, one patent will benefit several different fields. One of the best recent examples of this is the invention of a procedure for rapidly registering the three-dimensional shape of objects. This technique is now being used in security systems (for 3D face recognition), industry (for chassis calibration in vehicle assembly), power engineering (for examining turbine blades), and the medical sector (for measuring in-ear hearing aids).

## Knowledge: The Competitive Edge

The Corporate Information Research Center (IR), which is also a part of CT IP, collects and evaluates scientific, economic, and technological information for thousands of Siemens employees around the world. In addition, around 30 IR experts produce customer-focused reports as well as trend, market, and company analyses.

Recent years have seen information and knowledge acquire growing importance compared to other production factors such as capital, raw materials, land, and real estate. Today a company's competitiveness depends very much on its know-how. At Siemens, more than 200 specialists are responsible for optimizing the use of patents. Their strategy is to ensure that all new patents generate maximum value for the company. Here the value of a new invention is a function of not only its technological ingenuity but also, and above all, of the level of market interest it is likely to generate.



From left: Wolfgang Zeiler, Thomas Roth, Xiao Yang Qu, and Karla Weyand are some of Siemens Corporate Technology's 200 patent experts.

# Patents and People Protect Siemens' Intellectual Property Worldwide



With around 58,000 patents worldwide, Siemens takes intellectual property protection very seriously indeed. Patent rankings demonstrate that the company is consistently one of the most innovative firms in the world. Especially important here are so-called key patents, which protect know-how in specific areas from the competition. Such key patents are exceedingly difficult for market competitors to circumvent by means of alternative technologies. This applies particularly to patents that have been incorporated into an international standard or have themselves established a de facto standard. At Siemens such patents include those related to control technology, industrial automation, network management, rail traffic management (ETCS), and operator interfaces. The patent team's strategy is above all to promote industrial property rights in trend-setting technologies such as remote maintenance and efficient and low-emission energy generation systems. Siemens has around 18,200 patents to

protect the solutions from its Environmental Portfolio alone. Generating patents is an integral part of the entire development process. After all, patents play an important role in helping to ensure that know-how is secured for Siemens as quickly and fully as possible. On particularly important projects, the team expressly solicits the submission of reports on inventions by means of "invention on demand" workshops or by IP benchmarking — a process whereby competitors' patent portfolios and the state of their technologies are analyzed and shown to developers. Over the past ten years, Siemens substantially increased the number of inventions it generates. In fact, the average number of inventions reported per R&D employee has doubled since 2001. In addition to securing protection for the company's intellectual property, one of the patent team's key tasks is to monitor whether Siemens' patents are being illegally exploited by other market players. This is a complex process for a globally operating company, not least because regulations differ from country to country. What's more, different businesses require different approaches. Whereas all instances of product piracy in the field of automation technology must be effectively prevented, the company's commanding position in the medical technology sector can also be used to negotiate unrestricted access to the technology of major competitors through cross-licensing. In order to strengthen its own market position, Siemens also actively uses its patent portfolio to swap or sell licenses, negotiate compre-

hensive cross-licensing agreements, and penalize patent infringements. This is one reason for the company's regional distribution, with greater protection in the new Asian markets, for example. The battle to defend intellectual property — which has been described as the nerve center of the European and U.S. economies — has intensified dramatically in recent years. Siemens is well prepared for this struggle. **Dr. Thomas Roth — Protecting Know-how Related to Fossil Fuel Power Plants** To complement his interest in legal issues, Thomas Roth has a way with words. While working as a research assistant in physics at Kaiserslautern University in Germany, he came into contact with Siemens' intellectual property rights when he was dealing with the university's patent information center. He was immediately enthusiastic about a job description for the post of patent attorney, for which a degree in engineering or natural sciences is required. As a result, Roth decided to join Siemens' Intellectual Property Department in 1998. Like all patent attorneys, Roth had to plow through miles of legal texts and seminar papers while training for his new profession. Depending on the precise focus of their studies, students in this field subsequently take on a heavy schedule of exams, and if they are successful they can become either a European or a German patent attorney. Today, Roth is Siemens' key account manager responsible for all intellectual property rights issues concerning fossil fuel power plants worldwide. His work includes

