

UCUQUER WIND FARM, PHASES I AND II CHILE



Figure 1: Ucuquer Wind Farm, aerial view
Sources: Energías Ucuquer, SA.

Adriana Chávez Sánchez prepared this case study under the supervision of Cristina Contreras ENV-SP and Judith Rodriguez ENV-SP as part of the Harvard-Zofnass program directed by Dr. Andreas Georgoulas by initiative of IDB for the purposes of research and education.

Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation.

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EXECUTIVE SUMMARY

The Ucuquer Wind Farm (Phases I and II) is a unique and groundbreaking project. It has transcended standard sustainability practices within its main objective of enlarging renewable energy production, fulfilling categories of the Kyoto Protocol.

The Ucuquer Wind Farm is a project of Energías Ucuquer S.A. (Ucuquer Energy), a company committed to sustainability objectives in the execution of unconventional renewable energy projects in Chile. Since 2009 one of those projects has been the Ucuquer Wind Farm, located near the Rapel River and its hydroelectric plant. The project team's leadership was outstanding, as it is an innovative project in the Chilean context.¹ This project is aligned with Chile's national energy policy, which in 2010 set a requirement that 5% of the country's electrical power must be produced through renewable resources. The Ucuquer Energy team excelled in visualizing, analyzing, and communicating the site's energy potential, as well as in introducing the technological development required. The project includes ultra-low wind speed turbines manufactured and operated by Envision Energy, China's leading wind turbine manufacturer.

Despite the strong leadership found in the project, specific mechanisms or business processes could be further improved for managing the project's sustainability issues, impacts, and opportunities. It is suggested to provide more information about leadership roles, responsibilities, and authority. Ucuquer Energy is still a small enterprise, but it is highly recommended to establish protocols, measurements, and documentation for strengthening the company's sustainability practices.

Ucuquer Wind Farm is located in a rural property in the town of Matancilla, in Litueche district in the VI Libertador General Bernardo O'Higgins Region of Chile.² The project was carried out in two phases, with a total cost of US \$36 million, and was completed in August 2015. Phase 1 began on October 17, 2011 and initiated operations on October 4, 2012, requiring US \$15 million in investment.³ It is expected to have a lifespan of 30 years of operation, though its useful lifespan might be indefinitely prolonged with appropriate maintenance and advancements in technology. The wind farm will feed energy into Chile's main alternating current power grid, the Sistema Interconectado Central. The project installed ultra-low wind speed turbines, introducing technological innovations. The project was developed in record time, leveraging economies of scale and efficiencies in logistics.

¹ Luis Ljubetic Villanueva, "Declaración de impacto ambiental Parque Eólico Ucuquer," Chile, 2011, 8.

² Ibid., 11.

³ Ibid., 15.

Being located in a rural area with no close human settlements, the project does not directly affect or interact with nearby communities. It also concentrates development inside of the project's land, which has not been designed to be inhabited but will be operated remotely. The project's challenges go beyond the community scale, largely incorporating environmental goals. It provides sustainable growth and development at a regional scale, representing an opportunity for energy growth. No specific community linkages have been found, nor major local stakeholders.

The technological innovations implemented in the project will also lead to minimizing noise and vibration generated in the wind farm's construction and operation phases. The project takes advantage of existing highway infrastructure from the Rapel Dam, attenuating environmental impacts and investment costs.

Ucuquer Energy specifies two types of interventions. One of these is associated with the installation of nine turbines, the electric substation, and the transmission line. The other type is associated with earth movements for the configuration of interior roads. The project's material sources vary from on-site earth and gravel to concrete and steel coming from regional sources and wind turbines coming from China. Excavation by-products were reused for constructing wind generator foundations and for leveling roads inside the project.

Waste management strategies have been stated in the environmental impact assessment for construction and operation phases. A specialized company will manage waste according to Chile's laws. The project team did not provide complete information about materials synergies, life cycle analysis, or net embodied energy; therefore, credits couldn't be completely evaluated for these areas. On the other hand, Ucuquer Wind Farm not only reduced energy consumption inside the project (having 0% consumption) but will also create renewable energy for the next 30 years. Monitoring and maintenance are performed remotely, reducing energy and water consumption. Moreover, the wind farm does not affect the availability, quantity, or quality of freshwater, as it does not interfere with or modify either groundwater or surface water. No potable water will be consumed or used in the wind farm. As a result the environmental impacts are considered to be low.

Ucuquer Wind farm is located in the hills of Chile's Coastal Range. The site includes numerous hills and ravines with native vegetation. Current conditions show intense agricultural activity along with zones of ravines and rivers with native vegetation.⁴ The site is located adjacent to the Rapel River, the Rapel hydroelectric plant, and lakes and streams surrounded by forest. An ecological analysis developed by the project team shows existing animal and vegetation

⁴ Alvaro R. Tomé, "Informe paisaje. Parque Eólico Ucuquer, Rapel, VI Región," Chile, 2011, 8.

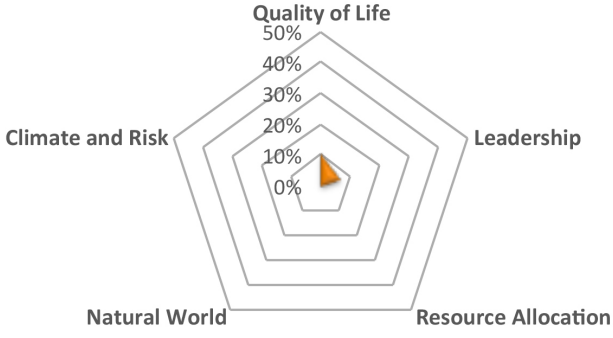

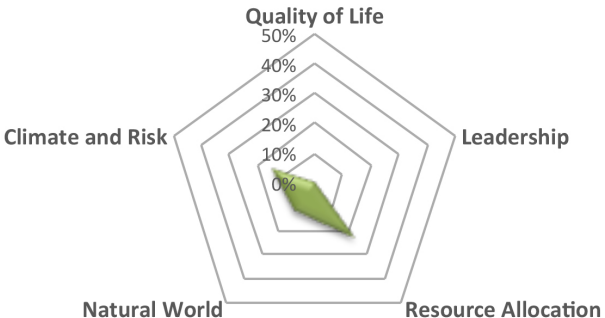



habitats. Biodiversity studies show that most of the native species on the site have been influenced by direct or indirect human activity, such as erosion and overgrazing as well as fires. The wind farm's area of intervention in direct contact with prime habitats is proportionally small, only 4.3% of the total site. Therefore, the project did not produce any relevant impact on them. Habitat restoration for degraded areas is part of the project owner's long-term vision. The remaining 95.7% of the project's surface area will be dedicated to restoring forest and enhancing agriculture.

During the construction phase, recognizing the ecological importance of the area, the wind farm did not interfere with surface water functions or other existing natural habitats, and it did not produce any surface or groundwater pollutants. According to Chile's VI Region's laws, the project includes environmental regulations, but buffer zones have not been pursued in areas close to the Rapel River, and neither a hydrological or stormwater assessment nor operational policies for controlling the application of pesticides and fertilizers have been developed.

Ucuquer Wind Farm is one of Chile's pioneering nonconventional renewable energy projects. Its actions are deeply connected to efforts to reduce greenhouse gas emissions. The project has expanded its lifespan from 20 to 30 years, maximizing the efficiency of the intervention. This accomplishment gives the project team the possibility of planning long-term adaptive measures for the site. No life cycle carbon assessment, climate impact assessment and adaptation plan, or long-term adaptability studies have been conducted yet. All are crucial for the future of the site and the development of these studies has been recommended to the project team. However, the project's design allows it to undertake certain actions and programs for long-term planning, as its intervention directly affects only 4.3% of the site. The remaining area has been designated for forest and agricultural activities, avoiding the use of non-permeable surfaces, reducing heat island effects, and aligning with future restoration projects. The project is located in a rural area; therefore, most of the adaptation strategies would refer to ecological restoration activities and other environmental programs.

Considering that Chile is an earthquake-prone region, the project team has taken a lead on short-term hazards. Wind turbine foundations have been designed according to earthquake-proof structural norms. Finally, the project has been successful in accomplishing its goals through leadership commitment to sustainability objectives and innovation. Ucuquer Wind Farm is a pioneering project in Chile's VI Region. Being one of the first projects to implement sustainable measures, it stands as a foundation for nonconventional renewable energy projects and will have a positive impact on Chile's expansion in this field. Yet, as Ucuquer Energy is a small-scale enterprise, it has not developed thorough studies for achieving high sustainability standards. Documenting and developing long-term climate adaptation plans in this area could result in great benefits, as could other studies such as life cycle analysis of material sources.

It is highly recommended to develop monitoring and evaluation systems for analyzing environmental impacts. The project takes advantage of the site's strategic location near the Rapel Dam; therefore, it has not produced more impact on the surrounding landscape. One of the project's main assets is the possibility of incorporating an ecological restoration project, enhancing agricultural and forestry activities. This action can incorporate economic and social development for the region and restoration of degraded habitat caused by problems in the area. Finally, the project's best opportunity for further achievement is to consolidate standards and best practices that might influence other future projects in Chile's VI Region.

	
Figure 02: People & Leadership award	
	
Figure 03: Climate & Environment award	
	
Figure 04: Infrastructure 360 award	

1. PROJECT DESCRIPTION AND LOCATION

The Ucuquer Wind Farm (Phases I and II) aims to contribute to growing energy demands and diminish fossil fuel emissions while generating employment for Chile's VI Region. It consists of nine wind generators with a capacity of 1.8 MW each and a total annual electrical energy generation of 50 GWh, which will be fed into Chile's main alternating current power grid, the Sistema Interconectado Central.⁵ The project also includes the construction of an electrical substation and a transmission line. The second phase of the project installed ultra-low wind speed turbines manufactured and operated by Envision Energy, China's leading privately owned wind turbine manufacturer. The project was commissioned and developed in record time, leveraging economies of scale and efficiencies in logistics in China complemented by equipment and talent from Chile, Brazil, Spain, and Costa Rica, as well as state-of-the-art monitoring control and systems on the cloud.

A project of Energías Ucuquer S.A. (Ucuquer Energy), a company constituted entirely by Chilean investment, the wind farm is intended to contribute to the development and diversification of Chile's energy matrix through the implementation of small-scale unconventional renewable energy projects. The project is aligned with the Chilean government's national energy policy, which as of 2010 requires 5% of electrical energy produced by energy companies be obtained through renewable sources or unconventional renewable energy sources. In addition, the project is a Clean Development Mechanism project for credits and fulfills the categories of the Kyoto Protocol.

Ucuquer Wind Farm is expected to operate for at least 30 years, but its useful lifespan may be indefinitely prolonged with appropriate maintenance and advances in technology. The project was carried out in two phases with a total cost of US \$36 million. Phase 1 began on October 17, 2011 and initiated operations on October 4, 2012, requiring US \$15 million in investment. This phase consisted of the installation of four 1.8 MW wind generators with a combined energy output of 22 GWh annually. Phase 2 began on January 1, 2015 and initiated operations on August 19, 2015, requiring US \$21 million.⁶ This phase consisted of the installation of five wind generators with capacities of more than 2 MW, and the construction of a substation and a power line of 110 kV connected to the substation of the Central Rapel Hydroelectric Plant. At the present time, both phases of the project are in operation. After completing seven months of operation in phase II, the turbine generators are performing better than expected. Once adjusted to their normal capacity, the phase II generators reported an average performance 4% higher than the technology installed in phase I.

⁵ Ljubetic, "Declaración de impacto ambiental," 8.

⁶ Ibid., 15.

The site is located in a rural property called Fundo Ucuquer e Hijuella Mantancilla, comprising 1,405 hectares in Matancilla town in Litueche district in the VI Region.⁷ This region has a population of 1,861,562 (2002 census), with a population density of 53.9 inhabitants per km². Its location provides various advantages for the generation of wind energy. Litueche district has an economy based on commerce, mining, forestry, and agriculture, fueled mostly by small-scale producers, which are the main economic engine. The Ucuquer Wind Farm generators only utilize 4.3% of the site's surface area and are 100% compatible with other activities such as forestry, agriculture, and animal husbandry.

The wind farm is located far from residential buildings and population centers but is accessed easily by major route I-124 that runs from Litueche to the Rapel Dam, with connections to Melipilla and Santiago.⁸ Ucuquer Wind Farm has a strategic location since it is close to the Rapel Dam, taking advantage of the existing road infrastructure that serves the dam while minimizing impact on the landscape and minimizing construction costs. In sum, the wind generators' placement maximizes energy generation while minimizing impact on adjacent communities. The distance from the communities reduces noise and other disturbance produced by the wind farm.

Ucuquer's Phase I location was not regarded as having a high wind potential. Nonetheless, at present two or three developers are measuring winds in sites nearby, potentially bringing more investment into the region. Involvement with the local community is crucial for improving welfare by developing services, industries, trade, and tourism. Visitors are amazed to see the operation of Ucuquer Wind Farm. Perfect execution and coordination of works among different contractors contributed to reduce movements and impact on the site, adding value to a former tree farm affected by a forest fire in the area.

2. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision® system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. Envision consists of 60 credits grouped into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Each credit pertains to a specific indicator of sustainability such as reducing energy use, preserving natural habitat, or reducing greenhouse gas emissions. Those credits are rated on a five-point scale referred to as a "level of achievement": "improved," "enhanced," "superior,"

⁷ Ibid., 10.

⁸ Ibid., 13.

“conserving,” and “restorative.” Evaluation criteria are provided to determine whether the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a special credit called “Innovate or exceed credit requirements.” This is an opportunity to reward exceptional performance that applies innovative methods within the subjects that Envision evaluates.

The criteria for the levels of achievement vary from credit to credit, but generally an “improved” level of achievement is awarded for performance that slightly exceeds regulatory requirements. “Enhanced” and “superior” levels indicate additional gradual improvement, while “conserving” often indicates performance that achieves a net zero or neutral impact. “Restorative” is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI⁹ and Zofnass Program¹⁰ websites.

3. QUALITY OF LIFE CATEGORY

Envision’s first category, Quality of Life, pertains to potential project impacts on surrounding communities and their well-being. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing community networks, and consider long-term community benefits and aspirations. Quality of Life incorporates guidance related to community capacity building and promotes infrastructure users and local members as important stakeholders in the decision-making process. The category is divided into four subcategories: Purpose, Well-being, Community, and Vulnerable Groups.

Purpose

The Purpose subcategory addresses the project’s impact on functional aspects of the community, such as growth, development, job creation, and the general improvement of quality of life. Positive results from infrastructure projects can include community education, outreach, knowledge creation, and worker training.

The project is located in a rural area near the Central Rapel Hydroelectric Plant with no human settlements. The site comprises 1,405 hectares in Matancilla town, Litueche district, in the VI Region of Chile.¹¹ Situated in a rural area, the project does not directly affect any community.

⁹ www.sustainableinfrastructure.org

¹⁰ www.zofnass.org

¹¹ Ljubetic, “Declaración de impacto ambiental,” 13.

The project team has not specified any type of community linkages with major stakeholders or government institutions that might be directly affected by the project. It is recommended that the project provide documentation regarding meetings with stakeholders.

The Ucuquer Wind Farm provides sustainable growth and development at the regional scale, feeding 50 GWh per year into Chile's main power grid. The investment represents an opportunity for Chile to experience growth in the clean energy market. The project provided 30 jobs during stages of construction and operation.¹² It has multiple environmental benefits, but has not studied possible impacts at a local scale on nearby communities in Central Rapel.

Using only the existing road infrastructure, the wind farm did not incorporate any infrastructure outside of the project site. Nonetheless, the project can serve as a spur to economic activity and other investments in renewable energy in the region: connecting jobs and education with environmental and development programs. The site is also compatible with the development of agricultural activities and has a great potential for environmental restoration while implementing economic development.

The wind farm is aligned to the Communal Development Plan, the region's most important planning instrument. It is recommended that the project provide additional information demonstrating how it will contribute to local employment and workers' skills, as well as how it will improve its integration of training programs or enhance long-term community competitiveness. Finally, specific consideration of disadvantaged or minority groups is also advised.

Well-being

The Well-being subcategory addresses issues related to comfort, health, and mobility of local communities and project workers. Safety is an integral part of the planning process, as is promoting the expansion of alternative modes of transportation.

The Ucuquer Wind Farm (Phases I and II) has excelled in developing acoustic studies over the excavation and construction phases.¹³ It also incorporates acoustic criteria into the design and placement of the wind generators, as they are remote from adjacent communities, preventing disturbance from noise and vibrations. All phases of the project were certified as successfully meeting established noise and vibration levels. Each phase was analyzed in comparison to a worst-case scenario. For the excavation phase, earth movement, trucks, and the installation of

¹² Ibid., 15.

¹³ Acustec, Soluciones de Ingeniería a Problemas Acústicos, "Evaluación de impacto acústico. Proyecto Eólico, Ucuquer, Vestas, General Power," Santiago de Chile, 2011.

other machinery were considered. In the construction phase, noises and vibration from cranes were examined as well as other movements related to the positioning of wind generators. Lastly, in the operation phase, scenarios were calculated with the assumption that all nine generators would be simultaneously functioning. Over all, none of these studies showed sound or vibration levels disrupting any of the adjacent communities.

The Ucuquer Wind Farm provides documentation regarding regulations established by Chilean law. However, it does not include information about workers' health and safety. The project did not take into account nor offer information about risk protocols associated with the project's new materials or technologies. The project integrates ultra-low-speed turbines, a new technology imported from China and developed by the Envision company.

The project does not convey lighting information. The Ucuquer Wind Farm has not been planned to be inhabited by a community because of its remote location. Nevertheless, activities such as forestry and agriculture will continue on site, overlapping with the wind farm facility. Under these circumstances, the project team needs to develop energy considerations for improving the function of such activities.

According to accessibility reports, the main access to the wind farm will be the I-124 highway connecting Litueche to Central Rapel, from which one can continue via G-60 and G-78 toward Santiago.¹⁴ The project is located near the Rapel Dam and takes advantage of existing infrastructure, avoiding new construction works outside the site.¹⁵ This condition attenuates environmental impacts and investment costs on the site. Taking this into consideration, the Ucuquer Wind Farm does not affect the region's mobility and accessibility. The project only has only required the construction of interior roads to facilitate construction truck access for transporting supplies and machinery. These roads will support the park's operation, minimally affecting the landscape. No studies have been found on how the project would improve safety, accessibility, and wayfinding within and outside the site.

