Press backgrounder: Smart Grid

Introduction:
- Today’s power grids aren’t yet equipped to handle sharp increases and large fluctuations in energy supplies from renewable sources like wind and solar power plants. In the future, millions of small producers will be feeding electricity from these sources into power grids. The grids aren’t yet sufficiently equipped to handle these multidirectional energy flows either. To cope with this development, it will be vital to expand the networks with smart grid components.
- It will no longer be sufficient to regulate just the generation of power; both the demand and the consumption of electrical energy will have to be controllable. The resulting ability to shift load peaks into idling times will mean that the networks are more evenly loaded, saving on investment in the grid and in power generation plants. There will furthermore be less need for conventional backup plants, ready to make up for missing energy when the wind is not blowing or the sun not shining. The necessary introduction of Smart Grids will in the coming two decades be the biggest challenge facing the energy industry.
- A Smart Grid is an intelligent, self-monitoring, highly automated power supply network that can be better controlled than a conventional system. It is equipped with innovative information and communication technology, in order to enable end-to-end data flow from the generator to the consumer and in the other direction. Whereas in a conventional supply network generation follows the pattern of consumption, a Smart Grid controls consumption depending on the available of electrical energy in the network.

Benefits of Smart Grids:
- Smart Grids allow not only the integration of renewable energy sources into the network; they also ensure that the increased infeed of renewable energy can be intelligently controlled.
- Smart Grids enable a change in the energy mix in the direction of renewable energy sources.
- Smart Grids reduce effects on the climate: Studies indicate that, with the help of Smart Grids, CO₂ emissions worldwide can be reduced by more than a billion tonnes by the year 2020.
Market:

- Calculations indicate that worldwide energy consumption will clearly increase – by a good 60 percent to around 37,000 terawatt hours (TWh) by the year 2030. The associated demand will be concentrated even more in cities: According to UN data, the urban population will in the coming four decades nearly double; by 2050 an 84 percent increase is expected, from 3.4 billion in 2009 to a figure then of 6.3 billion. Even today, so the International Energy Agency points out, cities are responsible for two thirds of global demand – a trend likely to intensify. In order to meet this energy demand in an ecologically-sound manner, the proportion of renewable energy sources will rise sharply.

- According to a study by Frost & Sullivan, the market for Smart Grids will in the five years up to 2017 triple up to about 100 billion Euros. The study however also includes medium-voltage switchgear and high-voltage transmission systems, which at Siemens are not in the Smart Grid Division but in another Sector.

Growth drivers:

- Old, overloaded network infrastructure (which can be more evenly loaded with a Smart Grid) – for example in North America.

- Rising demand for power (where more even consumption with the aid of a Smart Grid saves on investment in networks and energy generation plants) – for example in Asia.

- High and still growing proportion of renewable energy sources (which do not continuously generate power) – for example in Europe.

Smart Grid Division:

- The Smart Grid Division of the Siemens Infrastructure & Cities Sector supports its customers such as power providers, network operators, industrial enterprises, multi-utilities, cities and railroad companies in the development of intelligent transmission and distribution grids, as well as in the incorporation of centralized and decentralized energy generation.

- Siemens provides nearly the complete range of products, solutions and services for protection, automation, planning, control, monitoring and diagnosis of the network infrastructure, along with products, holistic solutions and services for rail electrification. Software and end-to-end solutions ranging from Enterprise IT to Smart Metering are gaining in significance.

Selected Smart Grid technologies from Siemens:

- For the bay control level, Siemens provides the technology needed to record the current network status and to transmit it to the higher levels. Siprotec 5 for example is the first range of protective relays on the market specially developed for protection, automation, measurement and monitoring
of high-voltage networks. Siemens’ holistic Smart Metering solution, the consumption data recording and distribution network automation system AMIS (Automated Metering and Information System), also forms part of the bay control level.

- The end-to-end-solutions for Smart Metering from a single source also include the meter data management system Energy IP (capable of supervising more than 20 million intelligent meters), which, since the acquisition of the Californian Smart Metering expert eMeter in January 2012, is an integral part of the Siemens Smart Grid portfolio. As a data hub, EnergyIP incorporates existing IT systems of the power suppliers via an SAP-certified interface into the Smart Metering infrastructure.

- The DEMS (Decentralized Energy Management System) networks and pools on the basis of sophisticated information and communication technology individual decentralized power generation sources in order to control them centrally as a virtual power plant. The system processes all the important information such as weather forecasts, current electricity prices and energy demand.

