

SIEMENS

Siemens R&D in China

As one of the world's most innovative companies, Siemens aims to be a trendsetter in technology development, focusing on delivering tangible benefits to customers and stakeholders for their sustainable growth.

To further strengthen its power of innovation, Siemens is planning to increase its global investments in R&D in fiscal 2017 by some €300 million to around €5 billion.

In 2016, Siemens set up a separate unit, next47, globally to foster disruptive ideas more vigorously and to accelerate the development of new technologies. Activities at next47 will focus on five fields of innovation: artificial intelligence, autonomous machines, distributed electrification, connected mobility and blockchain applications that are designed to simplify and increase the security of data transfers in areas such as industrial operations and energy trading.

With diverse market needs and customers willing to try new things, China provides an ideal environment for world-class innovations. For decades, Siemens has been increasing R&D investments in China. Meanwhile, China has become one of the most important R&D bases for the company. By Fiscal Year 2016 (October 1, 2015 – September 30, 2016), Siemens had over 4,500 R&D researchers and engineers, 20 R&D hubs and more than 11,000 active patents and patent applications in China.

Siemens is making constant efforts to locally design and develop the right products and solutions for the Chinese market to meet local customers' needs, integrate into local innovation eco-system, and also use China's advantages to develop technologies in the country for global application.

In China, Siemens' network of innovation centers combines the company's global R&D systems with local business demands. Siemens brings in cutting-edge global

technologies in the fields of digitalization and automation to intelligent infrastructure industry of China. The network also propels development of local innovation industries with demand-driven projects of industrial digitalization. Meanwhile, Siemens will also cooperate with local innovative medium-sized, small and micro enterprises to initiate pilot projects, and join hands with local companies to establish innovation platforms, aiming to achieve win-win with local governments and partners.

By fiscal 2016, Siemens has established R&D branches in cities including Beijing, Shanghai, Suzhou, Nanjing, Wuhan, Wuxi, Qingdao, Tianjin, etc.

For example, Siemens Wuxi Innovation Center was established in 2013. Based on local demands, the innovation center carries out extensive cooperation with local enterprises in fields such as intelligent equipment, transparency factory, PROFINET, etc. to support industry upgrade and enterprise automation. Wuxi Innovation Center has cooperated with Miracle Automation Engineering Co., Ltd. to develop the digital car assembly line in an Internet of Things demonstration project, helping the company increase quality of products and services and realize fast business growth.

Moreover, in Tianjin, Siemens cooperated with Sino-Singapore Tianjin Eco-City Investment and Development Co., Ltd. to establish Siemens Eco-City Innovation Technologies (Tianjin) Co., Ltd., focusing on developing and promoting demand-based innovative solutions about ecological technologies to support sustainable development of China.

In 2016, Siemens launched Siemens China Innovation Center initiative, focusing on innovation in the area of digitalization. Under this initiative, Siemens Qingdao Innovation Center was set up in March 2016. As Siemens' first innovation center of intelligent manufacturing outside Germany, this center further enhances Siemens' R&D in China. In September 2016, the Siemens Corporate Technology Suzhou opened with focus on researches of big data, the web of systems, connected mobility, cyber security solutions and industrial robotics. In the field of industry cyber security, by joining hands with local partners, Siemens has established Siemens Cyber Defense Center to provide excellent services to Chinese industrial enterprises,

helping them improve operation and reduce security risk of their industrial control systems.

In January 2017, Siemens opened Wuhan Industry Maker Space to explore innovation models and industrial ecosystem of intelligent manufacturing in China together with partners. Siemens will also join hands with local universities and scientific research institutions to accelerate innovations in medium-sized, small and micro enterprises. Wuhan Industry Maker Space is a part of Siemens Wuhan Innovation Center. The center was established in 2013, focusing on R&D in areas including Industrial Internet of Things data integration and application support technology, intelligent manufacturing, smart water, etc.

Siemens has also initiated the Open Lab for Building-Energy Innovation in Yangpu to increase energy efficiency of buildings, provide an efficient communication platform for collaboration among technology enterprises, and boost development of local innovation ecosystems.