The project holds the potential to link environmental and economic opportunities in the region. Due to this reason, It is essential to keep in mind during the design phase how forestry or agricultural activities can be strategically configured to promote sustainable mobility, while creating better conditions for accessibility.

¹⁴ Geodiversa, Consultores Ambientales, "Plano general de ubicación del Proyecto," Chile, 2012.

¹⁵ Ljubetic, "Declaración de impacto ambiental."

Community

The Community subcategory covers the visual and functional impacts of infrastructure projects on their immediate surroundings. Projects are encouraged to use innovative ways to integrate into the local community without disturbing its character and natural features.

The project's largest contributions in this subcategory are thorough studies regarding cultural heritage and the preservation of local views. The site selection is vital, as the wind generators do not disrupt any community or landscape features. The project team hired a series of experts not only to integrate the project into Chile's heritage preservation regulations, but also to enhance its natural character. The project team excels in respecting the site by working with local archaeologists and ecologists for these evaluations.

The VI Region corresponds to an archaeological area in central Chile. Human settlements have been documented in the region since the end of the Pleistocene, even though this site's subsoil consists of granite metamorphic rock, which makes an unsuitable site for human settlement in addition to the lack of water resources. Most of the wind farm is located at high altitude and is clear of vegetation.¹⁶ Complete studies were realized to determine whether the areas of intervention held any archaeological evidence. The site contains 1,405 Ha in total, but only the 60 Ha of direct intervention were investigated in detail.¹⁷ No archaeological, historical, cultural, or prehistoric evidence was found.

The regional landscape features a mosaic of hills belonging to the coastal range with various ravines. Within this landscape is the Rapel River and its hydroelectric dam. The hills of Loma Pelada and Loma el Bolson are located near the Rapel River, along with the lake, and several estuaries. Forestry and agriculture are the dominant activities. Observation points were defined based on physical and visual connectivity within the territory. Important landscape elements and activities were categorized in scenic areas, visual landmarks, vegetal surface, wildlife, water bodies, human interventions, and areas of historical interest.

Vulnerable Groups

The Vulnerable Groups subcategory refers to a project's engagement with women and indigenous and diverse communities. Infrastructure projects impact vulnerable communities and can advance mobility and education as well as promote empowerment. All of the credits in this subcategory were evaluated without a score, as the project does not include information or evidence that addresses this topic. The Ucuquer Wind Farm is located in a rural area, physically

¹⁶ Ibid., 5.

¹⁷ Luis Ljubetic Villanueva, Energías Ucuquer S.A., "Anexo F. Estudio arqueológico, Declaración de impacto ambiental," Chile, 2011, 8.

disconnected from any community or human settlement. No documentation was found addressing engagement with vulnerable groups such as women.

The project takes advantage of the Rapel Dam's existing infrastructure; it has only intervened in the interior of the project site. Under these conditions, some characteristics of integrating vulnerable communities are neither clear nor required. The project has yet to expand its scope of influence as it maintains a regional lens.

Considering the project's lifespan of 30 years,¹⁸ it recognizes the possibility of incorporating community engagement activities to empower women and vulnerable communities. Nonetheless, this has not been considered in any of the project's documentation. This possibility is not a requirement, yet the region could benefit from possible future interventions. It is recommended to include this under Ucuquer Energy's wind farm development guidelines.

4. LEADERSHIP CATEGORY

The Leadership category evaluates project team initiatives that establish communication and collaboration strategies early on, with the ultimate objective of achieving sustainable performance. Envision rewards stakeholder engagement as well as encompassing a holistic, long-term view of the project's life cycle. Leadership is distributed into three subcategories: Collaboration, Management, and Planning.

Collaboration

The Collaboration subcategory aims to provide effective leadership and commitment to achieve project sustainability goals, establish a management system that improves sustainable performance, and foster collaborative and innovative teamwork methodologies.

Ucuquer Energy has been committed to sustainability objectives, promoting small-scale projects that contribute to reducing greenhouse gas emissions. The Ucuquer Wind Farm was identified as a project of great potential in 2009; the project team has excelled in visualizing and analyzing the site's energy potential, through technological development and other strategic economic alliances that realize the project. The project was commissioned and developed by leveraging economies of different scale and efficiencies in China. All of these efforts were supported by team collaboration and stakeholder engagement processes, as well as innovative policies, which are key to its success.

¹⁸ Ljubetic, "Declaración de impacto ambiental," 15.

Nonetheless, the project team needs to document and report all the management process. Team collaboration, clear management, and stakeholder inputs remain to be reported as part of the project's process. It is recommended to provide more information and develop protocols, strategies, and programs to advance leadership systems and to create better frameworks and implementation methodologies.

Management

The Management subcategory considers new ways of managing and understanding the project which aim to reduce cost, enhance efficiency, increase sustainability, and extend the life of the project through resilience against future unexpected problems.

The project team has addressed an opportunity for creating synergies within the site by using waste and other construction by-products.¹⁹ Ucuquer reuses excavated material for the construction of the site's roads and the wind generators' underground foundations. The project team has yet to create any synergy or construction outside of the wind farm. More systematic efforts might identify unwanted by-products or discarded materials in nearby facilities and develop a detailed assessment of their potential use during design, construction, or operation of the wind farm.

Ucuquer's most important interaction with nearby infrastructure projects relates to its proximity to the Rapel River and its hydroelectric plant. By taking advantage of its existing and optimized infrastructure, the project team foresaw cost minimization and infrastructural investment as well as increased use of the transport infrastructure in the site.

The project has also taken into consideration protecting the natural landscape.²⁰ A small percentage of the site has been altered and developed. Ucuquer Wind Farm uses the triple bottom line, including conservation of resources, use and production of renewable resources, and the protection of environmental, economic, and social systems.

Planning

The Planning subcategory addresses a project's understanding of long-term planning issues, such as the regulatory environment, and its anticipation of future growth trends in the area. Effective planning can reduce costs and streamline the project's whole process.

Ucuquer Wind Farm was developed according to policies, plans, and programs aligned to

¹⁹ Ibid., 34.

²⁰ Tomé, "Informe paisaje," 8.

regional and district development objectives. Among others, Region VI's Regional Development Strategy, Regional Environmental Policy, and Regional Strategy for Biodiversity Conservation support the creation of the wind farm. No documentation was found regarding any existing regulation that might conflict with the project's sustainability objectives, nevertheless by its construction the project reinforces and enhances existing sustainable policies.

The wind farm has expanded its usual lifespan from 20 years to 30 years, enabled by the use of ultra-low wind speed turbines.²¹ The project also has various possibilities for merging new uses such as forestry, agriculture, or animal husbandry, which might support the project's lifespan upon full capacity. The project team has not provided information about its future plans or whether and how it intends to prolong the life of the project. Incorporation of these activities provides great potential for more durable, flexible, and resilient design. Despite its remotely controlled operation, the project has yet to provide specific maintenance plans that guarantee its long-term performance. These monitoring plans are expected to be developed during the upcoming years of initial operation.

One of the most important recommendations in this subcategory is to conduct feasibility studies to determine areas of potential long-term cost savings related to future expansion, reconfiguration, and durability. Supplementary activities can contribute to the project's long-term vision and support monitoring and maintenance strategies.

5. RESOURCE ALLOCATION CATEGORY

The Resource Allocation category deals with material, energy, and water requirements during the construction and operation phases of infrastructure projects. The quantity and source of these elements as well as their impact on overall sustainability are investigated throughout this section of the Envision rating system. Envision guides teams to choose less toxic materials and promotes renewable energy resources. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

The Materials subcategory focuses on minimizing the total amount of materials used, as well as the amount of natural resources that must be extracted and processed and the energy required to produce and transport those materials. Reducing material use must be balanced with safety, stability, and durability. The source of materials also matters. Materials obtained from distant

²¹ Ljubetic, "Declaración de impacto ambiental," 17.

sources should be avoided, minimizing the footprint of the project. The life cycle of a material should always be considered; this will help to identify where the material comes from and where it will go after its useful life in the project.

Ucuquer Wind Farm includes the installation of nine wind generators, an electric substation, and a transmission line. Additional roads and site leveling were completed. For this work three types of material sources have been specified: on-site materials such as excavation by-products; concrete and steel coming from regional sources; and wind generators imported from China.²² The project team has only developed studies of the project's environmental impacts and waste management. Such studies do not include any life cycle analysis or recycling plan nor address the selection of materials from suppliers with sustainability standards. Ucuquer's team has not reported or documented evidence quantifying the amount of materials coming from any recyclable source.

The most important action regarding use of materials is the reuse of excavation materials in the foundations of the nine wind generators and for stabilizing the terrain. This action reduces transportation costs and also maximizes the use of on-site materials. The project does not include vast transformations of the natural landscape; it only intervenes where necessary to locate the turbines and roads. The project design helps minimize the use of materials in general and reuses materials located on site whenever is possible.

No further information has been provided regarding other materials such as the components of concrete and steel. It has been reported by the project team that such materials come from regional sources, specifically from Melipilla, a nearby town in Chile's VI region. However, no specific information regarding the supplier or technical information about materials has been delivered. More effort on reporting evidence, quantifying the impact, and planning these activities is required for enhancing and developing a standard practice on other infrastructure projects.

The team has not yet planned future recycling, upcycling or reuse of its materials after its useful lifespan, as there have been large technological advances in recent years. The project team is expecting to complete 5 years of operation before planning future uses for the wind farm components. Up to now, no studies or plans have been provided relating to this topic.

Energy

The Energy subcategory addresses the importance of reducing overall energy use, particularly

²² Ibid., 29.

from nonrenewable fossil fuel sources.

The project generates a net positive amount of renewable energy, which will be fed into the Sistema Interconectado Central.²³ Ucuquer's strategic proximity to the Central Rapel Hydroelectric Plant diminishes energy losses while maximizing the project's transmission efficiency. Energy is transmitted from the wind farm to Central Rapel, where it is connected to the grid that feeds Santiago, Chile's capital.

With a total investment of US \$36 million and a 30-year lifespan, the energy generated will allow the diversification of Chile's energy matrix by incorporating nonconventional energy sources. Feasibility studies not only prove that producing wind energy projects is possible, but demonstrate that there is an entire industry that can be implemented in the area. The project team has developed calculations for the project's estimated annual energy production during its active life.

The project team indicated that an external operating center that monitors the performance of the wind farm has been installed. Monitoring efforts are supported by Envision, the company that developed the wind generators. No further information about the monitoring system has been provided. The project team has scheduled maintenance operations every year for the following 30 years. As the project team has reported, within 5 years a performance assessment will be developed in order to quantify and analyze the impact and possibilities of the project.

Water

Ucuquer Wind Farm has no negative impact on the availability, quantity, and quality of freshwater. It does not interfere with or modify groundwater, or surface water. During the operation phase, water is not contemplated as a main resource since the project team reported a net-zero water use rate. No water infrastructure supply has been built or planned. No water-related analysis was realized, as it has not been identified as a main component or asset for the project. More research and documentation on each of the credits is required to further analyze this subcategory. The project's most complicated task during construction was water supply, since water infrastructure was not part of the project. Water was supplied by external sources coming from Chile's VI Region.

Besides energy production, the site integrates the restoration of a forest and agricultural areas located on site. One of the most relevant actions is that revenue coming from the wind farm

²³ Ibid., 17.

has helped the site and project owner to recuperate some of the natural areas, which benefits water along with other natural resources located there.

Moreover, Chilean environmental law (No. 20.283, article 16) directs that protective measures should be taken to safeguard soils, water, and biodiversity.²⁴ The project team has followed the established regulations without going beyond the mandatory requirements. One of the most relevant aspects are the plans to recuperate the site's environmental services. Nonetheless, no long-term plans have been submitted.

During its operation phase the wind farm will be managed remotely. Therefore, it does not need to incorporate any type of water infrastructure for its regular consumption. Thus, potable water use has been reduced 100%, though this has not been one of the project's aims but circumstantial.

Ucuquer Wind Farm only foresees monitoring systems for the 4.3%²⁵ of the site directly related to energy production. Ucuquer Energy has developed an external observation and monitoring station and it does not integrate environmental monitoring services – including monitoring of water. The monitoring systems put in place could be expanded to incorporate other environmental aspects in order to successfully measure positive effects at the forestry and agricultural areas of the site. This would help the project to document environmental changes through the restoration activities of the site, rather than only monitor energy performance.

6. NATURAL WORLD CATEGORY

The Natural World category focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects with a focus on enhancing surrounding natural systems. Natural World is subdivided into three subcategories: Siting, Land and Water, and Biodiversity.

Siting

The Ucuquer Wind Farm is located in Chile's Coastal Range, which holds numerous ravines with native vegetation. The Coastal Range includes the Rapel River and the hydroelectric dam. The

²⁴ Hector Ibarra, Leonardo Miranda, and Victor Quintana, "Medio biótico. Parque Eólico Ucuquer," Chile, 2011, 72.

²⁵ Ljubetic, "Anexo F. Estudio arqueológico," 8.

current site condition shows intense agricultural activity with forest zones like ravines and rivers with native vegetation including pines and eucalyptus. The project (turbines, electric substation, and transmission line) only occupies 4.3% of the site area.²⁶ The rest of the site is dedicated to forestry, agriculture, and other environmental services, which serve to preserve prime habitat, surface water, floodplain functions, and greenfields. The project team has yet to provide complete documentation regarding these subjects.

Ucuquer Energy S.A. has reported that a part of the revenues from the wind farm will be allocated to restoring forest and agricultural areas on site. If properly documented, this project has the potential to become a leading best practice for other similar projects. As the project is located on private land, it can instigate sustainable standards and guidelines for other developments in Chile.

At this moment, there is no geological analysis evidencing the non-existence of adverse soils on site. While no water bodies were affected by the project, the area's vegetative condition reveals site erosion and degradation due to human activity. Since Chile is located in an earthquake zone, it is important to consider site conditions in developing the project.

The project is located in an area of hills and ravines, yet specific programs for avoiding erosion and preventing landslides have not been identified. The project's nearness to the Rapel River necessitates such measures. While diverse forestry activities can provide solutions that avoid erosion, the project needs to establish specific procedures and methods for investigation and assessment.

Land and Water

The Ucuquer Wind Farm team has not presented a hydrological assessment or stormwater management plan that delineates intentions to restore and protect water resources. Water management practices can complement Ucuquer's scope and provide an integrated vision for the site's development. Similarly, there is no information about operational policies for controlling the application of pesticides and fertilizers. This is very important considering the site's agricultural potential, and given its proximity to the Rapel River. It is advised to explore design measures and monitoring systems to control agricultural pollutants that can affect the region's water system.

The Ucuquer Wind Farm does not generate surface or groundwater pollutants. The project was designed to have minimum impact on the site, with strategically placed turbines and non-paved

²⁶ Ibid.

roads providing site access. As the project does not produce liquid effluents throughout the year, it intends to manage its by-products through a specialized company in accordance with Chilean law.

Biodiversity

The Biodiversity subcategory focuses on how infrastructure projects should minimize negative impacts on natural species and their habitats, on and near the site. Special attention must be paid to avoiding the introduction and spread of invasive species, as well as the fragmentation of habitats that prevents animal movements.

The project team identifies the different habitats with their animal species and vegetation in order to provide an environmental analysis of the site and calculate the project's impact.²⁷ The site's native vegetation and fauna have been identified as previously influenced by direct or indirect human activity. The environmental studies recommend recuperating an area with vegetated native species that can contribute to improving mammal habitats.

The area of the site in direct contact with the wind farm is proportionally small, so the project does not present any major impact. During the construction phase no native vegetation was affected and no restoration works on the area of intervention were required. Nonetheless, in coming years forestry and agricultural areas are planned to be rehabilitated. These activities will take advantage of revenues coming from the project's operation phase and will support the surface water functions by enhancing existing degraded habitats.

Finally, analyses were developed of the risk of collision for birds and bats. The studies conclude that there was a low risk, due to the low-range flights of the species that are present. Similarly, no studies for controlling invasive species have been developed and research on fauna and flora do not identify any invasive species.

7. CLIMATE AND RISK CATEGORY

Envision aims to promote infrastructure developments that are sensitive to long-term climate disturbances. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promotes mitigation and adaptation actions to ensure short- and long-term resilience to hazards. Climate and Risk is further divided into two subcategories: Emissions and Resilience.

²⁷ Ibarra, Miranda, and Quintana, "Medio biótico," 9.

Emissions

The Emissions subcategory aims to understand and reduce dangerous emissions, of greenhouse gases as well as other pollutants, during all stages of a project's life cycle to minimize short- and long-term risks.

Being a project of renewable energy generation, its main aim is to reduce the emissions associated with energy production. The project's life span has been extended from 20 to 30 years, maximizing the possible average for emissions reduction. Ucuquer Wind Farm itself is a groundbreaking project which aims to expand the nonconventional renewable energy market in Chile. However, no life cycle carbon assessment has been developed to document in a detailed manner its carbon footprint.

The project team developed atmospheric emission studies regarding the emissions produced during the construction phase. Most of the pollutants were related to machinery movements for building roads and transit of materials, machinery, and personnel for the construction works. The highest emissions corresponded to vehicle transit on non-paved roads.

Resilience

The Resilience subcategory addresses the ability to withstand short-term risks, such as flooding or fires, and the ability to adapt to changing long-term conditions, such as changes in weather patterns or sea level rise. Increased adaptability and decreased vulnerability ensure a longer useful life and ensure that the project will be able to meet the future needs of the community.

The project team needs to address long-term vulnerability issues. It has been recommended to develop a climate impact assessment and adaptation plan. Because the project is located in a rural area, it doesn't imply any future impact on nearby communities, yet changes in the climate might affect surrounding ecosystems. One of the project's strengths is the recovery of the site's forest and agricultural areas. This process gives an opportunity for planning long-term adaptability measures specific to Chile's VI Region.

One of the major factors that the project team has taken into account is the short-term earthquake hazard and compliance with structural standards mainly in the foundations of the wind turbines. No further information was provided regarding other short-term natural hazards or any other human-related activity that might affect the project's performance. One of the major recommendations is to generate an analysis of all vulnerabilities that might occur in the site. Other aspects such as fires or flooding from the Rapel River must be considered.

Ucuquer Wind Farm is expected not to have a big impact in terms of heat island effect in the area. Interior roads have not been paved, so they have a low reflectance index, and reforestation and ecological restoration efforts will also help combat any heat island effect. Nevertheless metrics and policies need to be developed. These measures could also create a standard for future projects in the region.

APPENDIX:

APPENDIX A: PROJECT PICTURES AND DRAWINGS



Figure 05: General picture of the project
Sources: Energías Ucuquer, SA.



