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## El Totoral Wind Farm, Chile

### Case Study 61

Skanska Latin America (LA) constructed the El Totoral Wind Farm, which was the largest in Chile on completion, with the intention of maximising local socio-economic benefit whilst minimising environmental impacts.

### Aspects of Sustainability

This project highlights the following:

**Social Aspects**

Human Resources  
Corporate Community Involvement  
Business Ethics  
Health and Safety

**Environmental Aspects**

Energy and Climate  
Materials  
Ecosystems  
Local Impacts

**Economic Aspects**

Project Selection  
Supply Chain  
Value Added



### Project Introduction

The El Totoral Wind Farm ('Parque Eólico El Totoral' in Spanish) is located 300 km north of Santiago, in the municipality of Canela, on a remote site 800 m from the Pacific Ocean. The farm has an installed power of 46 MW and is designed to annually generate 103 GWh of energy, which is sufficient to meet the needs of 20,000 homes. The project became the country's largest wind farm on completion, with over twice the installed power of the second largest wind power plant in Chile at that time.

Skanska LA constructed the US\$ 100 million project for Norvind S.A., which is a subsidiary of the Norwegian company SN Power that develops and operates renewable energy projects in emerging markets. Skanska was responsible for civil works and all electrical engineering work

between September 2008 and November 2009.

The farm consists of 23 Vestas 2 MW wind turbines, with a blade diameter of 90 m and tower height of 120 m, distributed over a 900-hectare site. The turbines were positioned almost perpendicular to the prevailing wind direction in four parallel lines in an east-west orientation, following a 10-year wind resource study by the client. A control centre was also constructed, along with an underground cable network to connect the wind turbines to a medium voltage substation, which increases the voltage from 23 kV to 220 kV prior to connection to the SIC (National Interconnected System). The farm has a design lifespan of 20 years, although this period can be extended by future renovation work.

The El Totoral Wind Farm generates renewable energy that does not create greenhouse gas emissions. The client financed the wind farm as

a carbon emission reduction project by gaining carbon credits. The farm also supports the government objective to source 5 percent of its energy from non-conventional renewable sources, such as wind, by 2014.

## Contributing Toward Sustainable Development

The El Totoral Wind Farm supplies clean and renewable energy to the SIC and helps to meet the rising demand for energy in Chile. The project will also promote regional economic development by generating tax revenue for the municipality throughout its lifespan and has strengthened the capacity of the Chilean wind energy industry to deliver similar projects in the future. During construction, Skanska sought to promote good stakeholder relations by informing and involving local people and the project was located on a site that would cause minimal public disturbance. Local people with limited skills were employed and trained on the project, and gender equality was promoted by ensuring that women held a number of key managerial positions. A perfect safety record was maintained throughout the project through careful planning and initiatives to educate and involve the workforce. A comprehensive environmental management plan ensured that there were minimal environmental impacts and damage to flora and fauna during construction. Waste was thoroughly sorted and recycled and several charitable contributions were made to local organisations in the form of revenue from project recycling or the donation of waste materials.



## Social Aspects

### Stakeholder relations and communication

A public meeting was organised to present the project plans to local people and to give them the opportunity to discuss any concerns with the project team. The public meeting was held at the Cultural Hall in Canela town, which is the capital of Canela municipality and is situated approximately 30 km from the site. The meeting was organised together with the local government and invited members of the public through a poster campaign, and announcements and a discussion on local radio. Attendance was high and around 180 adults and 20 school children attended the meeting. Public concerns raised at the meeting included local employment opportunities, workforce gender equality and wildlife disturbance, all of which were addressed by special project considerations.

### Workforce gender equality

Several women held management positions during construction, including the Quality Manager and the Field Operations Manager.

### Minimal public disturbance

The project was located on a remote site with no villages or settlements in the immediate area. The nearest town is Puerto Oscuro, which is 7 km from the site and has a population of around 100 inhabitants. An urban development analysis indicated that the closest potential human settlement in the future could be around 1 km from the site.

### Occupational health and safety

The team completed over 500,000 hours without accident and the Lost Time Accident Rate was zero. A “tool box talk” with the workers was conducted each morning to discuss the activities to be undertaken during the day, along with the associated safety risks. Workers were also encouraged to complete safety observation cards to help identify and eliminate potential site safety risks before they occurred.

### Charitable donations

White paper collected as part of the project’s waste management activities raised over US\$ 450 for a child charity foundation. Around 6,500 aluminium cans were also collected and raised funds for a day care centre for infants in Canela. Other surplus and waste materials were donated to local communities and employees where possible, such as wooden scaffolding that was donated to the local fire service to be used as firewood.



