



## SOUTH ASIAN ENERGY EXECUTIVES EVALUATE SPANISH INTEGRATION OF RENEWABLE ENERGY USEA EXECUTIVE EXCHANGE IN MADRID, SPAIN

Under the South Asia Regional Initiative for Energy (SARI/Energy) Partnership Program, funded by the U.S. Agency for International Development (USAID), fourteen executives from Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka met in Madrid, Spain, October 19 – 23, 2009, to identify strategies used by Spain for the interconnection of renewable energy and distributed generation/independent power projects into the power system. The exchange, which was organized and conducted by the U.S. Energy Association (USEA), was part of the SARI/Energy South Asia Regional Renewable Energy Partnership.

The USAID/SARI/Energy program promotes energy security in South Asia through three activities areas: (1) cross border energy trade, (2) energy market formation, and (3) regional clean energy development. Through these activities, SARI/Energy facilitates more efficient regional energy resource utilization, works toward transparent and profitable energy practices, mitigates the environmental impacts of energy production, and increases regional access to energy. SARI/Energy countries include: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

### EXECUTIVE EXCHANGE HIGHLIGHTS

During the five-day exchange, the South Asian delegates visited with representatives from federal government agencies, utilities and manufacturers to discuss government policies, strategies and incentives for renewable energy deployment, as well as commercially proven renewable energy technologies.



Above: Delegates meet with the Spanish system operator. **Red Eléctrica** is responsible for the technical management of the Spanish electricity system. As the owner of 99% of Spain's high voltage power transmission grid, it is the only company that specializes in the transmission of electricity in Spain. Red Eléctrica also acts as the operator of the insular and extrapeninsular power systems. Integrated into Red Eléctrica's control structure is a control center specially dedicated to "Special Regime" (renewable & CHP) generation, especially wind power. The control center for Special Regime issues generation instructions through the SCADA system to the control centers.

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## BACKGROUND ON SPANISH RENEWABLE ENERGY SECTOR

If it weren't for the promotion of renewable energy, by 2030, Spain could have an 80% energy dependence on foreign sources. This, combined with the environmental motivation, is what has driven Spain to become one of the most attractive countries for the development of renewable energy. Since establishment of a "Special Scheme" for renewables and the feed-in system, Spain has launched extraordinary amounts of renewable energy into the grid, making it second in wind and photovoltaic production and third in mini-hydro in the European Union. By 2010, renewable energy is expected to account for 30.3% of electricity production – or 337,407 GWh.

Spanish electricity reform to promote renewable energy began in 1980 and since then a variety of legislative measures and financial support has been implemented to refine the system. The current tariff system, which began in 1997, is responsible for much of Spain's success in integration of renewable energy. In 1997, the Spanish Electric Power Act introduced the liberalization of the electricity sector and differentiated between the average rate of electricity produced and what it labels the "Special Scheme" for renewable energy sources whose installed power does not exceed 50 MW. The Act ordered the incorporation of these sources into the electric grid and established a premium payment for this energy that improves its market price.

Then in 2004 the Spanish government modified the law to remove the remaining economic barriers to the connection of renewable energy technologies to the electricity grid, and established conditions for large-scale renewable energy generation through guaranteed prices and obligated purchase of renewable energy – otherwise known as a feed-in system. In general terms, the laws define a premium which is paid to producers of renewable energy electricity for each kWh produced (there are different levels of tariffs provided depending on the technology and the capacity of the installation). The producer can choose between a fixed price and a "premium" added to the price negotiated in the electricity market. The choice is valid for one year; after that the producer can decide to maintain the formula or swap to the alternative. The system is paid for by the electricity consumers through a charge that is added to their bill, proportional to the consumption.

Already, from 1998 to the end of 2008 the capacity installed of renewable energy sources has increased from 4,544 MW to 28,763 MW. At the same time, Spain has surpassed its target for solar PV, having installed more than 3 GW of PV solar through 2008 and will have installed another 450 MW in 2009, almost all of which is grid-connected. Wind, which is not as a readily-available source as solar, has been almost as successful – an installed capacity of 31,112 GWh at the end of 2008 that accounts for more than 11% of Spain's total electricity demand. Meanwhile, the country continues to refine its targets and incentive structure to expand growth in the other renewable energy sources, such as biofuels.