Figure 06: General picture of the project
Sources: Energías Ucuquer, SA

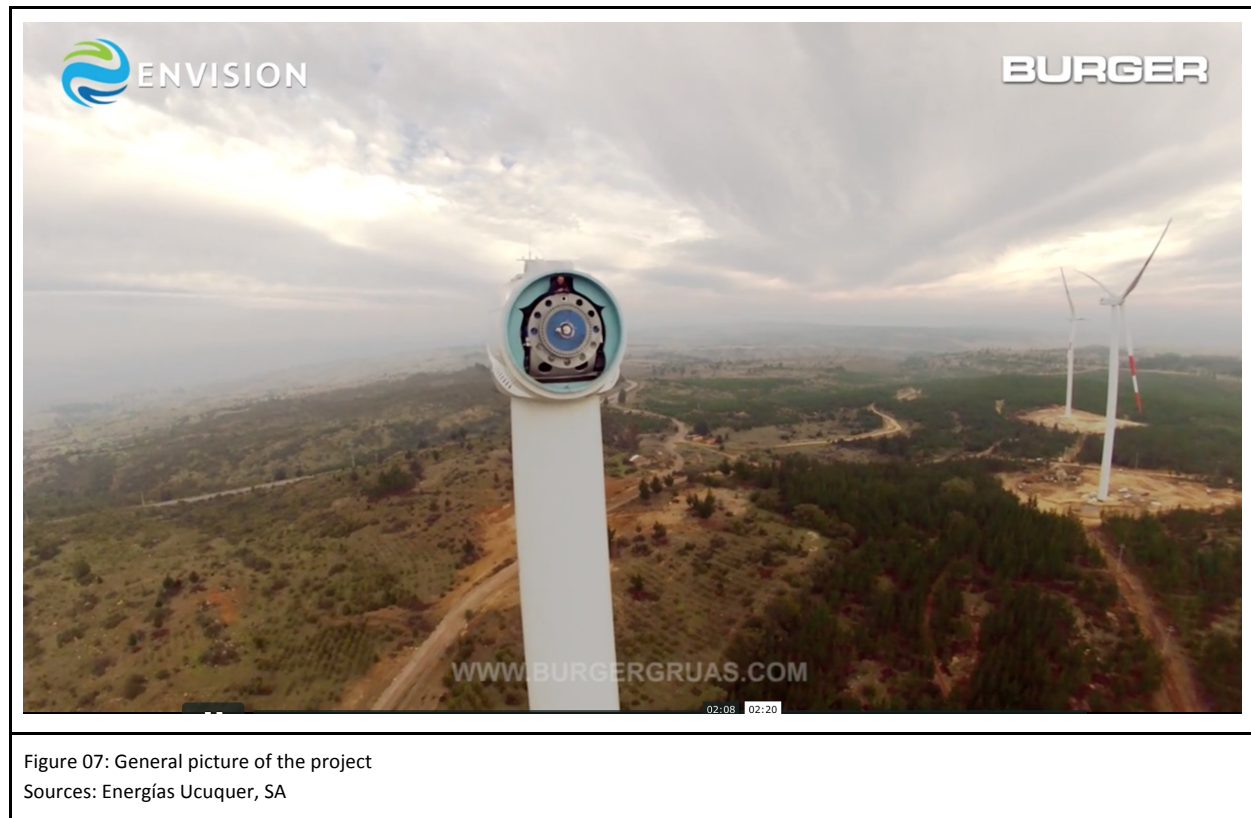




Figure 09: Access roads to Ucuquer Wind Farm

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011),9.

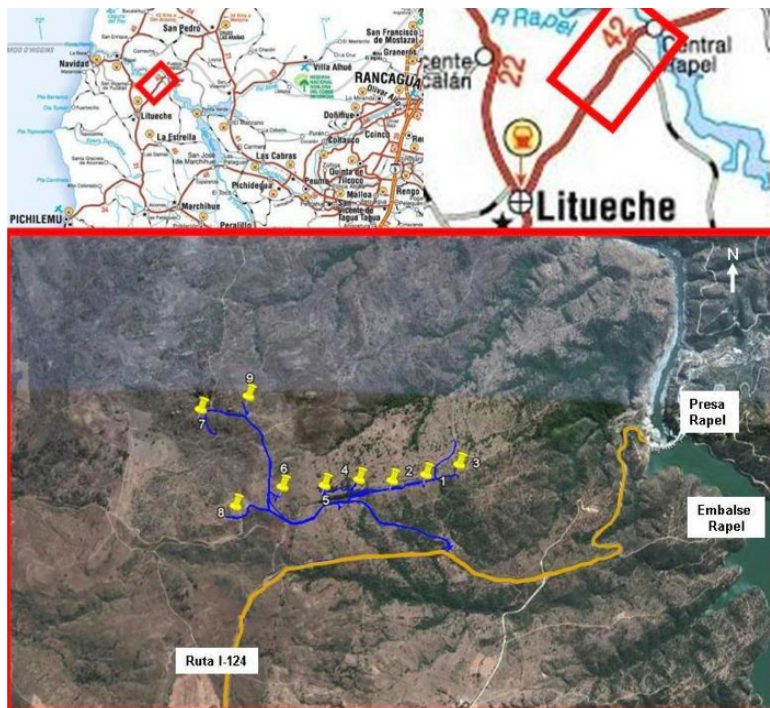


Figure 10: Access roads to Ucuquer Wind Farm

Sources : Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 4.



Figure 11: Access roads to Ucuquer Wind Farm

Sources : Donoso, Correa Gonzalo. *Estimación de Emisiones Atmosféricas*. (Chile, 2011), 3.

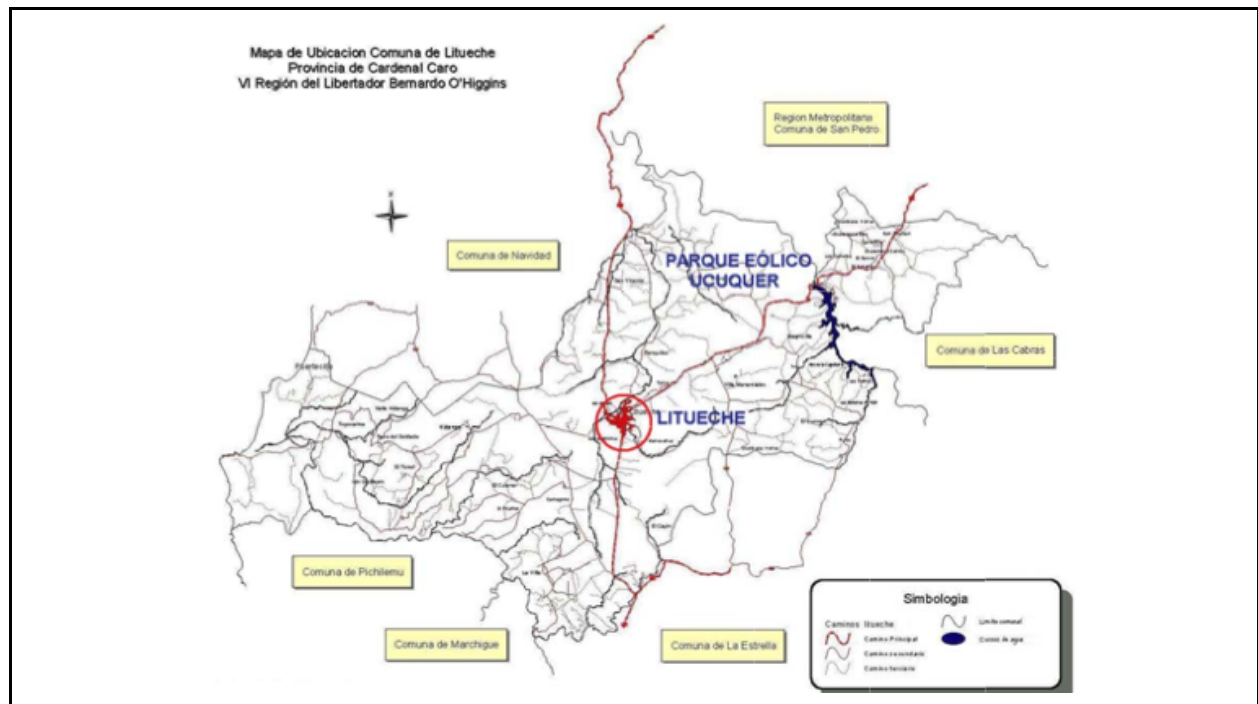


Figure 12: Regional map. Litueche Municipality.

Sources : Luis Ljubetic Villanueva, Energías Ucuquer S.A., “Declaración de Impacto Ambiental Parque Eólico Ucuquer,” Chile, 2011, 12.



Figure 13: Interior non-paved roads

Sources :Donoso, Correa Gonzalo. *Estimación de Emisiones Atmosféricas*. (Chile, 2011), 4.

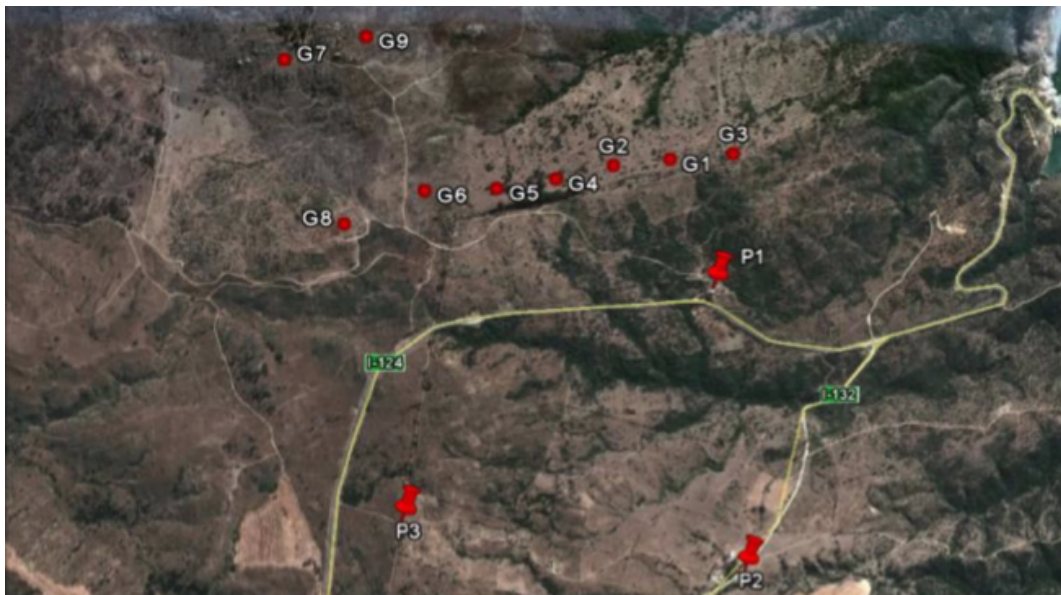


Figure 14: Location of wind generators

Sources: Acustec, Soluciones de Ingenieria a Problemas Acústicos. *Evaluación de Impacto Acústico. Proyecto Eólico, Ucuquer, Vestas, General Power*. (Santiago de Chile: 2011), 3.

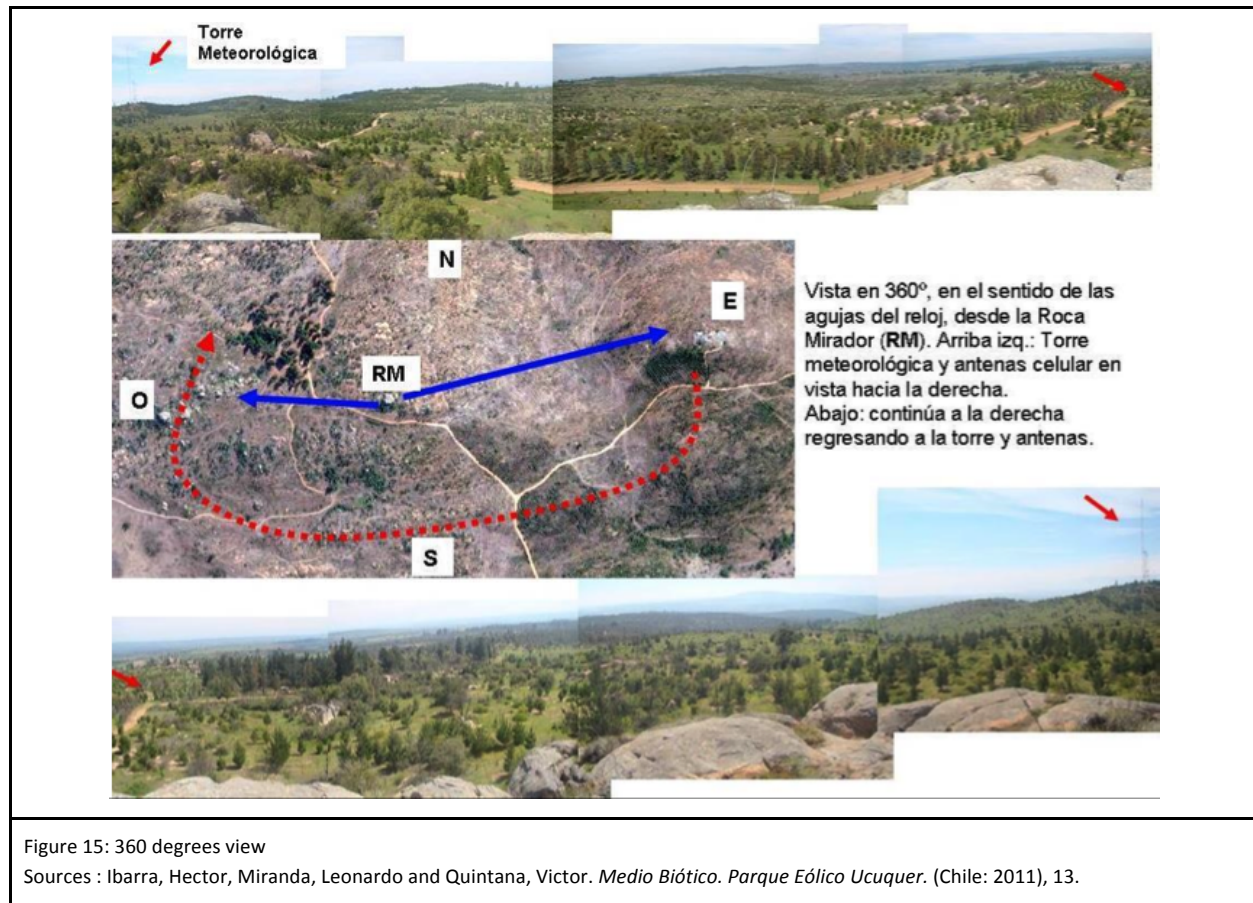




Figure 18: Bird sitting

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 10.

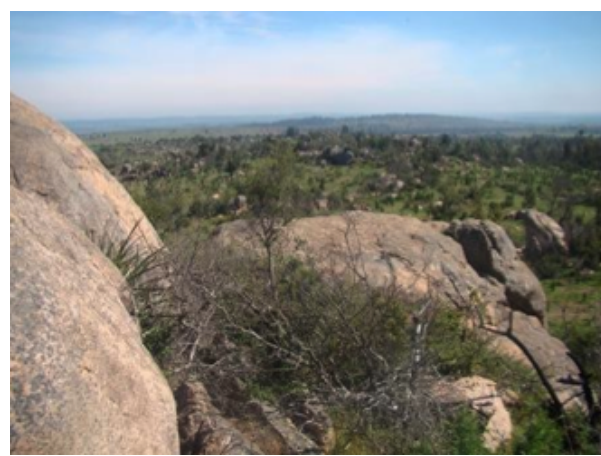


Figure 19: Micromammals

Sources : Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 10.

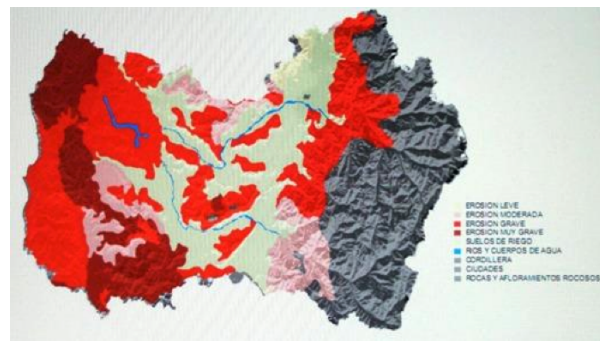


Figure 20: Erosion levels map

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 12.

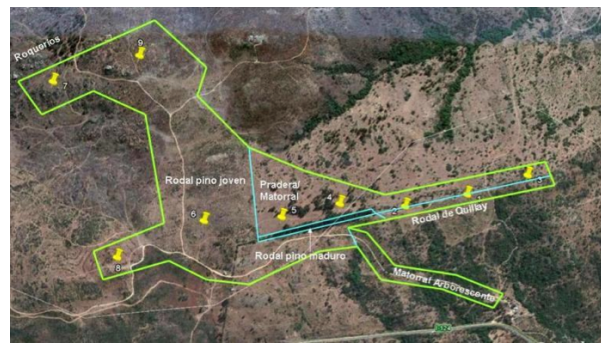


Figure 21: Vegetation units

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 16.



Figure 22: Arborescent shrub

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 17.



Figure 23: Prairie shrub

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. *Medio Biótico. Parque Eólico Ucuquer.* (Chile: 2011), 17.



Figure 24: Young pine

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 18.



Figure 25: Mature pine

Sources : Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 18.



Figure 26: Quilloi-quilloi (*Stellaria cuspidata*)

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 23.



Figure 27: Orchid (*Chloraea chrysantha*)

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 23.



Figure 28: Eagle (*Buteo polysoma*)

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 33.



Figure 29: Tenca (*Mimus thenca*)

Sources: Ibarra, Hector, Miranda, Leonardo and Quintana, Victor.
Medio Biótico. Parque Eólico Ucuquer. (Chile: 2011), 34.



Figure 30: Viewshed No. 2 at Litre Mocho

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 10.



Figure 31: Viewshed No. 3 at Rapel River and El Bolson Hill.

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 10.