strategically aligning the activities of intellectual property management, coordinating related measures, and maximizing the benefits associated with all IP services for the company's business in this sector. **Wolfgang Zeiler — Focusing on Industry** Electrical engineers generally don't work their way through mountains of files, deliver eloquent testimony before a court of law, and polish the wording of texts. But Wolfgang Zeiler worked as an electrical engineer in the research and development of Siemens rail systems for several years before he became a patent expert in 2002. While gaining this qualification, Zeiler, like all patent attorneys, initially worked for three years under the supervision of an experienced colleague from the Intellectual Property Department. Today he is a licensed patent assessor and a European patent attorney at IP's Industry Solutions Department, where he is responsible for protecting Siemens innovations. Four times a year, the Siemens Patent Committee reviews and evaluates all the reports on inventions that have been submitted by employees and then selects those that are suitable for patenting. "That takes a lot of foresight. For a start, patents cost money, and secondly, we have to make sure that the portfolio as a whole has no gaps and that it remains manageable," explains Zeiler. One of his tasks is to continuously optimize this and other core processes at CT IP. Zeiler heads the Processes unit, which records and documents patent processes for specialized

departments at CT IP worldwide. The unit also draws up recommendations for improvements, including the exploitation of synergies. For example, it makes the most successful processes from individual IP departments into standards for all of Siemens. **Xiao Yang Qu — Patent Specialist in One of the World's most Promising Markets** Xiao Yang Qu is responsible for Siemens patents in what is probably one of the most interesting IP regions in the world: China. What particularly appeals to Qu, who is a mechanical engineer, is the wide range of his tasks. Not only must he and his department make effective use of Siemens patents; they also have to keep an eye on innumerable new products and solutions from competing companies. A key job here is to check to see if there have been any patent infringements. As it goes about its work, his department also monitors general developments in the Chinese market so that Siemens can respond as quickly as possible to new trends. In addition, Qu and his colleagues closely examine product developments at Siemens to make sure they don't infringe on other companies' patents, a task that has to be performed especially meticulously in China. "Imitation products are no longer the only problem in China," he says. "More patent applications will probably be filed in China this year than in the U.S." Siemens alone applied for 1,226 patents in China in fiscal year 2009-2010. Drafting a suitably worded application requires a certain gift for abstraction as well as a feeling for language.

"The art is to achieve optimal protection for an invention without revealing too many of its actual technical features," he says, describing this complex juggling act. **Karla Weyand — Diagnostics in North America** Process automation specialist Karla Weyand also works in a region that is renowned for its patent activity: North America. So far, the U.S. has been the country registering the largest number of patents. The daily grind that is involved in monitoring patent infringements and checking licenses means that the work is anything but straightforward. This is especially true with regard to patents in the area of diagnostics — an area that Weyand is responsible for in North America. Accordingly, the patent work she does is highly valued. Among other things, Weyand takes great care that her department works very closely with Siemens' research and development teams. One example of how patenting work at Siemens differs from that of other U.S. companies involves the provision of specific recommendations to employees on just what kinds of inventions to submit. Another is the company's development of electronic tools for general patent searches. New trends in the field and the aggressive exploitation of patents, especially in the U.S., mean that patent professionals like Weyand have to continually rethink their strategies. "But that's exactly what makes this job so exciting — in spite of all the files," she says.

Universal standards are a major benefit, whether they apply to industrial automation systems or energy network infrastructures.

For globally operating companies like Siemens, it is important to ensure that the same norms and standards are accepted throughout the world. That's why specialists from Siemens work in international committees on the development of global norms and standards.



## Establishing Standards Means Defining Markets

Norms and standards are a prerequisite for today's global trade. Without internationally-recognized norms and standards, trade barriers would arise and technological progress would be stalled. In particular, companies that operate around the world, such as Siemens, would find it unprofitable to adapt their developments for small sub-markets. Technologies that could not be operated according to the same norms and standards in different countries would spread much more slowly. And incompatible solutions from different manufacturers would prove to be a hindrance.