- SCADA systems (Supervisory Control and Data Acquisition) are used for operator control and monitoring of energy networks; the DMS (Distribution Management System) combined with them optimizes distribution network management. The SCADA/DMS system Spectrum Power enables network operators to control network management and energy flow. The jROS (Joint Resource Optimization and Scheduler) is a planning tool that provides various algorithms on a common platform, in order to support the tasks of power plant deployment planning (energy scheduling and optimization of energy trading).

- The load on power supply networks has risen continuously in recent years. Systems are consequently often operated close to their stability limits, and new load flows are resulting, unusual for the control center operators. This is where Siguard PDP (Phasor Data Processor) comes in. This system for network monitoring with synchrophasors allows a quick appraisal of the current network situation.

- In Rail Electrification Siemens is the second largest solution provider worldwide. This includes energy-efficient converters and energy storage systems. Energy storage includes the stationary and mobile systems Sitras SES, Sitras MES, Sitras HES. If all DC traction networks worldwide were equipped with energy stores or inverters, CO₂ emissions could theoretically be reduced by up to 11.6 million tonnes.

Selected Smart Grid projects:

- **Siemens and Stadtwerke München jointly start up virtual power plant**: Stadtwerke München (SWM, Munich City Utilities, Germany), has jointly with the Smart Grid Division of the Siemens Infrastructure & Cities Sector created a virtual power plant in which a number of small-scale, distributed energy sources are pooled and operated like a single installation. The main aim of SWM is to improve the reliability of planning and forecasting for decentralized power generation sources in the area which it supplies, by means of this virtual power plant devised jointly with Siemens. In the first stage, unit-type cogenerating stations with a total rating of eight megawatts (MW) were
integrated, along with renewable energy generating plants amounting to twelve MW. The core component of this virtual interconnection is the Distributed Energy Management System DEMS from Siemens. It ensures that Stadtwerke München can not only optimally deploy and operate its decentralized energy sources and loads, but also add more value from greater marketing scope. For more information: [http://www.siemens.com/press/pi/ICSG201204017e](http://www.siemens.com/press/pi/ICSG201204017e)

**Siemens and RWE to expand virtual power plant with additional energy sources:** The virtual power plant operated by the Smart Grid Division of the Siemens Infrastructure & Cities Sector and RWE, which went on line in October 2008 as a pilot project, is to be expanded. At the beginning of February 2012, RWE Energiedienstleistungen GmbH, Germany, began marketing the product “virtual power plant” on the EEX energy exchange in Leipzig. This is the first centralized direct marketing of electricity from a large number of EEG-compliant (Renewable Energy Sources Act) energy sources in Germany. At the same time RWE and Siemens are starting on the further expansion of the virtual power plant, for which purpose RWE Deutschland AG and Siemens Infrastructure & Cities have signed an outline agreement. The merging of approximately 20 megawatts (MW) of electrical generating capacity is planned for the first year of operation in 2012, which is to be increased tenfold to about 200 MW by the year 2015. The objective is to integrate different distributed energy sources such as biomass plants, biogas block heating plants, wind turbines, and hydroelectric plants throughout the whole of Germany. For more information: [http://www.siemens.com/press/pi/ICSG201202012e](http://www.siemens.com/press/pi/ICSG201202012e).

**Siemens provides energy supplier in Qatar with turnkey Smart Metering solution:** For the Qatar General Electricity & Water Corporation (Kahramaa) headquartered in Doha, the capital of Qatar, the Smart Grid Division of the Siemens Infrastructure & Cities Sector is setting up a turnkey Smart Metering solution. The order is worth ten million euros. With the deployment of the Siemens solution, Kahramaa intends to test (in the context of a Smart Grid project) how energy demand can be managed during peak load periods, and how the billing process with customers can be improved. The project is scheduled to run in three districts of Doha up to May 2013. The Smart Metering solution to be supplied and installed by Siemens for one of these projects is based on the meter data management system EnergyIP, which, following the acquisition in December 2011 of the software specialist eMeter in California, now forms part of the Siemens Smart Grid portfolio. For more information: [http://www.siemens.com/press/pi/ICSG201204016e](http://www.siemens.com/press/pi/ICSG201204016e).