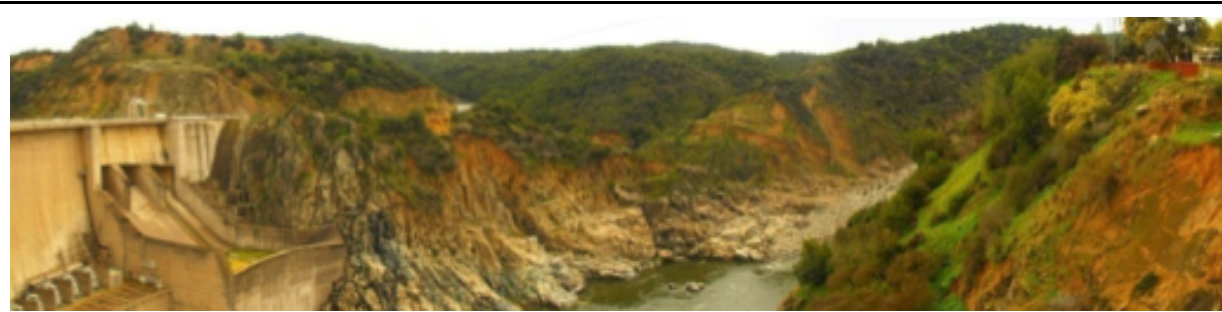


Figure 32: Viewshed No.3 at Rapel River

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 10.

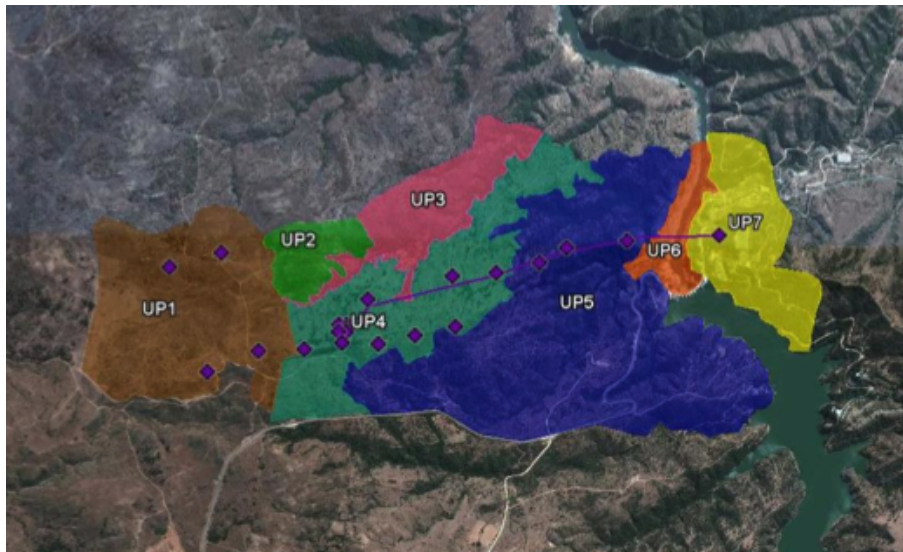


Figure 33: Landscape Units

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 12.



Figure 34: Rapel River

Sources : Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 12.



Figure 35: Rapel electric substation.

Sources: Tomé, Alvaro R. *Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.* (Chile: 2011), 18.

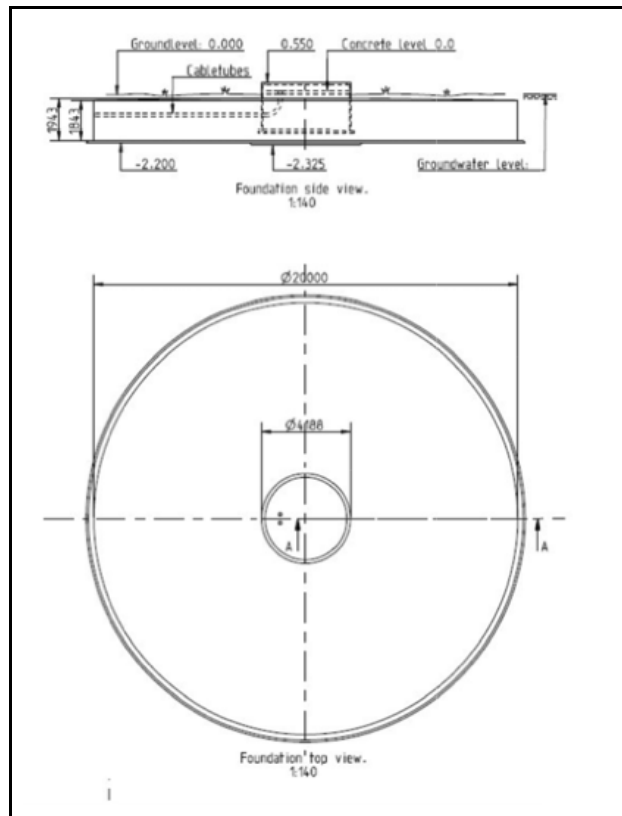


Figure 36: Wind generators

Sources: Ljubetic, Villanueva Luis, Energías Ucuquer S.A., *Declaración de Impacto Ambiental Parque Eólico Ucuquer* (Chile: 2011), 20.

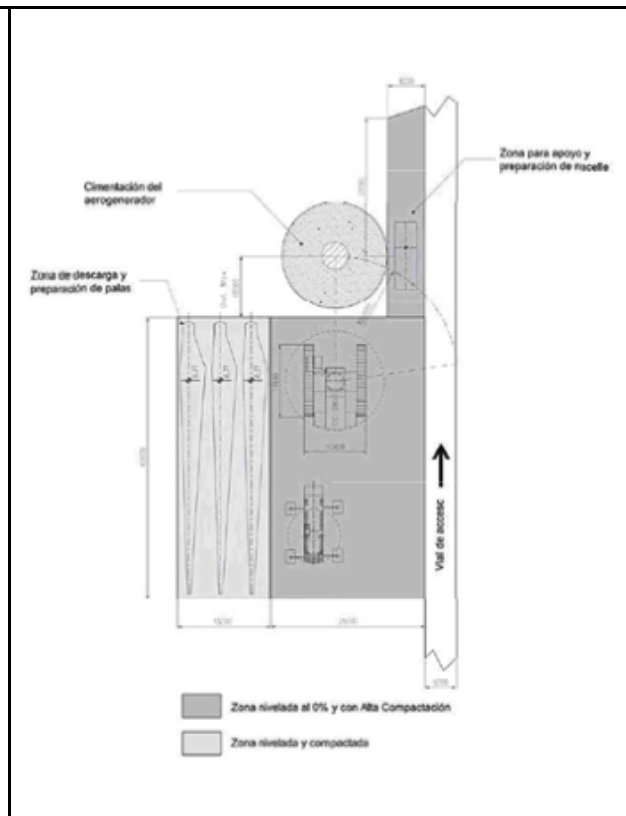


Figure 37: Platform

Sources: Ljubetic, Villanueva Luis, Energías Ucuquer S.A., *Declaración de Impacto Ambiental Parque Eólico Ucuquer* (Chile: 2011), 28.



Figure 38: Site excavation and construction

Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 39: Site excavation and construction

Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 40: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 41: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 42: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 43: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 44: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).



Figure 45: Site excavation and construction
Sources: Consultoría Víctor Lucero S.EIRL, *Estudios Patromoniales, Arqueológicos y Antropológicos*. (Chile: 2011).

APPENDIX B: ENVISION POINTS TABLE

ENVISION POINTS TABLE

		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE	
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
		QL3.2 Preserve views and local character	1	3	6	11	14
		QL3.3 Enhance public space	1	3	6	11	13
VULNERABLE GROUPS	QL4.1 Identify and address the needs of women and diverse communities *	1	2	3	4		
	QL4.2 Stimulate and promote women's economic empowerment	1	2	3	4		
	QL4.3 Improve access and mobility of women and diverse communities *	1	2	3	4	5	
	Maximum QL Points:					194**	
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
Maximum LD Points:					121*		
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
		RA2.3 Commission and monitor energy systems	—	3	—	11	
	WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
		RA3.2 Reduce potable water consumption	4	9	13	17	21
		RA3.3 Monitor water systems	1	3	6	11	
Maximum RA Points:					182*		

ENVISION POINTS TABLE

		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE	
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
Maximum NW Points:					203*		
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
	RESILIENCE	CR2.1 Assess climate threat	—	—	—	15	
		CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
		Maximum CR Points:					122*
Maximum TOTAL Points:					822*		

* Indigenous or afro-descendant peoples

** Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

* Indigenous or afro-descendant peoples

** Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

Figure 46: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.

Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX C: GRAPHS

UCUQUER WIND FARM (I AND II) PARQUE EÓLICO UCUQUER (I Y II)			IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
QUALITY OF LIFE CALIDAD DE VIDA	PURPOSE PROPÓSITO	QL1.1 Improve Community Quality of Life QL1.1 Mejorar la Calidad de Vida de la Comunidad					
		QL1.2 Stimulate Sustainable Growth & Development QL1.2 Estimular el desarrollo y el crecimiento sostenible					
		QL1.3 Develop Local Skills And Capabilities QL1.3 Desarrollar Capacidades y Habilidades Locales					
	COMMUNITY COMUNIDAD	QL2.1 Enhance Public Health And Safety QL2.1 Mejorar la Salud Pública y la Seguridad					
		QL2.2 Minimize Noise And Vibration QL2.2 Minimizar ruidos y vibraciones					
		QL2.3 Minimize Light Pollution QL2.3 Minimizar Contaminación Lumínica					
		QL2.4 Improve Community Mobility And Access QL2.4 Mejorar el acceso y la movilidad de la Comunidad					
		QL2.5 Encourage Alternative Modes of Transportation QL2.5 Fomentar modos alternativos de transporte					
		QL2.6 Improve Site Accessibility, Safety & Wayfinding QL2.6 Mejorar la accesibilidad, seguridad y señalización					
	WELLBEING BIENESTAR	QL3.1 Preserve Historic And Cultural Resources QL3.1 Preservar los recursos históricos y culturales					
		QL3.2 Preserve Views And Local Character QL3.2 Preservar las vistas y el carácter local					
		QL3.3 Enhance Public Space QL3.3 Mejorar el espacio público					
	VULNERABLE GROUPS GRUPOS VULNERABLES	QL4.1 Identify and address the needs of minorities QL4.1 Identificar y considerar las necesidades de minorías					
		QL4.2 Stimulate and promote women's empowerment QL4.2 Estimular y promover el empoderamiento femenino					
		QL4.3 Improve access and mobility of minorities QL4.3 Mejorar el acceso y movilidad de minorías					
	QL0.0 Innovate Or Exceed Credit Requirements QL0.0 Créditos innovadores o que exceden los requerimientos						

Figure 47: Quality of Life category_ Summary of results

UCUQUER WIND FARM (I AND II) PARQUE EÓLICO UCUQUER (I Y II)			IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
LEADERSHIP LIDERAZGO	COLLABORATION COLABORACIÓN	LD1.1 Provide Effective Leadership And Commitment LD1.1 Proporcionar compromiso y liderazgo efectivo					
		LD1.2 Establish A Sustainability Management System LD1.2 Establecer un sistema de gestión de la sostenibil-					
		LD1.3 Foster Collaboration And Teamwork LD1.3 Promover Colaboración y trabajo en equipo					
		LD1.4 Provide For Stakeholder Involvement LD1.4 Fomentar la participación de las partes interesadas					
	MANAGEMENT GESTIÓN	LD2.1 Pursue By-Product Synergy Opportunities LD2.1 Buscar oportunidades de sinergia derivada					
		LD2.2 Improve Infrastructure Integration LD2.2 Mejorar la integración de infraestructuras					
	PLANNING PLANIFICACIÓN	LD3.1 Plan For Long-Term Monitoring & Maintenance LD3.1 Planificar el monitoreo y mantenimiento a largo plazo					
		LD3.2 Address Conflicting Regulations & Policies LD3.2 Lidar con reglamentos y políticas en conflicto					
		LD3.3 Extend Useful Life LD3.3 Extender la vida útil					
		LD0.0 Innovate Or Exceed Credit Requirements LD0.0 Créditos innovadores o que exceden los requerimientos					

Figure 48: Leadership category_ Summary of results

UCUQUER WIND FARM (I AND II) PARQUE EÓLICO UCUQUER (I Y II)			IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
RESOURCE ALLOCATION ASIGNACIÓN DE RECURSOS	MATERIALS MATERIALES	RA1.1 Reduce Net Embodied Energy RA1.1 Reducir energía neta incorporada					
		RA1.2 Support Sustainable Procurement Practices RA1.2 Apoyar prácticas de adquisición sustentable					
		RA1.3 Used Recycled Materials RA1.3 Utilizar materiales reciclados					
		RA1.4 Use Regional Materials RA1.4 Utilizar materiales de la región					
		RA1.5 Divert Waste From Landfills RA1.5 Disminuir la disposición final en rellenos sanitarios					
		RA1.6 Reduce Excavated Materials Taken Off Site RA1.6 Reducir los materiales de excavación sacados del local del proyecto					
		RA1.7 Provide for Deconstruction & Recycling RA1.7 Prever condiciones para la remoción de la construcción y el reciclaje					
	ENERGY ENERGÍA	RA2.1 Reduce Energy Consumption RA2.1 Reducir el consumo de energía					
		RA2.2 Use Renewable Energy RA2.2 Usar energías renovables					
		RA2.3 Commission & Monitor Energy Systems RA2.3 Puesta en servicio y monitoreo de sistemas energéticos					
	WATER AGUA	RA3.1 Protect Fresh Water Availability RA3.1 Proteger la disponibilidad de agua dulce					
		RA3.2 Reduce Potable Water Consumption RA3.2 Reducir el consumo de agua potable					
		RA3.3 Monitor Water Systems RA3.3 Monitorear sistemas de provisión de agua					
	RA0.0 Innovate Or Exceed Credit Requirements RA0.0 Créditos innovadores o que exceden los requerimientos						

Figure 49:Resource Allocation category_ Summary of results

UCUQUER WIND FARM (I AND II) PARQUE EÓLICO UCUQUER (I Y II)			IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
NATURAL WORLD	SITING EMPLAZAMIENTO	NW1.1 Preserve Prime Habitat NW1.1 Preservar hábitats de alta calidad					
		NW1.2 Preserve Wetlands and Surface Water NW1.2 Preservar humedales y aguas superficiales					
		NW1.3 Preserve Prime Farmland NW1.3 Preservar tierras agrícolas de alta calidad					
		NW1.4 Avoid Adverse Geology NW1.4 Evitar zonas de geología adversa					
		NW1.5 Preserve Floodplain Functions NW1.5 Preservar funciones de llanura aluvial					
		NW1.6 Avoid Unsuitable Development on Steep Slopes NW1.6 Evitar la ocupación inadecuada en pendientes pronunciadas					
		NW1.7 Preserve Greenfields NW1.7 Preservar áreas sin ocupación					
	LAND + WATER IMPACTOS EN EL AGUA Y SUELO	NW2.1 Manage Stormwater NW2.1 Gestión de aguas pluviales					
		NW2.2 Reduce Pesticides and Fertilizer Impacts NW2.2 Reducir el impacto de fertilizantes y plaguicidas					
		NW2.3 Prevent Surface and Groundwater Contamination NW2.3 Prevenir la contaminación de aguas superficiales y profundas					
	BIODIVERSITY BIODIVERSIDAD	NW3.1 Preserve Species Biodiversity NW3.1 Preservar la biodiversidad					
		NW3.2 Control Invasive Species NW3.2 Control de especies invasivas					
		NW3.3 Restore Disturbed Soils NW3.3 Restaurar suelos alterados					
		NW3.4 Maintain Wetland and Surface Water Functions NW3.4 Preservar los humedales y las funciones de aguas superficiales					
		NW0.0 Innovate or Exceed Credit Requirements NW0.0 Créditos innovadores o que exceden los requerimientos					

Figure 50: Natural World category_ Summary of results

UCUQUER WIND FARM (I AND II) PARQUE EÓLICO UCUQUER (I Y II)			IMPROVED MEJORA	ENHANCED AUMENTA	SUPERIOR SUPERIOR	CONSERVING CONSERVA	RESTORATIVE RESTAURA
CLIMATE AND RISK CLIMA Y RIESGO	EMISSIONS EMISIONES	CR1.1 Reduce Greenhouse Gas Emissions CR1.1 Reducir las emisiones de Gases de Efecto Invernadero (GEI)					
		CR1.2 Reduce Air Pollutant Emissions CR1.2 Reducir las emisiones contaminantes del aire					
	RESILIENCE RESILIENCIA	CR2.1 Assess Climate Threat CR2.1 Evaluar amenazas relacionadas al Cambio Climático					
		CR2.2 Avoid Traps And Vulnerabilities CR2.2 Evitar situaciones de riesgo y vulnerabilidad					
		CR2.3 Prepare For Long-Term Adaptability CR2.3 Establecer estrategias de adaptación de largo plazo, frente al Cambio Climático					
		CR2.4 Prepare For Short-Term Hazards CR2.4 Preparación frente a riesgos de corto plazo					
		CR2.5 Manage Heat Island Effects CR2.5 Administrar el efecto Isla de Calor					
		CR0.0 Innovate Or Exceed Credit Requirements CR0.0 Créditos innovadores o que exceden los requerimientos					

Figure 51: Climate & Risk category_ Summary of results

UCUQUER WINF FARM (I AND II), CHILE			PT.	Performance	
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	0	No score
2			QL1.2 Stimulate Sustainable Growth & Development	1	Improved
3			QL1.3 Develop Local Skills And Capabilities	0	No score
4		COMMUNITY	QL2.1 Enhance Public Health And Safety	0	No score
5			QL2.2 Minimize Noise And Vibration	8	Conserving
6			QL2.3 Minimize Light Pollution	0	No score
7			QL2.4 Improve Community Mobility And Access	4	Enhanced
8			QL2.5 Encourage Alternative Modes of Transportation	0	No score
9			QL2.6 Improve Site Accessibility, Safety & Wayfinding	0	No score
10		WELLBEING	QL3.1 Preserve Historic And Cultural Resources	1	Improved
11			QL3.2 Preserve Views And Local Character	6	Superior
12			QL3.3 Enhance Public Space	0	No score
	VULNERABLE GROUPS	QL 4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	0	No score	
		QL4.2 Stimulate and promote women's economic empowerment	0	No score	
		QL4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	0	No score	
		QL0.0 Innovate Or Exceed Credit Requirements	0	0	
		QL	20		
UCUQUER WINF FARM (I AND II), CHILE			PT.	Performance	
13	LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership And Commitment	4	Enhanced
14			LD1.2 Establish A Sustainability Management System	0	No score
15			LD1.3 Foster Collaboration And Teamwork	0	No score
16			LD1.4 Provide For Stakeholder Involvement	0	No score
17		MNGMT.	LD2.1 Pursue By-Product Synergy Opportunities	0	No score
18			LD2.2 Improve Infrastructure Integration	1	Improved
19		PLANNING	LD3.1 Plan For Long-Term Monitoring & Maintenance	0	No score
20			LD3.2 Address Conflicting Regulations & Policies	0	No score
21			LD3.3 Extend Useful Life	3	Enhanced
		LD0.0 Innovate Or Exceed Credit Requirements	0	N/A	
		LD	8		
UCUQUER WINF FARM (I AND II), CHILE			PT.	Performance	
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce Net Embodied Energy	0	No score
23			RA1.2 Support Sustainable Procurement Practices	0	No score
24			RA1.3 Used Recycled Materials	0	No score
25			RA1.4 Use Regional Materials	3	Improved
26			RA1.5 Divert Waste From Landfills	3	Improved
27			RA1.6 Reduce Excavated Materials Taken Off Site	5	Superior
28			RA1.7 Provide for Deconstruction & Recycling	0	No score
29		ENERGY	RA2.1 Reduce Energy Consumption	0	No score
30			RA2.2 Reduce Pesticides and Fertilizer Impacts	20	Restorative
31			RA2.3 Commission & Monitor Energy Systems	11	Conserving
32		WATER	RA3.1 Protect Fresh Water Availability	0	No score
33			RA3.2 Reduce Potable Water Consumption	0	No score
34			RA3.3 Monitor Water Systems	0	No score
		RA0.0 Innovate Or Exceed Credit Requirements	0	N/A	
		RA	42		