From 2011 to the end of 2015, Siemens invested cash, equipment and software worth RMB 711 million in the field of education in China. In 2016, Siemens renewed the Memorandum of Understanding on Educational Cooperation with Ministry of Education of China in a bid to boost cultivation of innovation-oriented talents for China's national strategy "Made in China 2025". By fiscal 2016, Siemens has established good relationships with over 200 Chinese universities and vocational schools. Siemens has helped universities and institutions establish labs, and the company also set up Siemens scholarships to further promote the cooperation on scientific and technical exchanges, as well as talent cultivation. Siemens has been sponsoring the "Siemens Cup" China Intelligent Manufacturing Contest for 10 years to support development of innovative engineering talents.

Moreover, in 2016, Siemens signed a Memorandum of Understanding on Cooperation with Department of Education of Shandong Province. The two parties will join hands to introduce German experiences in engineering education, as well as Siemens engineering technology and experiences, to higher vocational schools and universities. Besides, they will also cooperate in setting up innovation bases for

intelligent manufacturing, cultivating talents, improving competence of teachers, and initiating engineering contests.

Digitalization for market value creation

The world is becoming ever more connected. Billions of intelligent devices and machines generate massive data, bridging the virtual world and the real world. Turning this mass of data into values is one of the key factors of Siemens' success. The company has mastered key know-how of many industries and is able to apply professional hardware and software technologies to develop innovative solutions. Across all domains, Siemens, one of the world's largest software companies, integrates data, software and hardware to help Chinese customers strengthen core competitiveness.

With its innovative "Digital Enterprise" Suite, which is based on Teamcenter as a collaborative platform (data backbone) that integrates Product Lifecycle Management (PLM), Manufacturing Execution System/Manufacturing Operations Management (MES/MOM), Totally Integrated Automation (TIA) and "Lifecycle and Data Analytics" (MindSphere, the cloud-based, open operating system for the Internet of Things), Siemens helps Chinese enterprises move forward to reach "Industrie 4.0". In process industries, Siemens helps Chinese enterprises achieve digitalization by providing comprehensive solutions from integrated engineering to integrated operation, including Comos – a software solution for plant engineering, design and management, Simatic PCS 7 process control system, Simit process simulator, Comos Walkinside 3D virtual reality platform, XHQ operations intelligence and optimization software, etc.

Siemens also provides advanced intelligent traffic information and management systems to help reduce traffic jams and accidents, and cut CO₂ emissions by 20%. To accommodate the increasing demand of power, Siemens' digital grid technologies can balance supply and demand, and also enable the large-scale integration of renewables at 40% less cost. Siemens intelligent building technologies can help cut energy consumption of buildings by as much as 40%. In the healthcare sector, the network imaging intelligent processing platform *syngo.via*, developed by Siemens,

can significantly make image reading process faster and save 77% of time for reading cardiac Computed Tomography (CT) images, compared with other reading solutions.

Embrace the future of manufacturing

Leading technologies from Siemens have laid firm foundations for “Industrie 4.0”, making production and management in manufacturing more efficient, more flexible and faster. The digital manufacturing solutions developed by Siemens center around Digital Enterprise, Totally Integrated Automation, Integrated Drive Systems, process automation, energy efficiency, services and so on, covering industry software, hardware and data-driven services.

Siemens Industrial Automation Products Ltd., Chengdu (SEWC) is one of the most advanced electronics plants in the world and also the first “digital enterprise” of Siemens outside of Germany. As part of Siemens global industry automation manufacturing and research system, SEWC has realized a high degree of digitalization of the process from product design to manufacturing, and shortened the time to market by up to 50%. The state-of-the-art design of SEWC also makes the factory highly flexible to enable mixed production of different products and allow reasonable planning for future production capacity adjustment.

To better serve the automation and drives markets in China, Siemens has developed and launched a number of S.M.A.R.T. (Simple, Maintenance-friendly, Affordable, Reliable, and Timely-to-market) products, including SIMATIC IPC 3000 SMART, S7-200 SMART, SINUMERIK 808D ADVANCED CNC and SINAMICS V90 Servo Drive System and so on. Two of the SINAMICS Perfect Harmony GH180 products, GH180 10kV (40-140A) and GH180 10kV (315-550A), hit the market in 2014. For the local customers, the company also launched SITRANS P310 and intelligent valve positioner VP160. Beide Motor, specially designed by Siemens for China market, covers low-voltage and high-voltage motors.

