



## Preserving Ecology when Designing a Wind Farm

The evolution of renewable energy in the Galapagos Islands **By Anthony Tisot**

As one of the world's most unique and ecologically sensitive regions, the Galapagos Islands are a natural choice for green energy technology. To help preserve the delicate ecological balance of this world heritage site, the government of Ecuador has embarked upon a mission to eliminate fossil fuel-based power production from the Galapagos archipelago by 2015.

As the first step in this initiative, the community of San Cristóbal is employing renewable energy technology as an environmentally friendly complement to the island's existing diesel-powered generating plant. In 2007, San Cristóbal's new wind energy facility came online as part of a hybrid wind-diesel solution, generating electricity for the island's 6,000 inhabitants while reducing the community's diesel fuel consumption by half. Appropriately, even the flashing obstruction lights that sit atop the three giant wind turbines use renewable energy (in this case solar energy) as a showcase of environmentally friendly technology at work.

### Adapting to life on the islands

Located on the equator some 600 miles from the coast of Ecuador, the Galapagos archipelago consists of 13 large islands and more than a hundred smaller islands, islets, and rocks that are home to some of the world's rarest birds and sea creatures. Although mariners have frequented the islands for 500 years, attempts to maintain self-sufficient communities in this remote location have historically proven challenging and, at times, problematic. Invasive plants and animals introduced intentionally or incidentally over the years have plagued the native species and threatened their habitats. Ongoing efforts to restore and protect the region's ecological balance have seen some success but, in recent years, a new threat emerged as the growing communities and expanding tourist trade demanded ever-more energy from the region's existing diesel-based power generation facilities.

Concerns about the risk of environmental contamination proved valid when, in January 2001, the Ecuadorian tanker "Jessica" ran aground at the entrance to Puerto Baquerizo Moreno on San Cristóbal Island, spilling 160,000 gallons of diesel oil into the fragile ecosystem. Though a combination of favorable currents and a determined response by Galapagos National Park Service staff, local fishermen, and volunteers helped to lessen the extent of the damage, the incident underscored the need for a more sustainable and environmentally friendly source of energy for this unique location.

### Harnessing the power of the wind

Fortunately, today's renewable energy technologies offer a range of alternatives that can help minimize the ecological impact and risks of traditional energy sources. In its role as steward to this irreplaceable ecosystem, the Government of Ecuador prepared to implement a renewable energy solution in the form of a \$10.8 million, 2.4-megawatt wind farm on San Cristóbal Island. The San Cristóbal Wind Project would be built in partnership with the United Nations Development Program (UNDP), private businesses in Ecuador, and the e8—a non-profit organization of the world's largest electricity companies dedicated to promoting sustainable energy development worldwide.

To reduce diesel consumption, while ensuring a reliable power supply in all seasons, the project's three massive wind turbines would work in conjunction with San Cristóbal's existing 650 kilowatt diesel generators. Together, this hybrid wind-diesel system would fulfill the island's power requirements while reducing CO<sub>2</sub> emissions by an estimated 2,800 tons per year and cutting diesel fuel shipments by fifty percent. Those selected for the project include

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Madrid-based Made Tecnologías Renovables to supply the wind turbines, diesel automation, and hybrid control equipment; SANTOS-CMI of Ecuador to construct the turbines onsite; and ELECDOR of Ecuador to install the transmission line.

#### Choosing a suitable location

The turbines' location was carefully chosen to minimize any impact on the region's indigenous species, such as the Miconia plant and the Galapagos Petrel, an endangered seabird that nests on the island. As part of a stringent environmental impact assessment, extensive research was conducted to determine the typical flight paths and areas favored by the petrel. Based on the findings of this research, a suitable project site was identified at El Tropezon—a location in the highlands, well away from the areas where the petrel typically flies and nests. To further reduce any danger to the petrel and other local birds, potential obstacles were eliminated wherever possible; transmission lines were buried underground, fencing was minimized, and the turbine towers themselves employed a design free from tension wires or lattice.

#### A solar-powered lighting solution

With two airports in the vicinity, effective obstruction markers were a necessity on the three 50-meter tall structures; although, as lighting can sometimes prove hazardous to birds, these too were chosen with care. For this project, Made Tecnologías Renovables selected a set of solar-powered LED (light emitting diode) obstruction lights from Canadian manufacturer Carmanah Technologies Corporation. Initially designed for the United States Air Force and approved for use in the Galapagos by the Ecuadorian Aviation Authority, the solar-powered obstruction lights were found to be an effective and environmentally friendly lighting solution.

Suitable for locations with limited access to sunlight, the stand-alone beacons require just 1.5 hours of sunlight per day to operate effectively—a valuable asset in an area where seasonal con-

ditions can result in a thick, persistent fog at higher elevations. Another benefit was the lights' ability to endure vibration and buffeting from the elements while shielding all components—solar modules, batteries, LEDs, and electronics—within a compact and durable enclosure.

#### Leading the way with renewable energy

As the first stage of an umbrella program to implement renewable energy alternatives throughout the Galapagos archipelago, the San Cristóbal Wind Project is a remarkable achievement. While reducing air pollution, cutting fuel deliveries, and introducing an affordable and inexhaustible source of electricity to the region, the hybrid wind-diesel system provides a functional link between traditional fossil fuel-based technologies and the new generation of sustainable energy alternatives.

Since the project's completion in October 2007, San Cristóbal's new wind-energy facility has performed according to plan, supplying more than 50% of the island's energy needs through wind power. Though it can supply up to 80% of the island's electricity during the region's windiest season, the facility can also work in conjunction with additional alternative energy technologies to further reduce the community's reliance on diesel generation. To this end, the project also includes a number of PV panels connected to the island's electricity grid. The solar panels, donated by the e8, represent an additional source of clean energy that can help to demonstrate the potential of a solar-powered solution, while providing the means to train local utility staff on yet another renewable energy alternative.

#### Looking ahead

As Ecuador's first large-scale wind project and one of the largest wind-diesel hybrid systems in the world, the San Cristóbal Wind Project is a milestone in sustainable development, equally notable for the scale and innovative design of the project, as for the shared commitment to environmental conservation and sustainable development that has characterized each stage of this six-year endeavor.

Following the successful completion of the San Cristóbal Wind Project, a second renewable energy project is underway for the archipelago. In 2008, the Project for Renewable Energy for Galapagos (ERGal) announced a proposed 3.2 MW wind energy project to accommodate the islands of Baltra and Santa Cruz. With the San Cristóbal Wind Project leading the way as an example of environmentally friendly energy generation, Ecuador is making significant progress towards its goal of eliminating diesel-based power generation from the Galapagos Islands.

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