		UCUQUER WINF FARM (I AND II), CHILE	PT.	Performance
35	NATURAL WORLD	NW1.1 Preserve Prime Habitat	9	Superior
36		NW1.2 Preserve Wetlands and Surface Water	1	Improved
37		NW1.3 Preserve Prime Farmland	0	No score
38		NW1.4 Avoid Adverse Geology	0	No score
39		NW1.5 Preserve Floodplain Functions	0	No score
40		NW1.6 Avoid Unsuitable Development on Steep Slopes	0	No score
41		NW1.7 Preserve Greenfields	0	No score
42		NW2.1 Manage Stormwater	0	No score
43		NW2.2 Reduce Pesticides and Fertilizer Impacts	0	No score
44		NW2.3 Prevent Surface and Groundwater Contamination	1	Improved
45		NW3.1 Preserve Species Biodiversity	2	Improved
46		NW3.2 Control Invasive Species	0	No score
47		NW3.3 Restore Disturbed Soils	8	Conserving
48		NW3.4 Maintain Wetland and Surface Water Functions	3	Improved
		NW0.0 Innovate or Exceed Credit Requirements	0	N/A
		NW	24	
		UCUQUER WINF FARM (I AND II), CHILE	PT.	Performance
49	CLIMATE	CR1.1 Reduce Greenhouse Gas Emissions	18	Conserving
50		CR1.2 Reduce Air Pollutant Emissions	0	No score
51		CR2.1 Assess Climate Threat	0	No score
52		CR2.2 Avoid Traps And Vulnerabilities	0	No score
53		CR2.3 Prepare For Long-Term Adaptability	0	No score
54		CR2.4 Prepare For Short-Term Hazards	0	No score
55		CR2.5 Manage Heat Island Effects	0	No score
		CR0.0 Innovate Or Exceed Credit Requirements	0	N/A
		CR	18	
		Total points	112	0

Figure 52: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX D: CREDIT DETAIL

CATEGORY I, PEOPLE AND LEADERSHIP		
SUB CATEGORY: QUALITY OF LIFE		
	Score	UCUQUER WIND FARM (I AND II), CHILE
QL1.1 Improve Community Quality of Life	0	No score
		The project is located in a rural area near the Central Rapel with no human settlements. The site comprises of 1,405 hectares in Matancilla town in the Litueche district in the VI Libertador General Bernardo O'Higgins Region in Chile. Because of its natural landscape, the project does not directly affect any community. However, the project team has not specified any type of community linkages with major stakeholders or government institutions that might be directly affect the project. The project team has not provided documentation regarding meetings with stakeholders.
		<p><u>Source:</u> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque eólico Ucuquer</i> (Chile: 2011), 16.</p> <p>RECOMMENDATIONS: Provide a list of documents and minutes with stakeholders, community leaders and main decision makers to support the process of the project. Although the project does not directly affect a community, its effect becomes relevant when analyzed in a regional scale. Evidence of the project process and evaluation of adjacent or nearby communities is recommended in order to obtain and identify any possible influence of this project in the area. Also, meetings with stakeholders for collecting and evaluating the project's future impact in the region is recommended in order to anticipate any disturbance.</p>
QL1.2 Stimulate Sustainable Growth & Development	1	Improved
		The project provides sustainable growth and development at the regional scale, feeding 50 GWh per year into Chile's main power grid (Sistema Interconectado Central). This represents an opportunity for Chile's clean energy growth. With an investment of US \$36 million the project provides 30 jobs during construction and during its operation. The generators will only utilize 4.3% of the surface area, therefore the project is compatible with the development of agricultural activities on site.
		<p>The Environmental Impact Declaration cites the possibility of agrarian or livestock uses of the site while the wind farm is in operation, being one of the greatest potentials of the project. No evidence of the creation of additional recreational or cultural capacity in this area due to this no investment has been provided.</p> <p><u>Source:</u> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque eólico Ucuquer</i> (Chile: 2011), 16.</p> <p>RECOMMENDATIONS: Although the project is located in a rural area with no human settlements, the project has the potential to incorporate more sustainable growth into its objectives. The project can bring economic activity to Central Rapel area, and investments into clean energy, however no documentation about this process has been developed. Although the project only contemplates the installation of nine wind generators, it has the potential of also improving infrastructure and connectivity in the region, thus being a catalyst for economic activity and other infrastructural investments. The project team has not provided any documentation regarding this topic.</p>
QL1.3 Develop Local Skills and	0	No score
		The project team has not provided documentation demonstrating how the project will

Capabilities		<p>contribute to local employment as well as training or education of workers and disadvantaged groups. The project does not show any involvement with training programs to reveal how these programs can enhance to the long-term competitiveness of the community.</p> <p><i>Source: N/A</i></p> <p>RECOMMENDATIONS: The project team has not identified workers' need for enhancing their skills and training. Although there are only 30 jobs created, it's important to recognize individual employee's requirements and skill level. Also, commitment to hiring local workers and including disadvantaged people in the employment process is necessary. This would have an impact on the region's productivity and educational level. The project also needs to create plans and document these initiatives. Another opportunity is to focus on the Communal Development Plan, which is the regional's most important planning instrument. It is relevant to explore community linkages regarding the region's urban development and its ecological capital.</p>
QL2.1 Enhance Public Health And Safety	0	<p>No score</p> <p>Besides regulations established under Chilean law, no specific documentation was submitted regarding worker's health and safety implications. The project team does not take into account risks and safety protocols associated with the use of new materials, new technologies, or new methodologies which present additional risk to workers. The project team introduced a special technology through low-speed turbines from China's leading company Envision Energy. Nonetheless, no specific risks associated with the use of this new technology have been identified.</p> <p><i>Source: N/A</i></p> <p>RECOMMENDATIONS: The project team should assess level of exposure to risk created by the application of new technologies and methodologies used in the project. It is recommended to report and document risks as well as safety protocols related to the new materials or equipment in order to reduce the worker's risk to both during and after construction. The team should also confirm the design in order to identify any possible features, which can create a better and safer work environment. Furthermore, they should make evidence of any safety protocols that were already put in place, and provide room for improvement with a detailed methodology and safety protocol that avoids negligible practices. If the project incorporates the use of a new technology, material or equipment, the correct guidelines to avoid negative effects should be provided.</p>
QL2.2 Minimize Noise And Vibration	8	<p>Conserving</p> <p>The project team developed acoustic studies during excavation, construction and operation phases. In all of them the project was qualified as successful as it does not exceed the established noise and vibration regulations. For the studies, the worst scenario was analyzed in relationship to the closest noise reception places. Under the first phase noise and vibration sources coming from the excavation, earth movement, trucks and other machinery were evaluated. For the construction phase, noise sources are associated to cranes and other machinery required for installing the wind generators. During the operation phase, noise projection scenarios were calculated having 9 wind generators functioning simultaneously. Over the three phases, the same methodology and regulations have been applied. The open-air noise regulation (ISO9613-2:1996 Acoustics—Attenuation of sound during propagation outdoors) where an specialized software was utilized for the purpose of these analysis. In all of three studies the project achieves successful noise levels. Since the project is located over a rural area with no human settlements, the project does not directly affects any nearby community as it is indicated in the graphics and data regarding noise can be found on the documentation submitted by the project's team.</p> <p><i>Source: Acustec, Soluciones de Ingenieria a Problemas Acústicos. Evaluación de Impacto Acústico. Proyecto Eólico, Ucuquer, Vestas, General Power. (Santiago de Chile: 2011).</i></p>

		<p>RECOMMENDATIONS: Provide credentials and qualifications of the persons responsible for conducting baseline studies and predictions. Develop noise and vibration monitoring proposals. Introduce into the project design noise and vibration mitigation schemes for reducing noise. It is recommended that proposals are comprehensive in terms of coverage and detail. Analyze if the reception areas that have been calculated correspond to any growing area. Although the area is rural, infrastructural projects might produce urban growth and some of the adjacent communities could be affected by noise at a long term. Provide documentation of such studies and revise the area of intervention in order to ensure the correct placement of all wind generators.</p>
QL2.3 Minimize Light Pollution	0	<p>No score</p> <p>The park has not incorporated any type of activity that requires lighting consumption since the part will be operated remotely and no workers will be on the site. Therefore no specific information was provided according to this topic.</p> <p><u>Source:</u> N/A</p> <p>RECOMMENDATIONS: As the project relates to the construction of clean energy, the park's lighting needs is advised to come from a renewable source. With a vast landscape, the project needs to document if it incorporates solar energy or if wind generators produce lightning, if used at all. The project also states the construction of new roads for connecting the project to its surrounding. It is recommended that the project specifies and develops lighting analysis not only in the park but also into the other roads that have been constructed. Also needed, provide an overall assessment of lightning needs and specify considerations of appropriate overall lightning zone levels. Delivery of plans, drawings and specifications showing the use of energy-efficient lightning as well as removal of existing but unnecessary lighting, use of automatic turnoff systems and application of non-lighting alternatives is required. If the project incorporates lighting components, it is recommended to design them in order to reduce or eliminate light spillage into sensitive environments, preserving the night sky.</p>
QL2.4 Improve Community Mobility And Access	4	<p>Enhanced</p> <p>The main access to the Ucuquer Wind Farm will be from the I-124 highway, which connects it to Litueche, Central Rapel before continuing by G-60 and G-78 to Santiago. The site location allows for taking advantage of the existing infrastructure without needing new works, thus shortening the dimension of distribution lines and attenuating environmental impacts and investment costs. Ucuquer Wind Farm (Phase I and II) is located alongside Rapel's Central Dam and benefits from the site's connectivity, as it is not necessary to intervene in other adjacent sites. Wind generators are distantly located from existing communities and towns, minimizing the impact to the landscape. In this regard, Ucuquer Wind Farm does not directly impact community mobility or access, as all construction works will be developed inside the site. All of the roads facilitate truck traffic for transporting supplies and machinery. These roads will also facilitate the park's operation, intervening as little as possible on the vegetated landscape.</p> <p><u>Source:</u> Acustec, Soluciones de Ingenieria a Problemas Acústicos. <i>Evaluación de Impacto Acústico. Proyecto Eólico, Ucuquer, Vestas, General Power.</i> (Santiago de Chile: 2011), 14</p> <p>RECOMMENDATIONS: The team should provide assessment studies addressing the effects of the constructed work on accessibility and mobility. The project is using existing infrastructure from Rapel's Da and therefore reducing investment in roads. For example, savings could be translated into incorporating alternate modes of transport where feasible. Plans should be developed, with specifications for reducing traffic disruption during construction, as regional road infrastructure will remain unchanged. The team should visualize if transportation infrastructure efficiency will require a long-term improvement, and if so, design components showing the extent to which long-term mobility and access needs and issues can be incorporated into the constructed work.</p>
QL2.5 Encourage Alternative Modes	0	<p>No score</p> <p>Ucuquer Wind Farm (Phases I and II) is located adjacent to Rapel's central dam, in a rural area</p>

of Transportation		<p>with no local inhabitants, and distant to any settlements. The project benefits from Rapel Dam's existing infrastructure, and only creates connectivity within the interior of the project site. The project provides minimal connectivity to the region, and does not encourage alternative modes of transportation since it is not located within walking distance of nearby communities. Under the completed project, there is no evidence that design facilitates access to multimodal transportation facilities. Although the project includes roads in the interior, it is not indicated if it also includes safe and convenient bicycle and pedestrian walkways, trails and networks. The project description does not include information about parking design, or if Ucuquer Wind Farm is configured and located strategically by encouraging users to use non-motorized transportation.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque eólico Ucuquer</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS:</i> Although Ucuquer Wind Farm is located on a rural area, the project has the potential to create mobility advantages for the region, such as in increasing walkability, the use of public transportation, and that of non-motorized transit. By solely utilizing existing infrastructure the project does not incorporate any studies related to alternative modes of transportation. Studies should be provided about the region's connectivity, documenting the state of roads, pathways, railways, and other specifications for upgrading the existing transportation infrastructure. At the interior of the project, pedestrian and bicycle pathways could be incorporated into the design, providing the potential to connect with forestry activities, agriculture, or livestock.</p>
QL2.6 Improve Site Accessibility, Safety & Way finding	0	<p>No score</p> <p>The project team has not provided information with regards it improving safety, accessibility, and way finding. The project's team description only includes information regarding the use of the existing infrastructure of the Rapel Dam located alongside the project's site. In the interior of the site, the project incorporates some roads for connecting the generators and the substation, however the documentation does not include detail about improving accessibility and safety within, and outside of the site.</p> <p><i>Source:</i> N/A</p> <p><i>RECOMMENDATIONS:</i> Clear, identifiable and intuitive design and signage for safe access and egress in and around the project should be integrated into the design schemes. The team should address safety and accessibility planning for effective emergency response. Accessibility and signage should be integrated in order to protect nearby sensitive sites and populated areas, and thus increasing neighborhood safety and security. Although the project is concentrated on construction within the site, the Ucuquer wind farm can help to enhance safety and way finding on the surroundings. As the area around Rapel's dam is rural, it's essential to specify how the project will impact public safety and security. If the project connects with the local community, the team should design documents and plan how the project can integrate all of the local environmental and cultural resources. Documents should be provided, demonstrating how the project has tackled these conditions by restoring safety and security in the region. As the project is bringing investment to the region, it's fundamental to develop a strategy to enhance the overall regional connectivity and accessibility, coupled with other transit interventions.</p>
QL3.1 Preserve	1	Improved

Historic and Cultural Resources		<p>The implementation of public and private investment works inhibits unavoidable interference on cultural heritage and archeological sites. In Chile, these are not ruins, but rather structures and materials located above or beneath the ground with cultural and scientific value. The Chilean law ensures the safeguarding of cultural and natural heritage, including three laws that govern the study. The project follows law Nº 17.288 about national monuments, which regulates cultural heritage. According to this law, national monuments are under custody and protection of the state. Under the articles 11 and 12, national monuments are under control and supervision of the National Monuments Council rather than public or private property.</p> <p>The sixth region Libertador General Bernardo O'Higgins corresponds to an archeological area called Central Chile, where human settlements have been documented since the end of the Pleistocene (c.a. 12.000 AP, en San Vicente de Tagua-Tagua, p.e. Montané 1968). As the area potentially withholds cultural and natural heritage, the project team developed various explorative investigations. Complete studies were realized over the site selected for the wind farm. Inspections on vast areas of vegetation were developed along a detailed archaeological inspection of the area. The works comprise of the areas in the aero generator, electric lines, paths, electric substation and transmission line. The site has 1,405 Ha in total but only 60 Ha is relative to the area of intervention, located at the site of intervention. No historical, cultural or prehistoric archaeological evidence was found.</p> <p>Most of Ucuquer's wind farm is located on a high altitude, clear of vegetation. The subsoil consists of granite metamorphic rock, which makes an unsuitable site for human settlement in addition to the lack of water resource.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Anexo F. Estudio Arqueológico, Declaración de Impacto Ambiental</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS:</i> Located on a cultural heritage site of the sixth region, the wind farm has the potential to recover the region's history. Although the site does not account to any historical heritage, the project is an opportunity to understand community needs and preservation opportunities. Providing reports, memoranda, and minutes of meetings with the archeologist and other experts is necessary. Documentation of efforts that enhance and restore cultural resources and communicate those with adjacent communities for informing them about regional value is also necessary. Communication of the findings with other stakeholders interested in developing other similar projects on this region need work, as lessons learned can be shared to preserve and restore the region's cultural and historical heritage.</p>
QL3.2 Preserve Views and Local	6	<p>Superior</p> <p>The regional landscape corresponds to a mosaic dominated by hills belonging to the coastal</p>

