SIEMENS

Case study

Infrastructure & Cities Sector
Low and Medium Voltage Division

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Reliable power supply provides flood protection

Siemens ensures uniform energy distribution for flood control installation in St. Petersburg

On August 2, 2011 it was finally a reality: For the first time in recent history the Russian metropolis of St. Petersburg on the Neva River is reliably protected against the threat of high water. An early attempt was begun as long ago as 1979, but in 1990 the work on the St. Petersburg flood prevention complex (known as the KZS) was suspended and only restarted in 2003, this time with a revised and improved design. This unique project has been realized using technical systems provided by Siemens.

The main function of the 25.4 kilometer dam – the third-longest in the world – is to safeguard the city's 4.8 million inhabitants from the risk of flooding, but the KZS also has an important role to play in the city's transport system, forming part of the highway loop around St. Petersburg that helps keep the city free from tough traffic. The construction of the KZS also provided the solution to an important power supply problem: there is a high-tension cable running through the length of the complex.

In all, the KZS comprises 11 dams, six sluice gates, two navigation passes for shipping (S-1 and S-2), a highway with bridges, a tunnel built beneath the navigation channel, and transport nodes. One special feature is the S1 submersible storm surge barrier, which is 200 meters across and 16 meters deep, and the only one in Russia to be operable all year round. In the event of a flood warning the barrier's giant gates close shut. Each one can move freely, functioning like a submerging submarine.

Software-aided project planning

The KZS unites a number of functions which are central to the city's infrastructure and safety, and require the precise coordination of extremely complex technical installations. Within the framework of this major project, Siemens partner BCC was responsible for planning, assembling and commissioning over 50 technical systems, including those used in the road tunnel, for the flood warning system (SPUN), the visualization system in the control center as well as video monitoring

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and data transfer for the entire complex. The most demanding job was installing the technical equipment in the road tunnel under the S-1 navigation pass.

To plan the energy distribution, BCC used Simaris software from Siemens. The software was used to carry out modeling of the various 10 kW power supply lines in BCC area of responsibility in the overall complex. Alongside the Simaris software, conventional calculations in accordance with the Russian GOST standard were also used. Doubling the planning in this way ensured that the calculations were extremely reliable. If any divergence in the results was spotted, the plans and specifications were then also compared in order to rectify the discrepancy. The Simaris software proved itself to be particularly suited to selecting appropriate systems and components and producing working specifications. For example, the time-current characteristics of the lines and the selectivity of the protective components were all calculated using Simaris.

Differentiated solutions

BCC experts succeeded in planning, installing and implementing dozens of automatic systems, including lighting, ventilation and fire prevention, as well as civil defense and disaster alert systems, all in a record time of 18 months. The majority of the systems and components came from Siemens – from systems for ventilation, drainage and water purification, to gas analyzers and temperature control systems, through to electrical power supply.

Key to the selection of Siemens systems was their guarantee to meet stringent safety standards for people and vehicles using the tunnel and comply with the new technical regulations on fire protection in operational facilities in accordance with 123-FZ. Systems used included the Simatic automation system for height checks, and Siprotec for relay protection. The automated control system of the KZS complex was created on the base of the SIMATIC PCS 7 process control system. A "mobile control center" was established, integrating many different individual control systems for the submersible barriers, and working as an automated control system to coordinate the supply and monitoring of power. The control panel installed in the center can also be moved to other areas of the KZS in an emergency. The backup system for the electrical power supply to the dam is equipped with container-mounted diesel generators with an output of 200 kW up to 1500-1700 kW

One of the unusual features of the complex in terms of electrical engineering is the fact that the overall output of the KZS's energy sources is subject to quite large fluctuations: The winter maximum is around 19.7 mW, between five and six times the summer figure. The main energy consumers on the St. Petersburg dam are the facility's mechanical operating systems, the electrical lighting systems and the safety and ventilation systems. The highest priority for all the functions of the KZS is given to the reliability and continuity of the power supply. This particularly applies to the automatic opening and closing mechanisms of the huge S-1 barrier which allow

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ships to pass through and which protects the city from floods. The power supply to the KZS is guaranteed by 21 tributary stations plus backup generators. The large tributary stations are in Gorskaya, in the district of Lomonosov, in Kronstadt and on the S-2 and S-1 shipping channel installations. In this way the electricity networks connect both shores of the Bay of Finland with each other. All the tributary stations were equipped with 100% backup, as required by the regulations on the supply of electricity to Category 1 users, i. e. consumers whose power supply must be secured. The system actually exceeds the requirements of Category 1 in terms of its reliability, as it is completely automated. In order to guarantee the operational reliability and continuity of power supply at the required level the elements of the power supply system have been equipped with modern Siemens technology which is proven to be reliable: In two tributary stations 27 NXPLUS C gas-insulated medium voltage switchboards have been mounted, and in the 10 twin-transformer technical control points there are GEAFOL transformers, 8DJH gas-insulated medium voltage switchboards, Sivacon S8 low-voltage power distributors and Sivacon 8PS busbar trunking systems.

Conclusion

St. Petersburg flood protection complex is a high-tech system which safeguards the city and at the same time provides sophisticated infrastructural benefits. Operational reliability and the continuity of the power supply are paramount, and are guaranteed by the systems and components from Siemens.

The **Siemens Infrastructure & Cities Sector** (Munich, Germany), with approximately 87,000 employees, offers sustainable technologies for metropolitan areas and their infrastructures. Its offerings include integrated mobility solutions, building and security technology, power distribution, smart grid applications, and low- and medium-voltage products. The Sector comprises the Divisions Rail Systems, Mobility and Logistics, Low and Medium Voltage, Smart Grid, and Building Technologies. For more information, visit http://www.siemens.com/infrastructure-cities

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