Destination:
Smart rail electrification

The Smart Grid – Constant Energy in a World of Constant Change

Answers for infrastructure and cities.
Welcome to the future of energy infrastructure

We live in a world of constant change …

In our dynamic and global economy, companies and customers are communicating in new ways. Markets and politics, industries and consumer behavior are all in the process of adapting to new realities. Globalization and urbanization, demographic and climate change are some of the megatrends we will have to find answers to. In a world where most of the population lives in urban areas, sustainable technologies for metropolitan centers and urban infrastructures become more and more important. Siemens is providing some of those answers: Answers for infrastructure and cities.

… where energy meets intelligence …

Power producers, grid operators, industrial companies, multi-utilities, cities, and rail operators need to adapt to changing business environments and become more efficient and more reliable. Energy businesses around the world are reviewing their value chains in response to changing regulatory and consumer requirements. To minimize the amount of energy, emissions and revenue wasted in transmission and distribution, we will have to maximize the intelligence we put into our energy systems. That’s why smart infrastructure grids will be a substantial, if not decisive, part of tomorrow’s energy distribution.

… and power grids become smart grids.

Based on decades of proven expertise and a unique global execution footprint, Siemens offers an open and flexible architecture of answers with the industry’s most comprehensive smart grid portfolio: the Siemens Smart Grid Suite. The Suite enables a multitude of customized solutions for smarter infrastructure grids and introduces unforeseen opportunities to stabilize systems, develop new business models and optimize energy trade. Together with customers and partners, Siemens has started to transform “smart grid” from a buzzword into a business model – and establish new ways of providing constant energy in a world of constant change.

The transportation challenge: We’re nowhere without transport

The proportion of people living in urban areas is growing rapidly. By 2050, 60 percent of the world’s population will live in cities. Correspondingly, the world’s passenger traffic will continue to grow – between now and 2030, experts predict an increase of about 1.6 percent per year. Freight transport is also expected to rise by an annual 2.5 percent. These developments mean an immense increase in demand for investment: spending on urban transportations is set to triple by 2050. In order to find sustainable answers to these trends, intelligent and efficient solutions for rail electrification are the order of the day.
Smart cities require ... 

Urbanization and globalization, climate and demographic change: the megatrends of our times present sizeable challenges for rail transportation systems. As a consequence of the developments of the 21st century, the logistic requirements of freight and passenger transportation are increasing rapidly. Intelligent and efficient solutions that guarantee reliable and sustainable mass transit, regional and main-line transportation systems are in urgent need. Without efficient rail transportation infrastructure, it is hard to organize a functioning megacity in a way that appeals to both its inhabitants and investors.

In rail electrification especially, there are basic questions concerning the efficiency and effectiveness of existing or planned supply systems. How well are traction power networks connected to distribution grids? What about the interconnections of control center technologies? Is the automation level of existing structures sufficient to meet future challenges? Are IT systems powerful enough and compatible with current developments?

Starting with the very first electric railway in 1879, Siemens has consistently driven innovation in rail electrification. Today, Siemens considers the electrification of rail traffic as an integral part of a new, intelligent grid environment. In our exceedingly complex world, and especially in terms of energy infrastructure, everything is interlinked.

Siemens offers innovative solutions, systems and products for traction power supply, including contact line systems and network control technology, and boasts the industry’s only comprehensive portfolio. From consulting to financing, from system design and implementation to aftersales services, Siemens realizes projects all around the globe that are specifically tailored to the individual requirements of rail operators.

Siemens rail electrification systems are the first choice for three reasons: in terms of leading technology, in terms of comprehensive system solutions and in terms of integration into smart grid environments and the intelligent infrastructure of the future.

... intelligent rail systems
Electrification solutions ...

Siemens is the perfect partner for tailor-made and reliable electrification solutions in mass transit and main-line systems. With comprehensive competence, personal commitment and many years of experience, Siemens realizes solutions on the basis of tested products that are setting standards in terms of technology, economic efficiency, and quality. The result: reliable and thoroughly impressive traction power supply and contact line systems.

Construction and statics
During the construction phase, Siemens creates the necessary system and assembly drawings – including lists of components with the highest degree of precision. Required special structures, such as modules or special fasteners (e.g. in supply buildings, on bridges or in tunnels), are designed in a second step. Extreme care must be taken when it comes to the static calculations that ensure the stability of the contact lines in all conditions. To this end, both soil/subsoil studies and building reports are evaluated – always with the aim to finding the optimum combination of functionality, economic viability and safety.

Outstanding hardware
Siemens produces hardware for markets around the world and for all kinds of conditions – in all cases, uncompromising quality is guaranteed. The materials and products Siemens provides have to withstand the harshest circumstances, from the freezing cold of –45 °C to 98 percent humidity in the tropics, from the sandstorm in the desert to the salt water mist on the coast. The mechanical and electrical functions of the systems have been successfully tested in all possible conditions.

Excellent engineering
Between the design and the commissioning of a system there is excellent engineering that’s precisely adapted to the requirements of a particular design. Siemens partners benefit from the comprehensive know-how and the unique “global execution footprint” of Siemens engineers. Alongside this, Siemens will design the buildings and define all necessary construction work, followed by the electrical and mechanical design. The engineering of interfaces ensures that all components are harmoniously integrated into the overall system.