### Renewable Energy Regulation



Above & Right: The **National Energy Commission** (Comisión Nacional de Energía or **CNE**) is the regulatory body for Spain's energy systems, including the electricity market and the liquid and gaseous hydrocarbons markets. The National Energy Commission has been assigned wide-ranging functions in order to fulfill its goals and it also acts as a consultative body on energy matters to the Central State Administration and the Governments in the Autonomous Regions.

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The Instituto para la Diversificación y Ahorro de la Energía (**Institute for Diversification and Saving of Energy**, or **IDAE**) is a state-owned business entity that reports to the Ministry of Industry, Tourism and Trade. The two main poles guiding the institution's activity are achieving the targets set by the 2007-2012 Action Plan under the Spanish Energy Saving and Efficiency Strategy and those of the Renewable Energy Plan for 2005-2010. Thus, as well as jointly coordinating and managing the measures and funds destined for these plans in conjunction with the autonomous regions, the IDAE also runs activities to increase public knowledge and awareness, it provides technical advice, and runs and finances example technology innovation projects with potential for replication. The Institute is also highly active internationally, in the framework of various European programs and cooperation programs with third countries.

### Solar Energy

Delegates visited the Toledo PV facility, operated by **Union Fenosa**. The facility was one of the early large-scale Spanish PV plants and was built as a joint venture of Endesa, Fenosa, and RWE with financial support from various German and Spanish organizations and the European Commission. The site, located 30km outside Toledo, has 8,000 modules in two 450-kW arrays with fixed structures and a 100-kW single-axis tracking system. Installation began in February 1993 and was completed in mid 1994 on schedule and to budget. Production reached 1,270 MWh in 2000. This landmark project was a successful field demonstration of PV and European institutional cooperation.



Above: A dual-axis tracker. The 180 degree tracking allows the panels to generate an additional 15% power than the single-axis tracking.

Left: The **Toledo PV facility**. Spain has more available sunshine than any other European country, making it a leader in solar integration.

### Wind Energy

Below: Mr. Fernando Ortega, Area Sales Leader Power & Water for Spain & Portugal of **GE Energy** provides an overview of the the role of renewable as a solution for power generation. GE provided detailed reviews of its solar and wind production in Spain, as well as globally.



Above right: GE's 2.5 MW wind turbine, which is currently the primary model being installed in Europe. The South Asian delegation toured **GE's Nobleias Plant** that produces the turbine.

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## Utility Leaders in Renewable Energy



Following a period of strong international expansion, Iberdrola established itself as one of the four largest energy companies in the world by market capitalization. Its sister organization **Iberdrola Renewables** has become a world leader of its sector. Boasting the largest base of operational renewable assets (+ 10,000 MW) and the largest portfolio of future projects in the world (+ 56,000 MW), the company has consolidated its leadership position at the head of the worldwide wind energy sector.



Left: Delegates met with **Union Fenosa** – an integrated international energy company with a presence across four continents. Union Fenosa is involved in the generation, distribution and supply of electricity, with a renewable focus on onshore wind, minihydro and combined heat and power (CHP). Spain’s “special regime” includes CHP, due to its efficiency.

## Renewable R&D



Left: Delegates meet with the **Center for Energy, Environment and Technological Research (CIEMAT)**. Generating knowledge and technology in the field of energy, both from renewable and conventional resources, the Center carries out research development and demonstration programs in concentrating solar energy, an area in which CIEMAT may be considered a European center of reference, as well as wind power, photovoltaic and biomass. It also studies clean fossil-fuel combustion processes and procedures for reducing or eliminating carbon dioxide emissions. All developments are at a point near their application in the interest of society and are accompanied by socioeconomic and environmental studies, as well as global analyses of the energy processes.

While in Madrid, the delegates met with the **Asociación Española de la Industria Eléctrica (Unesa)**, the Spanish Electricity Industry Association that represents and promotes the interests of the associate electricity companies. Mr. Angel Luis Vivar, Director of Energy Resources and the Environment and Mr. D. Aquilino Lobo Panizo, Head of Planning provided the delegation with an overview of the organization, which represents roughly 80% of the generation, distribution and transmission companies in Spain. Unesa also outlined some of the challenges the electric industry has faced with the quick uptake of renewable into the sector, for instance the impact on the conventional sources no longer being provided full cost recovery as the new subsidized renewable sources receive priority purchasing.