**Siemens to equip eight cities in India with supervisory control technology for power distribution systems:** The utility company of the Indian state of Maharashtra, the State Electricity Distribution Company Ltd., Mumbai, placed an order with the Smart Grid Division of the Siemens Infrastructure & Cities Sector for the installation of turnkey supervisory control and data acquisition technology (SCADA/DMS) for the power distribution networks in eight cities. This EUR18.5 million order has been awarded in connection with the Restructured Accelerated Power Development Reforms Program funded by the Indian government. The SCADA/DMS systems are to be installed.
and ready for operation by June 2013 and are expected to improve the availability and transparency of the distribution networks and cut the related power losses by as much as 15 percent.


- **Siemens and PJM Interconnection in the USA commission one of the world's most advanced grid management systems:** In late 2011, as the result of the Advanced Control Center (AC²) program run by the regional transmission grid operator PJM Interconnection (Norristown, Pennsylvania, USA), one of the most advanced grid management systems in the world commenced operation and is being used to manage North America’s largest transmission grid. The grid management system integrates the Siemens Spectrum Power energy management system and is based on a shared architecture integration platform developed by the Smart Grid Division of the Siemens Infrastructure & Cities Sector and PJM. The system is operated at two different sites. The control centers at each site are fully functional and capable of running the grid either independently or jointly as a single virtual control center. PJM is the only grid operator in North America and one of the few companies worldwide to have dual primary control centers.

For more information: [http://www.siemens.com/press/pi/ICSG201201006e](http://www.siemens.com/press/pi/ICSG201201006e)

- **Siemens to provide load and building management solution for EcoGrid EU project:** The Smart Grid Division of the Siemens Infrastructure & Cities Sector together with a number of European partner companies and universities will participate in the EcoGrid EU demonstration project. Within the framework of the EU-sponsored project a prototype smart grid will be installed and put into operation on the Danish island of Bornholm in the Baltic Sea. The project will run until 2015. Siemens will contribute an intelligent control system for energy loads in domestic and commercial applications. A solution for smart utilization of electrical energy will be implemented through the networking of the DEMS decentralized energy management system and components from the Siemens building technologies portfolio. The objective of the EcoGrid project is to demonstrate that intermittent wind- and solar-based power generation can through smart load control form the basis for reliable and sustainable power supply.

For more information: [http://www.siemens.com/press/pi/ICSG201110002e](http://www.siemens.com/press/pi/ICSG201110002e)

- **Siemens to electrify additional rail rapid transit line in Peru:** In 2013, the Tren Urbano rail rapid transit line in the Peruvian capital of Lima is due to be extended. This high-level extension will run along a viaduct and cover a distance of approximately twelve kilometers. The Smart Grid Division of the Siemens Infrastructure & Cities Sector will be responsible for electrifying the entire section of track on behalf of train consortium “Consorcio Tren Eléctrico”, and this will help it to build on the success it is already enjoying on the Peruvian market. Siemens carried out the electrification work for the first rail rapid transit line extension in Lima back in 2010, which enabled it to gain a foothold on this particular market.

For more information: [http://www.siemens.com/press/pi/ICSG201112004e](http://www.siemens.com/press/pi/ICSG201112004e)
• Siemens and Allgäu-based regional utility to test the “intelligent power distribution system of the future”: At the contract signing ceremony in Wildpoldsried in Germany’s Allgäu region on April 12, 2011, the Smart Grid Division of the Siemens Infrastructure & Cities Sector and Kempten-based Allgäuer Überlandwerk GmbH (AÜW) kicked off a joint project to test a smart grid in practice. In addition to AÜW and Siemens the project partners also include RWTH Aachen and the University of Applied Sciences in Kempten. The regional utility AÜW is making a portion of its power grid around Wildpoldsried, which lies to the northeast of Kempten, available for the smart grid pilot project. Siemens will use this section of the grid to implement a newly developed software package intended to improve power distribution planning and coordination, and to make grid operation more efficient. The two-year project, which goes by the name of IRENE (Integration of Renewable Energy and Electromobility), is being supported by the German Federal Ministry of Economics and Technology.


• The Smart Grid Division of the Siemens Infrastructure & Cities Sector is participating in the E-DeMa project for the development and demonstration of locally networked energy systems to the E-Energy marketplace of the future.

For more information: http://www.e-dema.de/de/index.html

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

The Siemens Smart Grid Division (Nuremberg, Germany) supplies power providers and network operators, industrial enterprises, infrastructure elements and cities with products and solutions for intelligent and flexible network infrastructures. To meet growing energy needs, the networks of today and tomorrow must integrate more and more renewable energy sources and ensure bi-directional energy and communication flows. Smart Grids help make it possible to generate and use power efficiently and on demand. For more information, visit http://www.siemens.com/smartgrid