SIEMENS
Ingenuity for life

Company Core Technologies

Ensuring Siemens stays at the forefront

Siemens wants to be at the cutting edge of several important technology and innovation fields, the so-called Corporate Core Technologies (CCTs). In fact, the CCTs have been determined to be critical for Siemens' long-term success and of its customers. What's more, they overlap in their relevance for Siemens' Divisions – that means a CCT is meaningful nearly for every Division. Around €500 million of the company's R&D expenditures in the current fiscal year have been earmarked for the CCTs.

Expertise for the CCTs comes from Corporate Technology (CT), Siemens' central R&D department, and from the individual businesses. In that way, the company's R&D efforts are bundled.

An overview of the CCTs

Additive Manufacturing

Additive Manufacturing (AM), or 3D printing, can fundamentally change the development and production of components. AM enables internal geometries that are lighter and require fewer materials, or that are more complex for improved component functioning.

Siemens aims to lead as both an end user and supplier of industrialized AM. As an end user, the company has made breakthroughs in maximizing gas turbine efficiency using AM. As a supplier, Siemens offers a comprehensive portfolio for a seamless digital chain, from Product Lifecycle Management software for 3D printing, to leading-edge simulation tools, to engineering and printing services.

Autonomous Robotics

Robotics is now disruptively changing the world of manufacturing. The proportion of tasks assumed by robots is estimated to increase from 10 percent today to 25 percent in 2025. As the market leader in industrial automation, Siemens already offers robotic solutions in handling and autonomous guided vehicles.

Siemens' worldwide R&D in robotics will be lead from China, the world's leading manufacturing country. Siemens is also working with universities and

manufacturers from Europe and the United States to boost autonomous technologies in industrial applications and shape the autonomous systems revolution.

Blockchain

Blockchain is a technology for distributed databases and a digital protocol for transactions between business partners – with no intermediaries such as banks or payment systems. A blockchain records transactions in a linear chronological order that is open and traceable at all times.

A current research focus at Siemens is peer-to-peer financial and legal transactions on decentralized databases across corporate boundaries. The technology is used to trade electricity in complex markets or to provide services digitally. Other applications include distributed audit trails, distributed ledgers and smart contracts.

Connected (e)Mobility

Autonomous systems, connectivity, electrification and sharing economies are transforming transportation and mobility. A growing communication network, aided by smart devices, has helped boost sharing solutions such as Uber. Increases in battery performance, coupled with lower costs, lead to mass adoption of electric vehicles, and companies race to develop autonomous vehicles and transport systems.

Siemens provides integrated, sustainable transportation solutions that optimize existing infrastructures with high-tech hardware and smart-management systems such as its Connected (e)Mobility.

Connectivity and Edge Devices

The intelligent networking of systems and components, or the Internet of Things (IoT), is an important driver of digitalization. Digitalization and connectivity are vital to Siemens' success in areas such as process automation, manufacturing and the energy sector.

The goal is to integrate systems and solutions into the new IoT structures and deliver the greatest benefits for customers by linking the various information sources. Having set market standards with products such as real-time Ethernet (Profinet), Siemens continues to explore future communication technologies and network architectures.

Cybersecurity

Cybersecurity is key for safeguarding critical infrastructure, protecting sensitive information and assuring business continuity. In 2016, damage from cybersecurity threats is estimated to have reached over half a billion euros.

With three Cyber Defense Centers, 30 years of experience, and 570 cybersecurity experts, Siemens is well equipped to supply customers with secure products and systems. Siemens monitors its own systems and provides plant security services, cybersecurity services for utilities and power grid operators, and virus protection for tomographs and other imaging products.

Data Analytics and Artificial Intelligence

Artificial Intelligence (AI) is based computer systems that use algorithms to perform tasks for which humans apply their natural intelligence.

Siemens has been active in data analytics and AI for 30 years, advancing technologies and tapping an enormous business potential. Siemens utilizes these techniques internally across divisions – to supply new medical technologies or to provide services for operators of power plants. Siemens also integrates its customers' manufacturing processes into digital platforms that enable them to boost efficiency by means of networked systems and self-learning machines.

Distributed Energy Systems

The energy landscape is changing from centralized, large-scale power generation to a network of often independently owned and operated power producers. The change to decentralization is characterized by the deregulation of markets, decrease in renewable energy prices and departure from carbon-based fuels.

Siemens delivers custom solutions to both new and established players to address energy efficiency, grid fee reduction, autonomy, resilience and CO_2 reduction. Advanced "Energy as a Service" business models are also on offer to help reduce customer complexity and risk.

Energy Storage

Renewable energies play a big role in cutting CO_2 emissions. One way of ensuring the energy system can cope with this transition is to develop energy storage systems.

Siemens focuses on three core storage technology areas: converting H_2O to oxygen and hydrogen (PEM electrolysis), in which the resulting hydrogen is used as storage; carbon monoxide electrolysis, in which the CO is used as green fuel or material; and converting nitrogen and hydrogen into ammonia for use in fertilizers and to transport oxygen. PEM plants, an ammonia demo plant, and a pilot plan for converting greenhouse gases are online in the EU.

Future of Automation

Automation technology has been a huge boost to manufacturing and infrastructure. However, automation works only with facilities whose behavior and environment are known and change little.

As the leader in automation, Siemens links the latest technology – including AI, the industrial Internet of Things and digital twins – with the company's deep automation know-how. To "automate the automation," Siemens is focusing on functions that facilitate intelligent behavior of a plant; the use of open, pre-fabricated modularized units with integrated and autonomous automation; and cloud-based operating systems.

Materials

In the future of industrial manufacturing, products will be created in a networked process that encompasses every step in the value creation, from material selection to design to production.

R&D and IP rights in materials and its technologies play a key role in advancing and safeguarding Siemens' competitive advantage and business leadership. The company develops metal alloys, protective coatings, reinforced plastics and insulating resins for turbines, motors and generators, as well as software and equipment for material-specific design, including 3D printing.

Power Electronics

Power electronics convert and control electric power. Renewable sources of electric power, DC infrastructure, energy storage, robotics and e-mobility make up the mass markets for power electronics. The global market is expected to reach €36 billion in 2022.

As the Internet of Things grows, power electronics become more important to Siemens, because they are the prime data source and the place for control execution. Siemens' efforts focus on functional integration, flexible modular and scalable architectures, and intelligent software-defined converter systems.

Simulation and Digital Twin

The digital twin concept sits at the center of digitalization, linking all models and data related to products, production and operations, and providing them to designers, engineers, operators and service technicians across vertical domains. Using digital twins allows systems to monitor their own condition and simulate future behavior in real time, buildings to be planned more efficiently and product design cycles to be shortened.

Siemens provides its customers with tools to create and use twins for their own products. The company also creates twins of its own offerings for customers to optimize their use. Goal is to fully close the loop from design to production and the performance of products and systems so that information of the operation helps to optimize the initial design process.

Further information

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Software Systems and Processes

For over 20 years, Siemens has been a leading driver of industrial software. In the meantime, users have come to expect company's software to deliver more immediate and tangible added value. To fulfill these expectations, pressure on software development speed is high, and the software itself becomes increasingly complex.

Engineers at Siemens are therefore working on reference solutions to meet the challenges of creating innovative digitalization software. These solutions are being made available across the company to use synergies effectively and to avoid duplication of work.