Build intelligent infrastructure

Siemens makes infrastructure more intelligent through automation and digitalization technologies to cope with challenges brought by fast urbanization process, economic change, climate change and demographic change in China.

Beijing Siemens Cerberus Electronics Ltd. (BSCE) is one of Siemens' key global Centers of Competence, focusing on research and manufacturing of Building Technologies for fire safety and HVAC (heating, ventilation, and air conditioning) products. Equipped with world-class labs and test machines, BSCE is committed to providing comprehensive building products and systems. The company develops and manufactures more than 1,200 products for customers in more than 60 countries and areas in Asia, America and Europe.

Siemens' investment in mobility R&D helps boost rapid development of China's railways and guarantee operation safety. By September 2016, the innovation hub of Siemens Signalling Co. Ltd., Xi'an (SSCX) has held 30 utility model patents and four invention patents awarded by China's State Intellectual Property Office. The signaling products of S700 K-C electric point machine, S 21 Balise system and AzS 350 U axle counting system, all introduced and adaptively designed by SSCX, have been widely used on China's speed-up lines, passenger-dedicated lines, high-speed lines and metro lines. Besides, JM2 end position detector and SRT6 contact group, both independently developed by SSCX, are now widely used on passenger-dedicated lines and high-speed lines. Catering to the market demand for improving performance of point operation system in China, SSCX introduced CKA-C external locking device from Switzerland and finished the adaptation design. So far, the product has passed the technical solution audit of the National Railway Administration. To further expand the product portfolio, SSCX has developed two types of internal locking point machine – S600 and S650 – and has been actively exploring the overseas market for the two products.

As a trusted partner for the development and promotion of efficient and reliable power infrastructure, Siemens boasts the most comprehensive energy management portfolio that fulfills the needs from power utilities, industries, infrastructure and buildings in China. The portfolio includes facilities and systems for high-voltage

power transmission, medium- and low-voltage power distribution, smart grid and energy automation solutions. As a result, Siemens has established R&D teams in Shanghai, Wuxi, Hangzhou and other cities to focus on designing and developing products including high-voltage gas-insulated switchgear, high-voltage circuit breaker, high-voltage disconnecter, circuit protection, medium-voltage gas-insulated switchgear, medium-voltage air-insulated switchgear, vacuum circuit breaker, vacuum contactor and so on. The R&D teams follow global design and quality control methods to serve all aspects of intelligent power infrastructure.

Together with local partners, Siemens will deliver the world's first 1,100 kilovolt (kV) converter transformers for the world's first 1,100 kV high-voltage direct-current (HVDC) transmission link between Changji and Guquan. These converter transformers are also the most powerful converter transformers in the world with a capacity of 587.1 megavolt amperes. The transmission link, currently the world's biggest HVDC project, is 3,284 km long with a transmission capacity of 12 gigawatts.

Siemens boasts more than 40 years of experiences in design and manufacturing of mobile substations. Siemens Transformer (Wuhan) Company Ltd. (STWH) is the only R&D base of Transformer Business Unit under Siemens Energy Management Division in Asia. STWH represents the industry's benchmark in R&D, design and manufacturing of mobile substations on trailer. China's first 66 kV and 110 kV mobile substations on trailer connected to the grid are both designed and manufactured by STWH.

Develop sustainable energy

Siemens is the world's leading provider of energy technology and solutions. As a trusted partner of China's energy industry, Siemens creates values for customers along the value chain of electrification.

To adapt to the rapid development of China's power industry and reach a higher goal of green power, Siemens is committed to promoting the concept of modern digital power plant. Siemens set up Siemens Power Digitalization Technology Hub in January 2016. The hub consists of Power Generation Digitization Hub and Siemens

Energy Solution Innovation Hub. Siemens combines know-how in the power generation area and digital technology to establish the “digital twin” for the whole value chain of power generation, providing the power industry with complete, reliable and sustainable solutions for digital management, analysis, mining and visualization of power generation.

The Power Generation Digitalization Hub focuses on optimizing operation, maintenance and management of power utilities to help customers increase reliability and profitability, as well as reduce emission. The hub is in the progress of developing products and solutions that fit China’s market.