Character		<p>range with various ravines. The Rapel River and its hydroelectric dam stand in this landscape. The Loma pelada and Loma el Bolson located near the Rapel River includes it's lake, estuaries, and small ravines. Forestry and agriculture are common, regional activities. Observation points are defined based on points of physical and visual connectivity in the territory. Important landscape elements and activities were categorized according to: scenic areas, visual landmarks, vegetal surface, wildlife, water bodies, human interventions and areas of historical interest. These supported the studies for defining landscape units that include: landscape morphology, vegetation, wildlife, water, anthropic activities, scenic view shed, uniqueness or rarity.</p> <p>Landscape evaluation presented 7 landscape units divided into 4 types, described as follows. First, all of the units presented medium values except for unit 6, which renders high fragility levels, containing a low capacity to absorb impacts from a future project into its landscape. Second, Landscape unit 5 is classified as type 2, vulnerable. Its landscape use is restricted to low-impact projects or to those projects that enhance landscape value. Third, landscape units 3, 4, 6 and 7 qualified as type 3, which can be incorporated into the previous category when any of the elements require individual protection. Those units don't accept high-impact effects over its landscape. Lastly, landscape units 1 and 2 have been classified as type 4, with a lower restriction level, allowing a higher degree of activity.</p> <p>The results indicate that the project will be built on areas that are visible to trajectories from the route I-128. The impact is seen as minimal when analyzed relationship to the site's total area.</p> <p><i>Source: Ljubetic, Villanueva Luis, "Anexo G. Informe de Paisaje," Declaración de Impacto Ambiental. (Chile. Agosto 2011.)</i></p> <p><i>RECOMMENDATIONS: Provide an inventory of all natural landscape features and views to be protected. Create a plan for addressing public views in the project design. Plans include identifying location of areas in need of protection, identifying compatible land use, setting up development standards, and establishing policies for inappropriate development and land use. Design guidelines include preserving specific views and other important landscape features of the area. Including all landscape recommendations into clauses for preservation of high-value landscapes and other important landscape features is important. The region has a great scenic value, as it is located near Rapel River and the Coastal Range. Document and create programs for monitoring and enhancing such views. Report all efforts that help local communities develop comprehensive policies and regulations that capture views and landscape of local character.</i></p>
QL3.3 Enhance Public Space	0	<p>No score</p> <p>The project is located on a rural area near Rapel River and a hydroelectric plant - with no human settlements. Given the nature of the project Ucuquer wind farm (Phase I and II), it does not include any type of public space into the project. The project design consisted of placement and installation of 9 wind generators, an electric substation, and a transmission line. In addition, roads were designed in the interior of the site to connect and facilitate construction and operative works. With these plans, no public space was designed, as the main goal of this project is to create and inject renewable energy into Chile's grid.</p> <p><i>Source: N/A</i></p> <p><i>RECOMMENDATIONS: As other activities such as forestry, agriculture or animal husbandry may be allocated into the project's site, the wind farm could also integrate public space for recreational facilities or wildlife refuge. All of these spaces could be designed altogether with mobility strategies focusing on local development. Although the project is located in a rural area, it has the potential to regenerate the landscape, supporting its cultural and natural value. The wind farm could potentially be used as a park with a defined ecological function that makes use of the scenic views of the area. Development of plans and drawings showing the scope and extent of any landscape restoration and other efforts made on public space is recommended. Creating a report documenting benefits, improvements and impacts of the project is necessary. Also consider incorporating studies about public health risks and safety in the open space design.</i></p>
QL 4.1- Identify and address the needs		<p>No score</p> <p>This credit evaluates the degree, to which the project has taken into account the needs of</p>

of women and diverse communities (indigenous or afro-descendant peoples)	0	women and diverse communities. The project team has not delivered information regarding this topic. The project is located on a rural area with no settlements.
		<i>Source: N/A</i>
		<i>RECOMMENDATIONS: It is suggested to investigate the nearby communities in order to identify if any indigenous or diverse community exists. Demographic analysis to determine the percentage of women population and their needs is necessary. Design initiatives would enable women and diverse communities to benefit from the project. Integration of such activities into the project's plan to create long-term sustainable goals that complement the main objective is necessary.</i>
QL4.2 - Stimulate and promote women's economic empowerment	0	No score
		There is no significant evidence that the project contributes to the increase of economic opportunities for women. The project team has not deliver information regarding this topic.
		<i>Source: N/A</i> <i>RECOMMENDATIONS: The project has the potential of incorporating other activities such as forestry, agriculture, and animal husbandry. If these activities are developed, they could stimulate and promote women's economic empowerment. It is recommended to analyze not only demographic analysis, but to define other areas of opportunity where economic development can be integrated into the project. This would give social and economical dimension to the project. These activities can support the project in the long term and lead to other activities after the wind generators are dismantled.</i>
QL4.3 - Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	0	No score
		The Ucuquer Wind Farm does not directly impact the community mobility and access of women and diverse communities because all construction works are to be developed inside the site. All roads facilitate trucks transporting supplies and machinery. These roads will also facilitate the park's operation, intervening as little as possible on the vegetated landscape. However, all plans for accessibility and mobility have been designed with the purpose of executing the project and do not have an impact outside of the scope of the project. It has also been designed to enhance efficiency during construction and operation; it has not taken into account access and mobility of women and diverse communities. The site's location allows the use of existing infrastructure located at Rapel's Dam to benefit from the site's connectivity, as it is not necessary to intervene with other adjacent sites. The Ucuquer wind farm's location is strategic to shorten the distribution lines and to attenuate environmental impact and other costs; nonetheless it does not integrate or enhance sustainable integrated mobility strategies for the region.
		<i>Source: N/A</i> <i>RECOMMENDATIONS: The Ucuquer wind farm utilizes the existing road infrastructure from Rapel's Central Dam to minimize its impact. However, it is recommended to analyze how the project can incorporate and enhance alternative modes of transportation and non-motorized transit. The project can become useful for the overall population of the VI region; it can generate mobility alternatives especially for women and diverse communities, which usually lack of mobility infrastructure. As roads are only built at the interior of the project, integration of pedestrian and bicycle pathways and other economic activities for women empowerment is necessary. These strategies can help the area and bring added value to the project and adjacent communities.</i>
QL0.0 Innovate Or Exceed Credit Requirements		
20		

SUB CATEGORY:LEADERSHIP		
	Score	UCUQUER WIND FARM (I AND II), CHILE
LD1.1 Provide Effective Leadership And Commitment	4	Enhanced
		<p>Ucuquer energy is a Chilean enterprise constituted by Chilean investment. It was developed with the intention of enabling economic development by energy diversification. Ucuquer energy is committed to sustainability objectives. The mission of the company is to promote small-scale renewable and non-conventional energy projects. Since 2009, one of those objectives has been realized through the Ucuquer wind farm, located near Rapel River and its hydroelectric plant.</p> <p>Ucuquer Energy is a groundbreaking company, being one of the first to implement non-conventional renewable energy projects in Chile. The project team excels on visualizing and analyzing the site's energy potential, through technological development and other strategic economic alliances. The project meets the categories established by the Kyoto protocol and minimizes the effect of greenhouse-emissions-generated wind energy. The Ucuquer team excelled on installing ultra-low wind speed turbines (2.1MW, 100m HH and 110m rotor, highest and largest in the country), manufactured and operated by Envision Energy, China's leading privately owned wind turbine manufacturer.</p> <p>The project team integrates the project into the 5% requirement of renewable and non-conventional energy demands. The project team also incorporated and leaded certifications on emissions reduction.</p> <p>The project's main objective was accomplished by incorporating energy into the Central Interconnected System by the production of nine wind generators. The project's implementation leads the diversification of energy sources by strengthening the market of renewable non-conventional energy projects not yet developed in Chile. The project was commissioned and developed on a time record, leveraging economies of scale and efficiencies in logistics in China complemented by equipment and talent from Chile, Brazil, Spain and Costa Rica, as well as state-of-the-art monitoring control and systems on the cloud.</p>
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque eólico Ucuquer (Chile: 2011).</i>
		<i>RECOMMENDATIONS: Documentation of public leadership statements in Ucuquer's Energy, regarding their commitment to principles of sustainability is recommended. Develop a written statement, by which the project leader and project team address economic, environmental and social aspect of the project at each stage. The project needs to provide examples of the company's published sustainability reports, organizational principles and policies regarding sustainability. Document all examples of past and ongoing efforts and significant actions taken to improve sustainable performance. Ucuquer wind farm and its project leaders have the potential to create an exemplary project where all sustainability goals are addressed. The wind farm has the potential to integrate and enhance long-term sustainability for Chile's VI Region. Presenting evidence and commitment on this matter can support effort made to accomplish the mission of the project.</i>
LD1.2 Establish	0	No score

A Sustainability Management System		<p>The project team has not documented specific mechanisms or business processes that have managed the project's sustainability issues, impacts and opportunities. The Ucuquer wind farm team has implemented various sustainability actions, yet have not provided any specific information. The project team has excelled on taking forward the site's energy potential, including all technological development and strategic economic alliances. However, the project roles, responsibilities and authorities addressing these aspects have not been clearly stated and documented. More information on organizational charts and documentation showing leaders and assigned responsibilities is required to analyze the efficiency of decision-making processes.</p> <p><i>Source: N/A</i></p> <p><i>RECOMMENDATIONS: Deliver information about the project's management system in order to analyze how the project accomplished sustainable development goals. The project team excelled on leading the construction and operation of the wind farm. However, no documentation informs how decision-making processes take form. It is essential to understand if the project team has created a sustainability management policy and the project's degree of completeness on its sustainability management policies. It is recommended to provide documentation on how the project team assess and prioritize the environmental, economic and social aspects of the project and if sustainability goals, objectives and targets were appropriate to the nearby communities. The project can incorporate more studies on community needs and issues aligned to the project's objective.</i></p> <p><i>Ucuquer wind farm has made several contributions and innovations in renewable and non-conventional energy. However the team has not provided enough evidence containing what mechanisms and business processes were used for managing the project and achieve the project's objectives. Documentation that shows the broad and robust business process and management controls is necessary. All of this information will reinforce management and implementation of frameworks for other sustainable projects in the area.</i></p>
LD1.3 Foster Collaboration And Teamwork	0	<p>No score</p> <p>The project team has not provided particular information about processes or methodologies for incorporating sustainability issues into its design. Although the Ucuquer wind farm was a collaborative effort under Ucuquer Energy enterprise, team and leadership efforts have not been documented as part of the overall process.</p> <p><i>Source: N/A</i></p> <p><i>RECOMMENDATIONS: Teamwork is essential for accomplishing sustainability goals. The Ucuquer wind farm team has not provided information on the team members' primary objective, or early communication between the parties involved in the project. It is recommended to document and deliver information on the project's process recognizing the importance of collaborative teamwork in the project delivery method mechanism. Documentation of all multidisciplinary efforts and the project team's business process and management controls is necessary in form of procedures, flowcharts, checklists, and other documented control measures. Documentation and identification of opportunities for improving sustainable performance and reducing design conflicts is necessary. Create guidelines to optimize the project's process and performance to implement risk and reward sharing among the parts. The Ucuquer wind farm is an excellent opportunity for advancing and developing exemplary frameworks that could be apply to similar projects in the</i></p>

		region.
LD1.4 Provide For Stakeholder Involvement	0	No score
		The project team has not documented stakeholder communication and information transfer between the stakeholders and the community. There is not sufficient information to document this credit.
		<i>Source: N/A</i>
		<i>RECOMMENDATIONS: This credit evaluates the sufficiency of the public input process established by the owner and the project team. The relationship among the public and key stakeholders is an important component of the engagement process. Provide the scope and extent to which stakeholders have been involved in the project. Develop information exchange shifts to active stakeholder engagement dialogues; enhance community involvement and transparency in project decisions. Create established lines of communication and plan a process for having feedback from the community. Generate a list of key stakeholder groups identified. Assess the stakeholder issues and concerns through meetings and information exchanges. Document them with letters, memoranda, notes and minutes. Create policies and business practices that ensure fair and equitable assessment and action. Report the input provided by the stakeholders and how they influenced decision-making. Establish stakeholder participation and communication programs for facilitating stakeholder participation and feedback. Document a planned or operating stakeholder involvement program.</i>
LD2.1 Pursue By-Product Synergy Opportunities	0	No score
		This credit measures the extent to which the project team has identified material needs for the construction and has established partnerships with facilities nearby to acquire unwanted materials used to reduce the amount of raw materials required on-site. The most relevant action related to synergy opportunity was the disposition of excavation material at a temporary storage field, which was utilized for filling in wind turbine foundations and land leveling. Yet this cannot be considered as a by-product reused on the site because it is owned by the project and quantify as a different project.
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico Ucuquer (Chile: 2011), 43 – 44.</i>
		<i>RECOMMENDATIONS: The project team had identified possibilities for creating by-product synergy opportunities, though those initiatives leave room for further enhancement. More systematic efforts to identify unwanted materials that could be used on the project needs to be implemented. It is recommended to identify unwanted by-products or discarded materials located in nearby facilities, and to develop a detailed assessment of the potential use of by-product materials on the project - either for design, construction or operation phase. Report the scope and details of how the process was assessed and which assessments were made. Provide</i>

		<p>records of by-products synergy opportunities, as well as how they were identified and pursued. These programs could lead to and connect with a larger regional perspective of by-product synergies.</p>
LD2.2 Improve Infrastructure Integration	1	<p>Improved</p> <p>Ucuquer wind farm (Phase 1 and 2) has considered operational relationships among other infrastructural elements. The most important interaction is related to its close proximity to the Rapel River and it's hydroelectric plant. Taking advantage of the already constructed and optimized infrastructure, the project team foresaw cost minimization and infrastructural investment by increasing the use of the transport infrastructure around the site. The project has also taken into consideration the protection of the natural landscape, as only a small percentage of the site has been altered and constructed. The wind farm renders the possibility to coordinate and create other uses for the area. For example, forestry or agriculture could have a strong impact on the community's infrastructure, improving the efficiency and effectiveness of the intervention. Ucuquer wind farm utilizes the triple bottom line, including resource conservation, use and production of renewable resources and the protection of environmental, economic and social systems. However, little exploration was made for creating synergies in and around the project context.</p> <p><i>Source:</i> Ljubetic, Villanueva, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p>RECOMMENDATIONS: <i>This credit evaluates whether the project took operational relationships into account, among other elements of community infrastructure that result in an overall improvement of infrastructural efficiency and effectiveness. It is necessary to develop design documents that show what advances were made, and the degree to which the advances were integrated to the regional infrastructure. Specify whether the project team sought to restore existing community infrastructure assets with intentions of enhancing a higher performance. If the project aims to restore present infrastructure in short or long-term, present plans and documents need to show the transformation of these elements over time. Large-scale investments in projects like the Ucuquer wind farm have the potential to restore and activate community assets. Although the project is located at a rural area remotely located from human settlements, the wind farm could become a catalyzer for other projects to invest and promote integrated infrastructure.</i></p>
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LD3.1 Plan For Long-Term Monitoring & Maintenance	0	<p>No score</p> <p>The project team has not specified plans and sufficient resources for ensuring maintenance and monitoring activities. Although the Ucuquer wind farm will have a lifespan of 30 years, no specific maintenance plans exist in order to guarantee the project's performance.</p> <p><i>Source:</i> N/A</p>

		<p>RECOMMENDATIONS: Monitoring and maintenance are essential procedures that guarantee the project's success. Prepare and document a clear and comprehensive plan for long-term monitoring and maintenance of the project. Develop a complete plan to guarantee the correct performance and operation of the wind farm. Monitoring and maintenance plans must include assessments that verify that the completed project functions as a design, and that the environmental impacts are within designed parameters. Verify that sufficient resources are allocated for monitoring and maintenance. Specify a personnel who leads efforts, or an organization that monitors and realizes maintenance works. Provide details about how funding will be allocated as well as records that show how fund levels are sufficient for monitoring and maintenance.</p>
LD3.2 Address Conflicting Regulations & Policies	0	<p>No score</p> <p>Under Ucuquer's wind farm documentation, no conflicting regulation or policy has been addressed. Laws, regulations, policies, or standards of practice affecting the project are taken as "given," regardless of their intended purpose or compatibility to sustainability goals and objectives. No documentation was found if the project assessed any of the regulations that interfere with the project's objectives of implementing sustainability. The project is developed according to policies, plans, and programs of regional and district development, supported by: the Regional Development Strategy of Libertador Bernardo O'Higgins Region, Regional Environmental Policy, Regional Strategy for Biodiversity Conservation or Plan O'Higgins. The project reinforces and enhances existing sustainable policies, instead of contesting any of the existing ones.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011), 81</p> <p>RECOMMENDATIONS: Changing laws and regulations that restrict sustainable practices can be challenging. This credit evaluates if the project team worked with officials to identify and address regulations or policies that inhibit the application of sustainable infrastructure. Find applicable laws, standards, regulations and policies that unintentionally run counter to sustainability objectives. Document all procedures that assess sustainability performance. Collaborate on identifying what policies have negative effect, and develop a strategy that mitigates such results. Create an archive of all minutes and reports about regulatory agencies to identify and allay existing conflicts.</p>
LD3.3 Extend Useful Life	3	<p>Enhanced</p> <p>Ucuquer's wind farm (Phase 1 and 2) has expanded its usual lifespan of 20 years to 30 years. Implementation of ultra-low wind speed turbines (2.1MW, 100m HH and 110m rotor, highest and largest in the country) has made possible such efforts. The turbines were manufactured and operated by Envision Energy, China's leading privately owned wind turbine manufacturer.</p> <p>The project also has various possibilities of merging diverse uses, like forestry, agriculture or animal husbandry, which may support the project when it reaches to its full capacity. The project team has not provided information on future plans. The project team needs to provide whether they intend to prolong the life of the project and how that process would take place.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p>

		<p><i>RECOMMENDATIONS: Ucuquer wind farm has the potential to incorporate other uses such as forestry, agriculture or animal husbandry for supporting and expanding the lifespan of the project. Document how these elements or activities intend to add durability and flexibility to the design. Document and show the specification of durable materials and how main elements are placed into construction contracts, as well as operations and maintenance procedures. Specify to what extend the project team considered the ability for future expansion or reconfiguration. Conduct feasibility studies to determine areas of potential long-term cost savings in regard to future expansions, reconfigurations and durability. Identify key areas where increasing investment in extending useful life could benefit the project. Analyze if the wind farm could allocate other activities or uses besides agriculture or forestry that might increase the value as well as expand the project's lifecycle. Such activities can contribute to monitoring and maintenance, as well as supporting the long-term future Ucuquer wind farm.</i></p>
LD0.0 Innovate Or Exceed Credit Requirements		N/A
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CATEGORY II: CLIMATE AND ENVIRONMENT		
RESOURCE ALLOCATION		
	Score	UCUQUER WIND FARM (I AND II), CHILE
RA1.1 Reduce Net Embodied Energy	0	No score
		Embodied energy is defined as the sum of energy used in the production of a material or product, including raw material extraction, transport, manufacture, and all those undertaken through completion. The 9 turbines that have been installed come from China, involving a vast amount of embodied energy that has not been calculated. On the other hand, the rest of the materials – concrete and steel mainly- come from local sources, which minimize the amount of energy produced. However, the project team has not developed or submitted a life-cycle analysis (measurement of the environmental impacts associated with all the stages of a product's life from raw material extraction through disposal or recycling).
		<i>Source: N/A</i>
		<i>RECOMMENDATIONS: It is recommended to develop a life-cycle analysis for the project, as large amounts of energy are associated with extraction, processing, manufacturing, and transport of materials and components. These studies go through not only reduction of initial net embodied energy, but also maintenance and repair, consuming large amounts of material over periods of time. Wind farms require an immense effort of technological advancement, which not produced in Chile at this point. However, it is important to question and calculate all the net-embodied energy required for the implementation of this project. Calculations showing the overall reduction of embodied energy would inform material selection. On the other hand, the utilization of other local materials such as concrete and steel provide great opportunity to minimize the overall net-embodied energy. For advancement, the project team must improve efforts on increasing reductions in net embodied energy compared to industry and government norms.</i>
RA1.2 Support Sustainable Procurement Practices	0	No score
		The project team has not provided information regarding this credit. Envision, a Chinese company that manufactures and assembles the turbines, did not provide information on their sustainable practices. No other manufacturer provided information according to their internal sustainability procedures or on the percentage of materials coming from sustainable practices. However, all other materials – mainly concrete and steel- come from local sources
		<i>Source: N/A</i>
		<i>RECOMMENDATIONS: This credit analyses materials and equipment, which come from manufacturers and suppliers who implement sustainable practices. Project teams are recommended to give preference to suppliers, who have taken into account the environmental, economic, and social impacts of their products and have active programs for performance improvement in place. For advancing this category, the project needs to create and demonstrate evidence of a sustainable procurement program consisting of policies and criteria for supplier identification and selection. Increasing the amount of low-impact materials specified and the use of suppliers with sustainable policies and practices is also necessary. As one of Chile's pioneering projects,, this project could set up standards for future projects. It is important not only to analyze best technology or materials available, but also to include some sustainable standards and practices. Requesting evidence from manufacturers or suppliers to demonstrate that sustainable practices are used for percentage of purchased products is necessary.</i>

