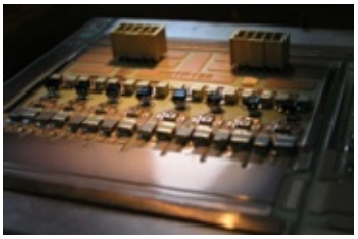
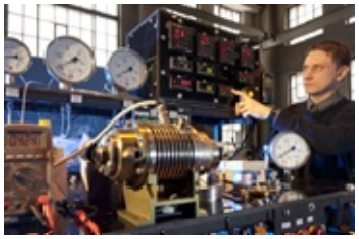
# Fact sheet – Siemens' R&D activities in Russia

**Russia is a strategic market for Siemens. Active in the country for 160 years, the company now has locations in over 30 cities nationwide. Together with its partners, Siemens is investing about €1 billion in projects in Russia. The company also intends to expand its research activities. Over the last few years, Siemens has cooperated closely with a large number of Russian research and educational centers.**

## Research institutions working at the highest international level

- In fiscal 2012, Siemens in Russia invested roughly €8 million in research and development (R&D). Our innovations in Russia are currently being generated by 108 R&D experts based in Moscow and St. Petersburg. About 80 percent of these specialists work for the central research unit, Corporate Technology (CT). Their activities focus on areas like materials engineering, energy conversion and software development. In the years ahead, Siemens Russia will expand its workforce at the Skolkovo research center to up to 150. The Siemens employees at Skolkovo will come primarily from CT.

- A large number of Russian research institutions are now working at the highest international level and are optimally networked with partners in the scientific and business communities. Siemens in Russia is currently participating in about 20 joint research projects with Russian universities and research institutes.

## Close technology partnership – Exemplary projects

- Siemens was the first German company to enter a strategic partnership with the initiators of the future **Skolkovo Innovation City**. At the R&D center, which is located at the gates of Moscow, about 150 Siemens scientists will conduct research in areas like energy efficiency, materials engineering, information technology and nuclear medicine. Siemens wants to invest about €40 million in Skolkovo.

- One of Siemens' first research projects at Skolkovo aims to develop **microwave power amplifiers that can be installed in particle accelerators**. In the project, Siemens is partnering with the Budker Institute in Novosibirsk, the University of Frankfurt, the Society for Heavy Ion Research in Darmstadt and the Institute for Theoretical and Experimental Physics in Moscow to develop high-performance high-frequency generators based on silicon carbide (SiC) semiconductors. The company has long been a pioneer in silicon carbide technology, which is now finding a wide range of practical applications. For example, SiC semiconductors will play a key role in making high-performance accelerators significantly smaller and cheaper in the future. Transistors made of silicon carbide operate at frequencies up to ten times

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higher (in the microwave range) than those made of silicon. They also conduct heat better and can therefore cope with higher outputs. On a surface of only six square millimeters, SiC transistors generate five kilowatts of power – conventional electron tubes would require a volume of about ten liters to achieve the same output. As a result, the new technology makes it possible to build extremely compact, energy-efficient high-performance accelerators for use in applications in fields ranging from research to healthcare.

- About half the primary energy used in industrial processes and the generation of renewable energy is currently being lost. In particular, there are hardly any economically feasible and technologically mature procedures for utilizing exhaust heat at temperatures below 300 degrees. Since 2011, Siemens – together with Moscow State University – has been conducting research on heat recovery generators based on **organic Rankine cycle technology** (ORC). Unlike conventional steam cycle processes, ORC does not use water in the circulation system but an organic, ecofriendly medium comprising carbon, fluorine and oxygen to ensure optimal efficiency at low waste heat temperatures, in particular. For example, the medium is well-suited for utilizing the exhaust heat produced by the melting ovens used in glass production, by diesel and gas motors, by gas flaring at refineries and by gas turbines in compressor stations. Test systems are now in operation at Moscow State University and at the Russian factory of glass fiber manufacturer Lauscha. The exhaust heat used by the 100-kilowatt system to produce electricity is generated by a glass fiber production line and has a temperature of only 220 degrees.

- Since 2010, Siemens has been working with Russian partners like Novolipetsk Steel (NLMK), one of the few companies in the world that can produce electrical steel for transformers, to investigate the properties of special **alloys**. Together with the steelmaker, Siemens researchers at St. Petersburg State Polytechnic University are looking for special alloys that can be used in transformers. The right alloy can, for example, keep transformer stations from buzzing. The material's **microstructure** – which is influenced by temperature, the degree of deformation and the material's chemical composition – likewise plays a key role here. For this reason, the researchers are also studying how heating and cooling rates impact the alloys' microstructure.

- So-called learning systems are universally applicable. In a close partnership with St. Petersburg State University, CT researchers at Siemens in Russia have produced an early warning system for dikes. In development since 2009, the **UrbanFlood system** is deployed on dikes equipped with internal and external sensors. The system continuously monitors factors like water and air pressure, dike expansion and humidity and temperature differences inside and outside the dike. Its feasibility is being field-tested in a long-term project at Livedijk in the seaport of Eemshaven, Netherlands. In the test, the intelligent software from CT Russia learns in wind and weather how to correctly interpret the values reported by the dike's sensors. The test also takes account of both seasonal and day-to-day influences like annual precipitation and changes in wind direction. The researchers want the system to be able to report promptly and automatically if and when a dike section becomes permeable, shifts its position and is thus in danger of collapse.