With a deep understanding of China’s market, Siemens Energy Solution Innovation Hub leverages customized products and innovative system design to provide energy customers in China with the optimized integrated solutions. Meanwhile, based on the best practice of Siemens energy business worldwide, Siemens also joins hands with local design institutions to initiate R&D in areas such as plant performance optimization and environment-friendly technologies, focusing on creating more values for Chinese customers along the energy value chain.

The Siemens Distributed Generation Innovation and Engineering Hub was set up in January 2016. The hub contributes to the development of distributed energy generation in China in the area of tailored industrial and aero-derivative gas turbine solution, customer order engineering, system and product development, etc. By cooperating with local partners, Siemens is committed to localizing gas turbine packages. Moreover, the company also joins hands with power design institutes to increase efficiency of distributed energy utilization, reduce emissions, improve operation of customers’ power plants, and eventually drive the upgrade of green energy generation and consumption in China.

In addition, Siemens also sets up Siemens Gas Turbine Engineering China Hub to make contributions to value adding of Chinese and global gas turbine product chains in the areas of new gas turbine frame R&D, existing frame modification and upgrade, customer order engineering, field service support, supply chain management and manufacturing support, etc. In 2013, Siemens started cooperation with Shanghai Jiao

Tong University to set up a gas turbine joint research center to conduct researches in fields including overall performance design of gas turbine, advanced processing technology, high temperature alloy and coating, gas turbine vibration and so on, jointly promoting the development of high-end equipment manufacturing industry in China.

Siemens Steam Turbine Engineering Hub is among the first batch of Siemens global R&D hubs set up in Shanghai. The Hub aims to establish R&D capability for steam turbines in China and focuses on engineering activities for the next-generation steam turbine product development of large coal-fired power plants. Moreover, Siemens has also established an R&D hub in Siemens Industrial Turbomachinery (Huludao) Co., Ltd. to provide design and manufacturing of turbo compressors and steam turbines for petrochemical, power generation and waste water treatment industries in China.

Deliver high-quality healthcare

For years, with its innovative technologies, Siemens provides comprehensive and customer-oriented medical solutions to enable more people to enjoy high-quality healthcare services.

As part of Siemens global CT R&D team, Siemens Shanghai Medical Equipment Ltd. (SSME) is the company's only CT R&D and manufacturing hub outside of Germany. In 2014, SSME launched the independently-developed SOMATOM Scope, a new generation of 16-slice CT. Meanwhile, SSME CT software R&D team has tied up with Healthcare R&D hubs in Germany for the development of software for advanced CT system. SSME is also the largest R&D and manufacturing base for Siemens X-Ray systems outside of Germany. In 2014, the first independently developed mammography of SSME, Mammomat Select, was launched to greatly benefit health of women.

Siemens X-Ray Vacuum Technology Ltd., Wuxi (SXVT) is the only Siemens R&D and manufacturing base for X-ray tubes and X-ray tube assemblies outside of Germany. So far, SXVT has completed the development of X-ray tubes RAY-6, SDR, RAY-1 with rotating anode as well as X-ray tubes SR120, SR125 and SR90S with stationary anode. Furthermore, SXVT has also accomplished the transfer and localization of CT

tubes DURA202/302/352 with ball bearing, CT tubes DURA422/688 with liquid bearing as well as X-ray tubes OPTITOP family with rotating anode for X-ray products.

As Siemens' largest R&D and manufacturing base of MRI (Magnetic Resonance Imaging) outside of Germany, Siemens Shenzhen Magnetic Resonance Ltd. (SSMR) works closely with the headquarters in Erlangen, Germany, and Siemens Magnet Technology Ltd. in Oxford, U.K., to develop the best-in-class MRI products, which always set the trend in the global MRI business. In 2012, Siemens Healthcare set up R&D and manufacturing bases of Angiography Imaging (AX) and Component and Vacuum (CV) in Shenzhen. SSMR AX works closely with the headquarters in Forchheim, Germany, to fulfill the global demands for AX products. As a solution provider, SSMR CV provides highly competitive and cost-efficient products with outstanding quality for customers in the medical industry, including customized electronic systems, high-performance imaging solutions and remote connectivity solutions.

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