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RA1.3 Used Recycled Materials	0	No score
		No complete information has been provided regarding this credit. The project's materials come from three sources 1) Materials located on site, such as earth and gravel, 2) Concrete and steel for roads and foundations from regional sources such as Melipilla, a nearby town, and 3) Wind generators imported from China. No information on material providers has been documented. The project team has only provided documentation about the reuse of materials coming from excavated sites, where wind generator foundations are laid. The project does not include vast transformations of the natural landscape; it only intervenes where turbines and roads are needed. The project design helps minimize the use of materials in general and extends the reuse of materials located on site whenever possible. No further information has been provided regarding other materials such as the components of concrete and steel.
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico Ucuquer (Chile: 2011), 81.</i>
		<i>RECOMMENDATIONS: The purpose of this credit is to reduce the use of virgin materials and avoid sending useful materials to landfills. It is recommended to expand the use of recycled, reused and renewable materials and products, including existing structures and materials on site. Using these materials also reduces waste and promotes recycling and reusing practices. It is recommended to ask the materials supplier for the product's specifications. It could be possible that a percentage of the concrete's or steel's composition comes from recycled materials. This credit evaluates the degree of use of recycled materials. It is suggested to enhance and improve efforts to specify reclaimed and recycled materials and structures to increase their total percentage within the project. The project team has calculated greenhouse emissions in order to minimize them. It is recommended to expand this effort under life-cycle analysis and material specifications as these aspects also contribute to the project's energy and emissions reduction. Create an inventory of existing materials or structures that may have reuse potential. Identify which structures have more potential for using more recycled or reused materials. For example, over the concrete and steel required for roads and foundations for wind generators. Documentation is needed where materials meet the necessary quality and performance criteria. Development is needed where calculations of percentage of total project materials by weight or volume are reused or recycled. Mechanical, electrical, water equipment and their components may be excluded from the calculations.</i>
RA1.4 Use Regional Materials	3	Improved
		Ucuquer Wind Farm includes the installation of 9 wind generators, an electric substation and the implementation of a transmission line. Only wind generators and towers have been imported. They have been provided by Envision, a Chinese manufacturer. The remaining materials come from local sources.
		Local materials are mainly concrete and steel, for wind generators foundations and roads along the site. Material sources have not been completely specified on the documentation provided. However, most of them come from Melipilla a nearby town in Chile's sixth region. Another asset of this project is that the excavation material coming from roads and other earth movements have been used for the foundations of the wind generators. This minimizes the project's need to import materials from other sources.
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico</i>

		<p>Ucuquer (Chile: 2011).</p> <p>RECOMMENDATIONS: This credit evaluates the degree of materials used coming from local sources. The project team has not documented to what extend locally sourced materials have been used. It is suggested to develop an inventory of materials, plants, aggregates and soils for construction, including the total cost of materials. Thereafter, development of calculations regarding the total percentage of locally sourced project materials is necessary. The project utilizes a large amount of local materials, although no metrics or calculations about this topic have been developed. This could enhance already sustainable practices that have been put in place under the project and inform decisions about materials sources, usages and other aspects in which the project can establish a standard for infrastructure development in the O'Higgins Region.</p> <p>-</p>
RA1.5 Divert Waste From Landfills	3	<p>Improved</p> <p>Ucuquer Wind Farm (Phase 1 and 2) will have most of its waste material production coming from the construction phase. However, the project team has reused and diverted waste from landfill by using all materials coming from site excavation. The project team has specified the waste management during construction and operation phases within the environmental impact assessment. Liquids and solids have divided waste. During the construction phase, most of liquid waste will be generated from toilets and will be managed by a company authorized by the sixth's region Health Service. No industrial liquid waste will be produced during this phase. A local company will also manage solid waste generated by workers. The most relevant action for credit is that excavation material be reused for foundations and leveling terrain. During the operation phase, liquid waste will be produced only by one toilet located on-site and no industrial liquids will be generated. However, solid industrial waste is expected once a year due to the maintenance of wind generators. The reuse of these materials is not viable as they are polluted and will be removed by an authorized local company.</p> <p>Source: Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011), 43-44.</p> <p>RECOMMENDATIONS: This credit evaluates waste reduction and diversion of waste streams from disposal to recycling and reuse. This effort requires identifying potential sources and destinations for recycling as well as a management plan. The project team has realized actions on this topic. However, they have not been appropriately documented under the implementation phase. It is recommended to realize a comprehensive waste management plans in order to decrease project waste and divert waste from landfills and incinerators during operations. Waste management plans include documentation of anticipated volume (or weight) generation. The plan also incorporates methods and strategies to reduce waste generation. Although Ucuquer's project team has diverted the amount of waste from excavation, this action could be enhanced by a comprehensive assessment. As Ucuquer Energy is already developing other projects, it showcases best practice and establishes a standard in the O'Higgins Region. It is suggested to include documentation demonstrating how contractors, subcontractors and operators are aware of waste sorting and committed to achieving target levels of reduction. A waste stream scheme can also complement those actions, creating an inventory of potential sites that can collect, reuse and recycle materials.</p> <p>-</p>
RA1.6 Reduce	5	<p>Superior</p>

Excavated Materials Taken Off Site		Under the Environmental Impact Documentations, excavation materials need to be reused in the project. The materials for this project are used to establish foundations of the 9 wind generators and on the stabilization of the terrain. This action reduces transportation cost and maximizes the use of on-site materials. The project team has excelled on this credit, as most of the site's interventions are related to the installation of the wind generators. Nonetheless, the Ucuquer team has not comprehensively documented the use and implementation of such actions. More effort on reporting evidence, quantifying the impact, and planning these activities is required to enhance and develop a standard for other infrastructure projects.
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico Ucuquer (Chile: 2011), 43-44.</i>
		<i>RECOMMENDATIONS: This credit analyses the minimization of movement of soils and other excavated materials off site for reducing transportation and other environmental impacts. Although the project team has taken a leading vision and action on this topic, it is recommended to enhance the project's design to balance cut and fill to reduce excavated material off site. It is suggested to document such activities showing estimations about excavated material taken off-site. These actions can create a standard for other upcoming construction projects and it can be developed in a comprehensive manner that can also become a sustainable practice for Ucuquer Energy. Having into consideration that Wind Farms usually have similar construction procedures and design, this has the potential to become one of the most relevant sustainable practices that can complement emission reduction efforts. The development of such analysis can also increase the percentage of excavated materials and improve the project's design.</i>
RA1.7 Provide for Deconstruction & Recycling	0	No score
		Ucuquer's wind farm (Phase 1 and 2) has expanded its usual lifespan of 20 years to 30 years. It has accomplished this by introducing ultra-low wind speed turbines (2.1MW, 100m HH and 110m rotor, highest and largest in the country), produced and operated by China's leading privately owned wind turbine manufacturer.
		The team has not yet planned future recycling, up cycling or reuse, as technological advancements have been large in the past years. The project team expects to complete 5 years of operation for deploying monitoring and planning future uses for the wind farm components. Up to this moment, there have not been provided any studies or plans about this topic. However, the project team has been planning to introduce other uses into the site such as forestry, agriculture and animal husbandry that might also guide future reuse or recycling of the installations. The project team has stayed within traditional boundaries. No special consideration has been yet given to the end-of-life of materials, components and equipment.
		<i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico Ucuquer (Chile: 2011).</i>

		<p>RECOMMENDATIONS: This credit encourages the reuse or recycling of usable components when a constructed project reaches the end of its useful life. It is good practice to identify the materials used in the components, because it will make recycling more effective. It is recommended to expand the scope to include more life-cycle elements beyond construction, moving outside typical owner considerations of functionality. Although technological advancements might help to better perform this activity, it is important to develop a plan and specific the existing materials that can be easily recycled or reused after the useful life has ended. As the project has just begin its operation phase, it is suggested to create an inventory of materials incorporated into the design that retain some value for future use. Design documents showing efforts anticipating future adaptations. Document that the project owners and the project team have foreseen the effect that time and the facilities operations will have on potentially recyclable materials. Document materials that will retain their recyclability through the end of the project life.</p>
RA2.1 Reduce Energy Consumption	0	<p>No score</p> <p>This credit measures the project team's efforts to reduce the overall energy consumed in the project. It requires the team to calculate anticipated operation and maintenance energy consumption on an annual basis throughout a project's life in order to achieve reduction in operational energy. No documentation indicates that the project conserved energy by reducing overall operation and maintained energy consumption throughout the project's life cycle.</p> <p>Source: Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p>RECOMMENDATIONS: The project already produces net positive energy. As the Ucuquer Farm is an exemplary and pioneering project, it is recommended to perform monitoring of all energy consumption and production rates. It is recommended to report and document all meetings with the project team regarding energy reduction strategies. Documenting and publishing all considered design documents and energy-saving and production methods are necessary. This component is the main asset of the project and its effectiveness must be showcased as much as possible. In order to enhance and complement all of the measures, initiatives and actions that have been taken need to perform studies throughout the overall operation and maintenance during the project's life.</p> <p>-</p>
RA2.2 Use Renewable Energy	20	<p>Restorative</p> <p>The project generates a net positive amount of renewable energy. Ucuquer is a wind farm consisting of 9 wind turbines of with a capacity of 1.8 MW. A total annual electrical energy generation of 50 GWh per year feeds into Chile's main alternating current power grid, Sistema Interconectado Central (SIC). Ucuquer Wind Farm I and II also include the construction of an electric substation and a transmission line. The project installed ultra-low wind speed turbines (2.1MW, 100m HH and 110m rotor, highest and largest in the country), manufactured and operated by Envision Energy, China's leading privately owned wind turbine manufacturer. Ucuquer's strategic proximity to Central Rapel diminishes energy losses while maximizing the project's transmission efficiency.</p> <p>Source: Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p>RECOMMENDATIONS: Providing documentation of the anticipated annual output of all renewable sources and the overall percentage of renewable energy to total energy consumption is necessary.</p> <p>-</p>

<p>RA 2.3 Commission & Monitor Energy Systems</p>	<p>11</p>	<p>Conserving</p> <p>Ucuquer wind farm's main objective is to generate electric energy that will be injected into the Chile's central system. 9 wind generators of 1.8 MW each generate energy. Energy generated will allow the diversification of the energy matrix by incorporating non-conventional energy sources. The total investment is of US \$36 million with a life cycle of 30 years. Ucuquer Energy has realized the construction effort and has started the operation. It has installed an external operating central that monitors the performance of the wind farm by Envision, a Chinese company that has supplied the technology for wind generators. The project team has also scheduled maintenance operations every year during the following 30 years. According to team reports, a performance assessment will be developed within 5 years in order to quantify and analyze the impact and possibilities of the project. Since monitoring is crucial for the project's correct performance, Ucuquer Energy S.A. has been already assured it.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS:</i> This credit recognizes systems designed to be energy efficient during operations. As systems might fail during operations, installing advanced monitoring equipment better allows operators to identify efficiency loss. In addition, monitoring equipment allows operators to identify high-energy processes and target them in their own sustainability efforts. It has been recognized that Ucuquer Energy is already implementing operations monitoring programs, as this is crucial for the project's overall performance. It is recommended to keep record of such plans, showing all specifications and type of monitoring equipment installed. This will not only benefit the overall project functioning, but also enhance sustainable practices and generation of similar projects with renewable energy sources. As Ucuquer Energy plans to address and analyze the project's performance during the next 5 years, it would be necessary to create an advance report on this matter.</p> <p>-</p>
<p>RA3.1 Protect Fresh Water Availability</p>	<p>0</p>	<p>No score</p> <p>Ucuquer wind farm (Phase 1 and 2) does not affect the impact on the availability, quantity and quality of fresh water. As the project main objective is to produce energy from wind, it does not interfere or modify fresh water, groundwater, or surface water. The project only used water during construction when provided by an external source. The project's operation phase will not require water, as it will be controlled remotely. The project will protect its natural habitat, to avoid any disturbance to water resources in the area. The wind farm does not affect any of the existing functions or water services in the area.</p> <p>According to Law No. 20.283 under Article 16, it is pointed that protective measures should be given to safeguard soil, water stream, and biodiversity. On the other hand, wind farm revenues will be used to monitor and maintain forestry and agriculture in the site.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p>

		<p>RECOMMENDATIONS: Fresh water, groundwater, and surface water are being used faster than they are being naturally replenished. This credit evaluates whether the project's water consumption will have a long-term net negative impact, net neutral impact, or net positive impact. Although the project neither integrates water into the design nor uses wind, it is important to construct a water availability assessment study. This could render any possible risk of interfering with water resources. Design documents indicating location, type, quantity, rate of recharge, and quality of water resources need to be available to the project. The project team has not addressed water resources as potentials for the project. It is recommended to design features to minimize the long-term negative net impact on ground and surface water source.</p> <p>-</p>
RA3.2 Reduce Potable Water Consumption	0	<p>No score</p> <p>The project does not include any type of water infrastructure. The project consists on 9 turbines, an electrical substation and a transmission line. During operation, the project will be managed and monitored remotely; therefore no potable water will be utilized. The project is focused on providing energy and recovering the forest located in the area. It does not integrate any type of water infrastructure and it has not been designed to be inhabited; rather it becomes a conservation natural area that also provides electric energy to Chile. Due to the nature of the project, the project team has not address potable consumption and simultaneously it has reduced potable use at its greatest levels.</p> <p><u>Source:</u> N/A</p> <p>RECOMMENDATIONS: Although the project does not includes any type of potable water infrastructure and the site does not contains any facilities that will use potable water, it is recommended to document any water reduction strategies. The project team is already implementing potable water consumption reduction, however a comprehensive approach including any possible alternatives has not been adopted. This includes documentation about water needs, considering future scenarios where water might play an important role. The project has already incorporated some of these actions. Therefore, the project team could develop an inventory of measure that can reduce water consumption in the future. Present design documents demonstrating the incorporation of water-saving strategies to design. The project is already achieving a 100% reduction in potable water use, it is recommended to design documents demonstrating this action. Analyze if the area has the potential to provide an available source of usable water (potable-non potable) for neighboring projects or communities. It might appear that any community of project nearby has great water needs and the wind farm could become a supplier of such sources. Designs for use of grey water and rainwater is encouraged.</p> <p>-</p>
RA3.3 Monitor Water Systems	0	<p>No score</p> <p>The wind farm includes monitoring systems for installed infrastructural elements (9 turbines, electric substation and transmission line). Nonetheless, the project does not use water and has not installed water-monitoring systems. The project has a net zero water use. Used water was reported at its highest level during construction, yet during the next 30 years of operation the project will not use water. As a non-applicable system, the project's water integration process has not been planned. The project is based on the production of renewable energy – generated from wind - and does not integrate any sort of water infrastructure. The project does not integrate any other use apart from forestry. Water monitoring systems do not correspond to this particular project. Water in the forest will be managed naturally and no other water sources will be disrupted.</p>

		<p><u>Source:</u> N/A</p> <p><u>RECOMMENDATIONS:</u> This credit refers to the implementation of programs for monitoring water usage and leak detection. Systems capable of monitoring flows and usage and detecting early leaks early save money in operations and prevent the unnecessary waste of potable water. As the project does not incorporate water use, this is not an applicable program. Nonetheless, agricultural, forest and natural areas commonly have natural sources of water. It is recommended to perform a water assessment analysis of the site in order to determine if there's potential of integrating a conservation approach to the site - including forest and water resources. As water is a vital environmental issue, it is relevant to analyze if the site could play a larger role in providing other environmental service. In this view, the project could integrate monitoring systems and programs for overseeing and measuring environmental aspects of the site. The project does not include any type of water infrastructure; yet a complete monitoring system that not only measures energy production but also investigates environmental aspects could be of great benefit for the project as well as for Ucuquer Energy.</p> <p>-</p>
RA 0.0 Innovate Or Exceed Credit Requirements		N/A
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NATURAL WORLD		
	Score	UCUQUER WIND FARM (I AND II), CHILE
NW1.1 Preserve Prime Habitat	9	Superior
		The Ucuquer wind farm is located on a habitat that corresponds to hills of Chile's Coastal Range. The site has numerous ravines with native vegetation, including Rapel River and the hydroelectric dam. The site's current condition shows intense agricultural activity with forestalls zones like ravines and rivers with native vegetation. The most relevant hills are Loma Pelada (406 meters above sea level) and Loma Bolsón (219 meters above sea level) in addition to Rapel river, lake, and streams surrounded by forests.
		Over the site, native vegetation of pines and eucalyptus exist. The low area of the project is located in proximity to the Rapel river and the hydroelectric plant. The wind farm only occupies 4.3% of the total surface, as the rest of the project avails forestry, agriculture and other environmental services. The project team has not documented any plans of occupying the site with other uses that are not hand-in-hand with the local natural resources.
		Ucuquer Energy, whose revenues come from the wind farm, has restored the forest around the site. It is expected that over time it will be restored along all natural functions and biodiversity. The project team has addressed this project with an innovative perspective, and is not only producing renewable energy sources, but using them to restore a site that otherwise will not have economical resources for recovery.
		As a privately own land, the project follows all regulations established by Chile's environmental law. The project is also being developed along other regional plans of the VI region in accordance to a sustainable vision to protect biodiversity and natural resources.
		<i>Source:</i> Tomé, Alvaro R. <i>Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región</i> , (Chile: 2011.)
		<i>RECOMMENDATIONS:</i> The project team has developed various strategies for habitat restoration. Apart from landscape and biodiversity studies, it is recommended to present a restoration plan for significantly increasing vegetation and habitat restoration. Although the project team performs all of these actions, the current plan fails to foresee future transformation. This documentation can be complemented and created along monitoring studies, including a site map, where restoration species and specific areas that will be protected. Presentation of a narrative describing efforts of an interdisciplinary team to research and document prime-habitat areas surrounding the project site of intervention is necessary. This will complement and verify if the 9 wind generators have not triggered any unexpected impact on the environment.
		-
NW1.2 Preserve	1	Improved