For Siemens as a trendsetter for innovative technologies, norms and standards therefore play a crucial role. To guarantee efficient interaction with the standardization process at all of its divisions, Corporate Technology's Standardization & Regulation (CT IP SR) team uses highly specialized methods and tools that have been mastered by more than 20 experts who are familiar with international standardization activities. They ensure that Siemens can maintain and expand its strong position in competitive international markets. The general rule is, "Those who make the standards make the markets."

One of the most familiar standards with major practical benefits worldwide is DIN ISO 688. It regulates the modular structure as well as the dimensions and weights of containers, which have revolutionized logistics processes throughout the world. This would not have been possible if many different norms and standards had been in effect. This example also demonstrates that uniform international norms and standards

ensure equal opportunity in the marketplace by making it easier for even small national economies to gain access to markets and innovative technology. For Germany, for example, the economic benefit of standardization is valued at over €30 billion per year.

Other examples of internationally-accepted standards whose value for Siemens is obvious from a business management perspective are the IEC standards for industrial field bus systems like Profibus and the IEC norm for the standardized communications protocol for energy network infrastructures. Once they were published, these norms and standards made customers more willing to invest; they enlarged the market and thereby spurred business for all the manufacturers involved. As a company that does business in more than 190 countries, Siemens pursues a proactive standardization strategy and is represented in the committees of all the important standardization organizations, including the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). For Siemens, this entails the advantage of being able to help formulate the technical content of standards at an early stage in the standardization process — and to incorporate it into its own product development process. Standardization organizations, in turn, ensure that norms and standards are of a high level of quality when they collaborate with major developers of new technologies.

By participating in standardization committees, specialists from Corporate Technology's Standardization & Regulation team help not only

to shape standards but also to strengthen the bonds between innovation, patents, and norms and standards. Particularly in the case of relatively new fields such as RFID and nanotechnology, it is essential to coordinate patent and standardization work.

Another focus of standardization experts' work is on making sure that regional Siemens companies are thoroughly integrated into the international standardization process. For example, CT IP SR advises Siemens standardization specialists in all relevant countries regarding the committees on which Siemens specialists must be represented in order to help shape standardization processes. Here too, Siemens strives to advance international standardization in order to avoid the possibility of having to manufacture according to many different norms and standards. Siemens is thus helping to define the technical and economic requirements for market access. Nevertheless, in spite of efforts to achieve international norms and standards, different requirements for access to the markets of various countries continue to exist. Knowing these different requirements — and informing the Siemens divisions about them early on during a new product's development phase — is thus the top priority. Ultimately, everyone profits from norms and standards because these norms and standards include the best technologies and help to ensure that users worldwide can rely on a high level of safety. Products from different manufacturers are then mutually compatible as well, and products can be used in the same way in many different countries.

What could come across to an outsider as somewhat dry subject matter — standardization and technical regulations — is in the opinion of Dr. Ralph Sporer an extremely effective tool for helping to shape the megatrends of the future from the very start. Sporer, who has a doctorate in physics, got his start at Siemens Corporate Technology in an entirely different field.

Ralph Sporer is a Siemens expert who helps to create uniform standards that are valid around the world for systems such as smart grids.



## The Future Will be Built on Standards

Physicist Ralph Sporer received his first exposure to German and foreign standards in his very first position at Siemens Corporate Technology, which he joined in 1996 to work on the simulation of electromagnetic compatibility and technical risk management.

When products are tested for their electromagnetic compatibility, the relevant technical parameters are specified by binding German and foreign norms and standards. Similarly, in the technical risk management process specialists have to ensure that required norms and standards are complied with during construction of infrastructure facilities, trains or industrial plants in order to avoid subsequent costs. Knowledge of applicable norms and standards is therefore essential to a company's technical and commercial work.

This knowledge is very valuable to Sporer in his current position with the Corporate Standardization & Regulation Department, where he has worked since 2008 and is responsible for the subject areas energy efficiency and smart grids.

