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## Siemens brings renewables-based power to Mallorca

Power link through the Mediterranean provides annual power supply for 2.5 million tourists.



Siemens has delivered high-voltage direct-current (HVDC) technology that allowed Red Eléctrica de España (REE) to link Mallorca with the Spanish mainland via an electricity highway laid in the Mediterranean. In the future a significant proportion of the vacation island's power demand will thus be met using wind, solar and hydroelectric power which is produced on the mainland. At the same time supply security to the island will be enhanced. This project is representative of a trend in Europe: Power grids are distinctively coming closer together. With our HVDC technology renewables-based power can be transmitted over long distances with low losses. HVDC links will become the

backbone of power grids and the German energy system turnaround. They will help to increase the share of renewables in the European electricity mix, said Michael Suess, member of the Managing Board of Siemens AG and CEO of Siemens Energy. HVDC is a rapid-growth segment. In the last 40 years links with a total capacity of only 100 gigawatts were installed, 40 percent by us. In this decade alone we're anticipating invitations to tender for new HVDC links worldwide for a further 250 gigawatts, added Suess.

One of the main reasons for the link connecting Mallorca with the mainland was the enhancement of supply security on the Balearic islands. On Mallorca, power failures will soon be a thing of the past, said Ramón Granadino, Head of Red Eléctrica de España en Baleares. Under contract to the Spanish grid operator Siemens installed two converter stations for the conversion of alternating into direct current, one in the vicinity of the island's capital city Palma de Mallorca and a second on the Spanish mainland near Valencia. A 244-kilometer-long power line was laid through the Mediterranean between the two stations. Through the HVDC link 400 megawatts can be transmitted to Mallorca, which is equivalent to a good 25 percent of the island's installed power plant capacity. In the future it will thus be possible to meet both the power demand of one quarter of the 860,000 inhabitants and ten million tourists annually from the mainland. The Spanish mainland power mix includes an outstandingly large portion of renewables-based generation amounting to 35 percent, whereas Mallorca's installed power plant fleet is almost exclusively operated with gas, coal or oil. Compared with the construction of an additional new power plant the link to the mainland will in the future reduce annual CO<sub>2</sub> emissions by as much as 1.2 million tons, or roughly halve emissions. In addition, the capacity of a new power plant would only be utilized during the high season, because power demand on Mallorca approximately doubles during the summer peaks. Not only Mallorca but also wide areas of the Balearic islands will in the future be supplied with power from the mainland. A power link exists between Mallorca and Menorca, and another submarine cable to Ibiza is planned. There is already a cable from Ibiza to Formentera.

Cable links longer than 80 kilometers are only possible with HVDC transmission technology. That is because for underground or submarine cables, hardly any electricity is delivered when AC lines are this length or longer, because the cable's insulation serves as a capacitor and becomes charged, thereby absorbing the electricity. The link laid to Mallorca comprises three single-piece submarine cables, which were supplied by the Italian cable specialist Prysmian together with the Norwegian cable manufacturer Nexans and laid at a depth of as much as 1485 meters on the Mediterranean seabed. With overhead lines, HVDC reduces the transmission losses by between 30 and 50 percent. Given the same width of the cable run, 30 to 40 percent more energy can be transmitted than with conventional overhead lines carrying alternating current.

Siemens has already implemented more than 40 HVDC projects, one quarter of which were in China. Through these Siemens-built HVDC transmission links flows an amount of electricity equaling the average power consumption of entire countries, such as Spain or Italy. The HVDC links worldwide with a transmission capacity of 350 gigawatts anticipated by the end of this decade would basically be capable of transporting the amount of electricity required to meet the combined average power demand of all 27 countries in the European Union.

High-voltage direct-current transmission systems are part of Siemens' Environmental Portfolio. In fiscal 2010, revenue from the Portfolio totaled about EUR28 billion, making Siemens the world's largest supplier of ecofriendly technologies. In the same period, our products and solutions enabled customers to reduce their carbon dioxide (CO<sub>2</sub>) emissions by 270 million tons, an amount equal to the total annual CO<sub>2</sub> emissions of the megacities Hong Kong, London, New York, Tokyo, Delhi and Singapore.

*The Siemens Energy Sector is the world's leading supplier of a complete spectrum of products, services and solutions for the generation, transmission and distribution of power and for the extraction, conversion and transport of oil and gas. In fiscal 2010 (ended September 30), the Energy Sector had revenues of approximately EUR25.5 billion and received.*