Siemens has also developed a solution for the connection of public power grid and traction power networks: multi-level converters which are more efficient, quieter and more compact than competitive offerings and stabilize both networks thanks to intelligent control technology.

Perfect project management
Professional project management strikes the right balance between time, cost and quality. The complete documentation of all measures and goals highlights saving and development potential, and simulates and evaluates the effects of different approaches to the life cycle costs and avoids errors through standardized steps. That is how Siemens creates systems today that meet the demands of tomorrow.

Service and training
Even after commissioning a system, Siemens continues to support its partners through staff training sessions and an introduction to the realities of the new facility. Siemens is also a reliable partner for the subsequent maintenance of your system. The systematic professional training of Siemens employees and constructive cooperation with all customers consistently ensure the highest quality standards.

... for mass transit and main-line systems

Expertise and dialog
Due to their international scope and detailed expertise as regards local regulations and the peculiarities of each market, Siemens can quickly handle projects worldwide and minimize transport distances. In individual consultations, the best possible electrification solution is developed – flexible financing solutions in close cooperation with authorities, government agencies and commercial banks all over the world included. Experts in Project Management and Engineering support a project at later planning stages and during implementation with proven expertise. Even after the completion of a system, Siemens supports all subsequent administrative and technical tasks.

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For each project, Siemens uses its own effective software tools. In addition, services include detailed calculations and simulations of systems, thus generating the best possible advice for each customer during each phase of the project.

**Enterprise IT**
The system design and calculation of rail electrification systems is one of the core competencies of Siemens. The more thorough and detailed the analysis and evaluation of data, the more sustainable and economically efficient the finished system. The Siemens Smart Grid Suite provides optimal Enterprise IT solutions.

Innovative simulation, analysis and design tools enable qualified system decisions – from optimizing the driving dynamics to the consideration of restrictive provisions of utilities, such as power quality and harmonics. With this knowledge, Siemens interconnects electronics, electrical engineering and mechanics in a system that is characterized by its quality, reliability, and reduced power consumption.

**Sicit® Master**
Using the configuration tool Sicit® Master, Siemens creates load analyses and detailed position plans with poles, catenary and traction power lines. In other profiles, calculations are made regarding the earthing system. Track data is recorded and longitudinal spans are optimized.

**Sitras® Sidytrac**
With this powerful simulation tool, Siemens offers its partners comprehensive network calculations, including meaningful rail simulations. The calculations are all based on routes, vehicles, and network and schedule data. New and existing traction power supply systems can thus be compared under realistic conditions, and subsequently configured and tested to assess their performance.

**Operational IT**
Traction power systems secure energy supply for main-line systems and mass transit, as well as for trams, metros, and trains. For continuous system management, and possible later modifications to equipment, Siemens provides rail operators with mature Operational IT solutions. With these applications, the economic efficiency of railway power systems will also be secured in the future.

The Vicos RSC network control system, for example, integrates a variety of applications in a SCADA control and monitoring system. Its modular structure is future-proof and extendable anytime. In addition to a comprehensive overview of the operational state of a system, it also offers the possibility to actively manage power consumption in the system and optimize business processes through fault and maintenance management.

With longstanding experience and comprehensive know-how in all relevant areas, Siemens guarantees optimal results that fully match even the most specific requirements.
Optimal rail electrification on every continent ...

... and under all circumstances

Extreme velocities – Example: China

For the 117 km from Beijing to Tianjin, travelers needed about 70 minutes – or at least they did until the summer of 2008. In early August, China’s first high-speed railway line was inaugurated, and was the first to reach speeds of 300 km/h and above. Today, the trip only takes 30 minutes. After an extremely short planning and construction period of a mere 27 months, Siemens, responsible for project management and system integration, signaling systems, telecommunications, power supplies and high-speed trains, was able to hand over the prestigious infrastructure project to Chinese authorities. Since then, 47 trains have been in operation per day, per direction.

Extreme innovations – Example: Germany

When a large utility company wants to supply Deutsche Bahn with 16.7 Hz of power, it is easier said than done: the DB’s energy converters are 75 years old and restrictions, especially in terms of noise pollution, are severe. With the delivery, installation and commissioning of static frequency converter Sitras® SFC plus with a capacity of 2 x 30MW, Siemens has enabled a win-win-win situation for rail operators, utilities and residents. DB saves on maintenance costs, operates more efficiently and has no more trouble finding spare parts, the utility generates new business and helps to improve efficiency and environmental performance, and residents benefit from quieter and cleaner technology.

Extreme conditions – Example: Saudi Arabia

Temperatures above 50 ºC, 72,000 transported passengers per hour, per direction, only 17 months of time – and a lot of sand. Despite the most difficult conditions and most ambitious targets, in November 2010, Siemens successfully completed the first phase of the electrification of the Mashaer Al Mugaddassah Metro project in Makkah (Mecca). The project included the installation of the entire power supply for the 18-kilometer route, with AC 110 kV primary substation equipment, AC 13.8 kV switching stations and RMU, eleven traction substations providing DC 1.5 kV traction voltage, the complete contact line system, 22 station substations and 10 diesel generators.
The information in this document contains general descriptions of the technical options available, which in individual cases may not be available. The required features should therefore be determined for each individual case upon conclusion of contract.

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