Because uniform standards must first be created before the infrastructure for intelligent power supply networks can be established, smart grids are a very hot topic. The representatives of a diverse group of stakeholders, all of whom are under deadline pressure, must come to an agreement concerning the standards to be applied. In the U.S., the power grid needs modernizing; China is facing an exploding thirst for energy; and in Europe, the proportion of renewable energies in the power grid is constantly increasing.

"Because we as a global company are naturally very interested in shaping the markets for our products, Siemens has laid the cornerstone for how the International Electrotechnical Commission will proceed strategically with respect to smart grids," reports Sporer. "What we need are international norms and standards that describe the exchange of information for grid automation, industry automation, and home automation," says Sporer, who has headed the company's efforts to develop standards for smart grids from the very beginning. "We can play a decisive role in shaping the future standards and technology landscape because we were on board for the fundamental work."

These activities now have to be continued in corresponding product committees. This is a very interesting job for Sporer, because anyone who wants to shape international norms and standards in the committees on the basis of their company's technology has to have a good bit of experience. The profile of requirements is very high.

"In addition to having a strong background in technical issues, these experts must also be well acquainted with product development and the needs of the customers," Sporer explains. "The human aspect is also important. The work in the committees of the international, European, and German organizations such as ISO, IEC, CEN, CENELEC, VDE, and DIN requires negotiating skills and powers of persuasion that are based on a high degree of technical and methodological competence. Leading international bodies enable intercultural cooperation,

which brings about an entirely different understanding of different cultures. These are experiences that are extremely valuable in a global company like Siemens," Sporer adds.

As he goes about his work, Sporer is in close contact with the various divisions. He is the Standardization & Regulation Manager for Energy Transmission and Distribution, for example. "Standardization activities that are tightly integrated with the business and portfolio strategy are a major reason for the success of the company's operating business," he explains.

Ralph Sporer's ultimate objective is to safeguard the future of the supply of electrical energy worldwide through efficient norms and standards. And CT IP SR offers him the ideal prerequisites for doing so — because the corporate department for standardization and technical regulation is a global organization.



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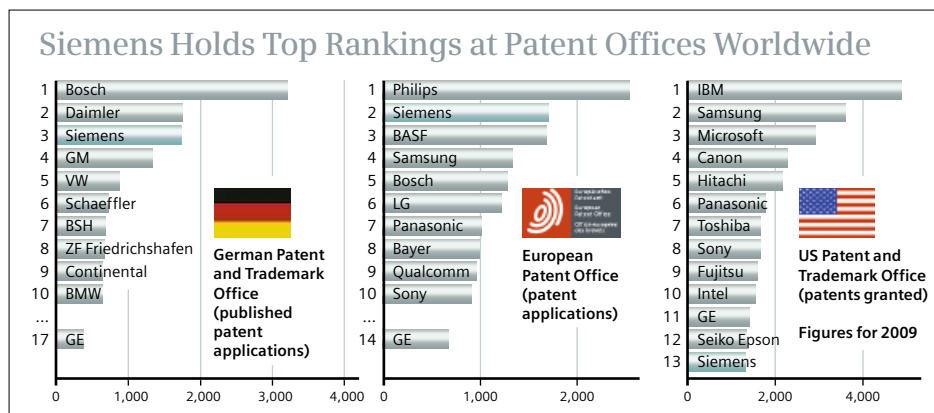
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In the age of globalization, knowledge and know-how are the trump cards of the Siemens integrated technology company. The protection, utilization, and expansion of the company's intellectual property is vital to its success. Siemens holds almost 58,000 patents. Managing these patents and protecting them from competitors is one of the tasks of Corporate Intellectual Property and

Functions (CT IP). CT IP employs nearly 500 people around the world. These professionals support Siemens researchers and developers when it comes to applying for patents, defending their claims, and exploiting their patent rights. About 31 percent of Siemens' patents — 18,200 in business year 2010 — are so-called "green patents," which protect sustainable technologies in the Siemens Environmental Portfolio. The innovations in Siemens' Environmental Portfolio already account for more than one third of its total sales, amounting to approximately €28 billion in business year 2010. Another responsibility of CT IP is to represent Siemens in committees for the establishment of international norms and standards. Here, CT experts are working to create uniform international norms and standards and to promote compatible technologies.