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## PARTICIPATING ORGANIZATIONS

- Asociación Española de la Industria Eléctrica (Unesa)
- Comisión Nacional de Energía (CNE) (National Energy Commission)
- GE Energy
- Centro de Investigaciones Energeticas, Medioambientales y Tecnológicas (Center for Energy, Environment and Technological Research - CIEMAT)
- Iberdrola Renovables
- Instituto para la Diversificación y Ahorro de la Energía (IDAE)
- Red Electrica de España
- Union Fenosa



Above: USAID SARI/Energy Deputy Program Manager Chinmaya Acharya provides an outline of the SARI/Energy's focus on energy security through improved cross border energy trade, energy market formation, and regional clean energy development.

## RESULTS

The SARI/Energy executives had the opportunity to examine the use of renewable energy in the Spanish power sector market. This exchange furthered the utility executives' and policy makers' knowledge of modern technologies, financing strategies, policies, and successful project development methodologies, to foster renewable energy production in South Asia and create a more attractive investment climate for the renewable energy sector.

Additional specific outcomes of the exchange are listed below:

- The Centro de Investigaciones Energeticas, Medioambientales y Tecnológicas (**CIEMAT**) invited the delegates and USAID to explore the possibility for collaboration on renewable energy studies and projects with South Asia. CIEMAT is currently conducting a number of studies in the Latin American and Mediterranean regions.
- **Bangladesh** expressed interest in GE's 100 kW turnkey technology. **GE** will coordinate with Bangladesh to discuss options.
- Delegates shared information for a company to assist **Bangladesh** with supplying DC irrigation pumps for solar PV-based pumping systems.
- Delegates are considering establishing an e-network to foster communication between them.
- Participants express interest in exploring the application of the feed-in system in South Asia to promote renewable energy growth.
- **Sri Lanka** will explore applying some of the policies used by Spain to promote renewable energy to their own policies back home as they begin to expand their wind energy market.
- **Pakistan** will consider application of similar coal gasification used by Spain, as a solution to the high-sulphur content in the coal reserves.
- As Pakistan is expanding its use of wind, they will consider installing the 2.5 MW turbines that have become commonly used in Europe. Although these units are larger, they produce more energy while using less acreage.
- **Bhutan** will conduct a techno-economic study on the expansion of solar and wind power in the market, and its impact on the competitiveness of hydropower.
- **India** expressed interest in promoting the use of tracking systems in solar PV installations, which can harness and additional 15-30% more power.

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## **SARI/E EXECUTIVE EXCHANGE PARTICIPANTS**

### **Bangladesh**

- Mr. Islam Sharif, Managing Director & Chief Executive Officer, Infrastructure Development Company Limited
- Dr. M. Rezwana Khan, Vice-Chancellor, United International University (UIU) & Chairman, Organizing Committee for the First International Conference on Development of Renewable Energy Technologies

### **Bhutan**

- Mr. Pem Dorjee, Executive Engineer, Bhutan Electricity Authority (BEA)
- Mr. Ugyen, Engineer, Renewable Energy Division, Department of Energy, Ministry of Economic Affairs

### **India**

- Dr. S. Iniyar, Professor & Director, Institute for Energy Studies, Anna University Chennai
- Mr. Ankur Jain, Executive Director, Ankur Scientific Energy Technologies Pvt Ltd
- Mr. Deepak Gadhia, Chairman, Gadhia Solar Energy System Private Limited

### **Nepal**

- Mr. Shiv Chandra Jha, Deputy Managing Director, Nepal Electricity Authority
- Mr. Bipin Karki, Engineer, Alternative Energy Promotion Center

### **Pakistan**

- Mr. Tariq Qazi, Chief Executive Officer, National Transmission and Dispatch Company
- Mr. Abdul Majid Malik, General Manager Planning, National Transmission and Dispatch Company

### **Sri Lanka**

- Mr. T.M. Herath, Additional Secretary (Tech), Ministry of Power and Energy
- Prof. Ranjith Perera, Director General, Public Utilities Commission of Sri Lanka

### **U.S. Agency for International Development**

- Mr. Chinmaya Acharya, Regional Project Management Specialist & Deputy Program Manager, SARI/Energy, USAID/India
- Mr. Abdul Rasool Wardak, Country Coordinator – SARI/Energy, Office of Infrastructure Engineering and Energy, USAID/Afghanistan

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