## Economic Aspects

### Local construction employment

Approximately 230 people worked on the construction of the project. Local workers were prioritised and around 60 percent of the construction workforce was from the immediate surrounding areas.

### Regional construction materials

The project strived to source locally manufactured materials where possible, including scaffolding and electrical installation structures. However, primary construction materials, such as steel and cement, were sourced as far as 290 km from the site due to the unavailability of sufficient quantities of materials in the local area. The wind turbines were imported from Denmark, as they were not available in Latin America.

### Vocational training

Special training was provided to compensate for the lack of local relevant skills concerning the construction, maintenance and operation of wind farms. Training days were held to educate the Chilean project workers how to operate the SCADA (Supervisory Control And Data Acquisition) power generation system as well as how to service and maintain the turbines.

### Regional economic development

Canela is one of the poorest municipalities in Chile and there were no other major public or private investment projects underway in the area during the construction of the El Totoral Wind Farm.

During construction, the project generated municipal revenue from permit fees and created community economic benefits through direct and indirect employment. Throughout its lifespan, the wind farm will also earn tax revenue of over US\$ 1.2 million per year for the municipality (based on the current 17 percent tax rate and the low long-term energy price estimate of 70 US\$ / MWh). The project also has the potential to become a visitor attraction, which could promote Canela's tourist industry and the associated businesses and services.

## Strengthening the Chilean wind energy industry

The construction of the El Totoral Wind Farm has contributed toward knowledge transfer by training local people to construct, operate and maintain wind turbines. This enhanced local competence may facilitate similar wind farm projects in Chile in the future. Wind energy accounted for only 0.2 percent of CIS's energy supply in 2007, and the Chilean government plan to encourage more wind farms in the future. Wind energy also helps to diversify the CIS's energy sources and promotes Chile's energy independence.

## Environmental Aspects

### Reducing environmental impacts during construction

The site is situated close to the Pan American Highway (Route 5), which ensured that minimal new roads were constructed to the site. 22 km of new dirt roads were created on the site to provide construction access and 30 km/h vehicle speed limits were enforced to reduce the amount of dust created. Grey water from the showers and bathrooms was also sprayed on the roads around twice each day to suppress dust. 500,000 m<sup>3</sup> of topsoil was excavated and used to restore areas of the site following construction work and the topsoil was temporarily stored so as to minimise impacts on site vegetation. All power generators contained low-emission and low-noise engines, and site machinery was stored on protective nylon sheets to prevent soil contamination. Water for construction purposes and the bathroom facilities was sourced from local wells. However, the water was too nutrient-rich for human consumption and bottled drinking water was also transported to the site. Portable chemical toilets were used, which allowed wastewater to be properly treated off-site. The project was also designed to reduce the visual impact of the project by digging an underground cable network, which minimised the need for overhead power lines.



## Limiting damage to flora and fauna

The site and surrounding area is a semi-dry coastal environment with some biologically valuable scrub flora and fauna species that the project strived to minimise impacts upon. In order to minimise impacts on biodiversity a decision was made by the project team to make large areas of the site off limits to the construction workforce, including sensitive nesting grounds and habitats. Biologically valuable scrub plants, including euphorbia portulacoides and baccharis macraei, were identified on the site and protected from construction activities where possible. Species of cactus that were at risk from project activities were temporarily relocated to a greenhouse before being transplanted on the site. Food was only allowed in the designated canteen area and special considerations were made to ensure that waste food from the canteen was not accessible to animals, such as rodents and foxes, in order to ensure they only fed naturally.

## Waste management

Project waste was separated into paper, metal, plastic and timber, and was recycled by specialist facilities or disposed of appropriately. Strict canteen recycling procedures ensured that all aluminium drink cans and food containers were recycled. Recycled construction materials included the steel used for the project that was sourced from a recycling plant.

## Reducing greenhouse gas emissions

With an annual production of 103 GWh, the project is expected to reduce CO<sub>2</sub> emissions by approximately 75,000 tons per year by substituting energy from the SIC, which sources a third of its supply from gas or oil fuelled power stations. The wind farm will also reduce the atmospheric pollution caused by sulphur dioxide, nitrogen dioxide and other particles emitted by the combustion of fossil fuels to generate energy.

## Learning From Good Practice

The El Totoral project has allowed Skanska LA to develop its capacity to construct large wind farms in Chile, which is a market with great potential. The project is also a showcase for other potential wind farm clients concerned with environmental and social project responsibility.