Wetlands and Surface Water		<p>One of the site's boundaries is the Rapel River, located at the southeast area of the site. Proximity to Rapel river and Rapel Dam has been useful for avoiding the lost of energy within transfer through the transmission line located near the Central Rapel - augmenting the project's efficiency due to lack of energy loss on the transmission line. The project area of intervention only reported of 4.3% of the overall site. The 9 wind generators installed on Ucuquer wind farm are located in distance to Rapel's River. The project team has not provided documentation about any regulation regarding to construction buffers nearby the river, though none of the development impacts this area.</p> <p>More information is required to analyze this credit, as wind turbines are positioned on the best location regarding wind energy production. Biodiversity and landscape studies account that the wind farm affects no prime habitats or surface water. Vegetation and water located at the project's ratio of influence document that anthropogenic activity has been already detected in the area though that no native vegetation or water body has been affected by the project. Although the project grasps all environmental regulations, the project team has not documented or planned buffer zones for limiting development over the area in contiguity to the river.</p> <p><i>Source:</i> Tomé, Alvaro R. <i>Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región.</i> (Chile: 2011.)</p> <p>Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. <i>Medio Biótico. Parque Eólico Ucuquer.</i> (Chile: 2011.)</p> <p>RECOMMENDATIONS: <i>Rapel River provides a number of ecological services including mitigating flooding, improving water quality, and providing wildlife habitat. Maintaining the integrity of this element requires more than avoiding development on this area. It is recommended to delineate and protect Rapel River from external sources. Design can be influenced if specific protection areas and buffers are identified. Protecting natural areas and Rapel River shoreline is not related only to limiting construction on it. Developing a detailed analysis that can lead to an established regulation and buffer for the shoreline can complement this measure. Although Rapel River has already being transformed by the hydroelectric plant, integration of a vision for restoring the previously degraded areas is important. This vision can inform a larger restoration plan for Rapel River and other vegetation programs inside the project site. Biodiversity and landscape studies demonstrate that the area has been mainly influenced by human activity, and it is recommended to delineate guidelines to restrict impact on the landscape.</i></p> <p>-</p>
NW1.3 Preserve Prime Farmland	0	<p>No score</p> <p>Although Ucuquer wind farm is located in a region with prominent agricultural activity, the project team has not identified areas on the site to be conserved and enhanced as prime farmland, unique farmland, or farmland of regional importance. The project team developed analysis on the landscape's features and biodiversity to determine the impact of the project. Ucuquer's team has specified that the site can potentially acquire another land use such as forestry and agriculture; nonetheless no documentation on agricultural potential in nearby communities has been identified.</p> <p><i>Source:</i> N/A</p>

		<p>RECOMMENDATIONS: Farmland supports the economic base of many rural and suburban communities. Farmland preservation is one of the main activities of Chile's VI region and carries potential that can complement Ucuquer wind farm. Linked to potential land-restoration programs, farmland restoration is a vital asset for a project's long-term sustainability. It is suggested to determine whether or not soils have been identified as prime farmland, unique farmland, or farmland of statewide importance to conserve for future generations. Documenting how prime farmland is protected or how development is prevented is important. This can be one of the main alternatives for the project site, and can also enhance other types of development along environmental resource management and restoration practices. The project is already the first wind farm project to be developed in the area and has the potential of establishing environmental standards to guide other future projects in the region - also setting standards for Chile's best practices in renewable energy and environmental responsibility.</p>
NW1.4 Avoid Adverse Geology	0	<p>No score</p> <p>The project team realized studies on landscape features and biodiversity, where no adverse soils were identified. However the information provided by the team does not accounts for a geological analysis or any document for supporting this credit. The project is not located on an adverse geologic formation, aquifer, or other groundwater resource area; therefore this credit cannot be evaluated.</p> <p><u>Source:</u> N/A</p> <p>RECOMMENDATIONS: Although the project team developed a site analysis that overlooks landscape, diversity and other environmental aspects, documentation regarding geology has not been provided. As Chile is an earthquake-prone area, these studies become relevant in order to identify and delineate if earthquake faults, low-lying coastal areas, karst formations, and aquifers are located around the site. Providing documentation of site investigations including the project site relative to these features is necessary. It is recommended to realize these studies within a larger area, as these types of features affect the project even if they are not located on site. Documenting how design strategies avoid damage to sensitive geology will be implemented on operating and monitoring plans is important. As hills and ravines surround the project site, it is recommended to identify possible hazardous locations, develop buffers, and create run-off controls in order to avoid any probable forthcoming damage. These studies might also inform the location of the wind generators, in order to render the least impact into the site in case of any geologic hazard.</p>
NW1.5 Preserve Floodplain Functions	0	<p>No score</p> <p>Ucuquer wind farm was only constructed on 4.3% of the project's site. The area of intervention is limited to the placement of 9 turbines, an electrical substation, and a transmission line. Interior roads were designed considering the least amount of intervention of vegetated surface that have minimum impact over the landscape. The rest of the project surface is expected to be restored as a forest and agricultural site, which also preserves floodplain functions and maintain water management capacities and capabilities. The project team has identified 7 landscape units under the analysis; all o units refer to a certain geographical and natural characteristic as well as a specific impact ratio. Under all landscape units the project team has identified natural resources that are able to maintain, particularly the ones related to Rapel River. The most important action regarding</p>

		<p>this credit is to preserve floodplain functions by limiting development impacts that maintain water management capacities and capabilities; nevertheless, no identification about water bodies or water services has been found.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS:</i> Ucuquer wind farm team conserves most of the floodplain functions by limiting development and impacts of development to maintain water management capacities and capabilities. The project team excelled at avoiding impacts to the site and minimizing the area of intervention. It is recommended to provide and support all design decisions with a project's documentation. Also realizing water-related studies related to the floodplain functions to document how siting relative to floodplain have been reduced is necessary. It is important to document the project's approach toward maintenance of floodplain infiltration characteristics; such as the amount of impervious surfaces, vegetation and soil protection zones. It has not been documented if Rapel River is subject to floods or if any of the project's areas would be subject of those. If applicable, create an inventory of flood-prone areas, design protocols, and emergency plans. Document that these events will not affect the long-term operation of the wind farm and design strategies for protection in case of any flood event.</p>
NW1.6 Avoid Unsuitable Development on Steep Slopes	0	<p>No score</p> <p>The project entails the installation of 9 turbines, an electric substation and a transmission line. The project is located on a rural area with hills and ravines. The project did not include development on hills and steep slopes; however the team has not specified any assessment for avoiding erosion or preventing landslides. Only 4.3% of the site has been intervened. The rest of the site will remain as forest or agricultural land. Although forestry management can be a way in which erosion can be prevented, the project team has not delivered specific documentation in regards to this credit.</p> <p><i>Source:</i> N/A</p> <p><i>RECOMMENDATIONS:</i> This credit expects to avoid inappropriate development and exposure to risk from erosion. If developed improperly, hillsides and steep slopes can increase erosion and landslides, rendering more expensive mediative challenges. As the project is located in an area with hills and ravines, it is recommended to develop an assessment regarding various risks relative to slopes and landslides. The project team has specified that forestry activities will be developed in the area, yet it has not been specified if they plan to follow best management practices to prevent erosion and landslides. Providing documentation of the process is necessary to identify high-risk hillsides or steep slopes and their location relative to the final site selected.</p>
NW1.7 Preserve	0	<p>No score</p>

Greenfields		<p>Ucuquer wind farm is located on a habitat that corresponds to hills that pertain to Chile's Coastal Range. The site has numerous ravines with native vegetation, considered as a greenfield in many cases. Current conditions show intense agricultural activity with forest zones like ravines and rivers with native vegetation. Over the site, native vegetation includes pines and eucalyptus. The low area of the project is located in proximity to the Rapel River and the hydroelectric plant. The wind farm only occupies 4.3% of the total surface, as the rest of the project surface an area dedicated to forestry, agriculture and other environmental services. Although the site's alteration has been minimal, the project has been developed over a greenfield, which is recognized as a rural area.</p> <p><u>Source:</u> N/A</p> <p><u>RECOMMENDATIONS:</u> This credit recognizes development on greyfields, brownfields, and other sites located in urban areas. This minimizes the likelihood of habitat fragmentation and ecological disturbance associated with infrastructure construction and operation. As the Ucuquer wind farm is located on a rural area with no development around, it is recommended to monitor and plan how the site's intervention can serve to environmental restoration services. Creating and documenting how the site can be revitalized can serve its function of providing renewable energy while providing environmental services. The project team has already reported some of these activities; however, it is necessary to document and develop a future forestry management plan for the site.</p> <p>-</p>
NW2.1 Manage Storm water	0	<p>No score</p> <p>The project does not include any hydrological assessment or storm water management. Because of the characteristics of the project and Chile's geography this might not be a important factor. Nonetheless, as the project intends to restore the surrounding habitat and create an emblematic renewable energy proposal, water management practices could complement Ucuquer's scope. The project only affects the landscape on 4.3% of the site's surface, yet no documentation was presented in order to support this credit.</p> <p><u>Source:</u> N/A</p> <p><u>RECOMMENDATIONS:</u> The credit focuses on minimizing the impact of infrastructure on storm water runoff. Development on site changes the natural flow and increases the quantity of impervious surfaces. Ucuquer wind farm does not occupy a vast area of the site and does not account for major changes on runoff. It is recommended to submit more information regarding infiltration and runoff. It is suggested to analyze and document the project's impact on the watershed and surface permeability. This can be a crucial asset of the project; nonetheless due to lack of documentation the credit cannot be evaluated.</p> <p>-</p>
NW2.2 Reduce Pesticides and Fertilizer Impacts	0	<p>No score</p> <p>The project team has not provided documentation about operational policies for controlling the application of pesticides and fertilizers. No information regarding their use on the forest or agricultural areas has been found.</p> <p><u>Source:</u> N/A</p>

		<p>RECOMMENDATIONS: Ucuquer wind farm has a large surface that will be used for forestry purposes and sometimes for agriculture. However, it has not been specified what fertilizer and pesticide control over these areas. It is recommended to reduce their use and eliminate its application when possible. Their chemicals can contaminate runoff and pollute the Rapel River. Also, it is recommended to analyze suitable vegetation, for enhancing communities that can grow in Chile's VI region particular climate.</p> <p>-</p>
NW2.3 Prevent Surface and Groundwater Contamination	1	<p>Improved</p> <p>Ucuquer wind farm is based on the generation of wind energy, which produces no surface or groundwater pollutants. The project has been designed to affect the site in a minimum way. Turbines have been strategically placed and roads provide accessibility to the site. Only during the construction phase may liquid effluents be generated. Throughout operation phase, industrial by products will be produced once a year. Due to Chile's law, all industrial by-products will be managed by a selected enterprise. Therefore, no surface or groundwater contamination was produced. The project does not affect any particular set of water conditions.</p> <p><u>Source:</u> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p>RECOMMENDATIONS: This credit analyses leak prevention and measures for avoiding pollutants from contaminating surface and groundwater and monitor impacts over operations. It is recommended that under the water assessments, preventive measures relative to leaks, spills and other types of possible pollution sources be incorporated into the design and operation protocols. Also, it is necessary to document all efforts for reducing the use or replacing future hazardous and/or potentially polluting materials with non-hazardous or non-polluting materials. The project team reported that once a year, due to maintenance hazardous materials could be produced. It is recommended to update protocols for avoiding future alterations over the water conditions.</p> <p>-</p>
NW3.1 Preserve Species Biodiversity	2	<p>Improved</p> <p>The Ucuquer wind farm project team has provided documentation and analysis of the existing habitats. Native vegetation and fauna have been clearly identified throughout the various site conditions. Regarding species biodiversity, the project studies reveal that most of the native species located on the site present influence from direct or indirect human activity. Lost of native vegetated species is minimal and their state is degraded. Environmental studies recommend to recuperate an area with vegetated native species that can contribute to improve mammal habitats.</p> <p>In general, vertebrate species are not abundant due to the lack of suitable environment. Despite potential collision of birds and bats, studies conclude that the project present a low risk, due to the majority of species have low range flights. Reports suggest that the project team continues to develop knowledge on local vegetation and fauna for developing and monitoring impacts of the wind farm and, if necessary, develop specific restoration strategies.</p> <p><u>Source:</u> Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. <i>Medio Biótico. Parque Eólico Ucuquer</i>. (Chile: 2011)</p>

		<p>RECOMMENDATIONS: The project team has realized detailed analysis of different habitats present on site. Nonetheless, documents do not outline strategies for mitigation of disturbed habitats. Reports have stated that native vegetation is under degradation due to indirect and direct human activity. One of the factors that influence is the Rapel Dam, which is located in close proximity to the site. Nonetheless, the project team can thrive efforts for protecting and upgrading existing habitats, also connecting, restoring and creating new habitats. The wind farm allocates wide potential for restoring the site's natural habitats. It is recommended to install monitoring systems in order to identify possible impacts from the wind farm and create an strategic program for habitat restoration. This effort could be made in local and state agencies in order to enhance Chile's VI Region biodiversity.</p> <p>-</p>
NW 3.2 Control Invasive Species	0	<p>No score</p> <p>The project team has not provided documentation regarding this topic. Analysis on vegetated and fauna species do not identify invasive species on site. Documents only present information about species with conservation problems due to indirect human activity. During the project construction no native vegetation will be affected; therefore restoration works are not required.</p> <p><i>Source:</i> N/A</p> <p>RECOMMENDATIONS: Although the site does not present any invasive species, it is recommended to create a management plan that addresses prediction and prevention strategies for minimizing potential for invasive species - both plant and animal - to reappear after initial removal. The plan must include strategies that monitor and remove invasive species emerging on site in the future.</p> <p>-</p>
NW3.3 Restore Disturbed Soils	8	<p>Conserving</p> <p>The area of intervention is located 2.5 km west of Rapel Dam. Ucuquer wind farm has constructed 4.3% of the site, corresponding to wind turbines and associated works. The site presents native vegetation under degradation due to indirect human activity, resulting in erosion and overgrazing. These areas are also over influence of fires and cattle grazing. The area of intervention in direct contact to the wind farm is proportionally small, and in relationship with the existing flora and fauna is not considered any important impact because of the minimal presence of native vegetation that has been historically impacted due to human activity. Under these conditions, the project team has documented that under the following years, the site's forestry and agricultural areas be restored. These activities will take place with revenues coming from the project's operation phase.</p> <p><i>Source:</i> Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. <i>Medio Biótico. Parque Eólico Ucuquer.</i> (Chile: 2011.)</p> <p>RECOMMENDATIONS: Restoring disturbed soils improve the site's ability to support healthy plants, biological communities, water storage and water infiltration. Disturbed soils cannot hold water, nutrients, or carbon dioxide as well as natural, undisturbed soils. Ucuquer wind farm does not present a major influence under native vegetation; nonetheless the site presents degraded conditions under its different soils configurations. The project team has stated their interest to develop restoration activities over the following years; therefore soil restoration becomes a major topic that must be further investigated. It is recommended to develop documentation about areas of disturbance and areas that will be restored. Developing calculations about soils that will be restored</p>

		and constructing an analysis of their original and proposed function is necessary
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NW3.4 Maintain wetland and surface water functions.	3	Improved
		Four main ways to improve ecosystem functions include maintaining or enhancing: hydrologic connection, water quality, habitats, and sediment transport. Ucuquer wind farm does not disturb any of the surface water functions through the construction of the project. The project team identifies different habitats with species and vegetation in order to provide an environmental analysis of the site and calculate the project's impact. Ucuquer wind farm also allocates plans for restoring the site and enhancing forestry and agricultural activities. This will support the surface water functions by enhancing existing threatened habitats.
		<i>Source: Tomé, Alvaro R. Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región. (Chile: 2011.)</i>
		<i><u>RECOMMENDATIONS:</u> Ucuquer wind farm will enhance habitat and other environmental services as the site starts to be restored. It is recommended to develop a habitat and a plan to maintain and enhance the habitats for aquatic and riparian species, particularly to the area near Rapel River. The habitat survey must include location and a proposed mitigation of existing obstructions to habitat connectivity such as dams, roadways and other infrastructure that may block species migration. Restoring surface water functions would be one of the long-term assets of the project, instilling positive impact over Chile's VI region.</i>
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NW 0.0 Innovate Or Exceed Credit Requirements		N/A
	24	

CLIMATE AND RISK		
	Score	UCUQUER WIND FARM (I AND II), CHILE
CR1.1 Reduce Greenhouse Gas Emissions	18	Conserving
		The Ucuquer Wind Farm (Phases I and II) aims to contribute to growing energy demands by diminishing fossil fuel emissions and generating employment for Chile's sixth region. It consists of the installation of 9 wind generators with a capacity of 1.8 MW with a total annual electrical energy generation of 50 GWh per year, which will be fed into Chile's main alternating current power grid, Sistema Interconectado Central (SIC). The project team has not provided documentation about the life-cycle carbon assessment. However, the project main objective is to produce renewable energy by installing wind generators. This actions are deeply linked to efforts of reducing greenhouse emissions.
		<i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).
		<i>RECOMMENDATIONS:</i> The main contribution of this project is the generation of renewable energy produced by wind. The project reduces greenhouse emissions and is aligned with sustainability goals. However, the project team has not provided a life-cycle analysis regarding this matter. It is highly recommended to document the carbon footprint analysis that has been performed in accordance with available methodologies, data sources, and software. Document all efforts made on reducing carbon emissions and calculations of percentage reduction. Being an innovative project in Chile, it is relevant to document these actions in order to standardize best practices in the region.
CR1.2 Reduce Air Pollutant Emissions	0	-
		No score
		Ucuquer wind farm is an innovative project that concentrates its effort on reducing greenhouse and air pollutant emissions generated from electrical energy. Nonetheless, the project team has not provided documentation regarding criteria of reducing expected emissions of the six criteria pollutants and strategies implemented to reduce air pollutions to required levels. The six criteria pollutants (carbon monoxide, nitrogen oxides, sulfur dioxide, suspended particulate matter smaller than PM-10, ozone, and lead) are part of US standards. The project team has provided documentation on the CO produced during the construction phase. Most pollution comes from machinery from building roads and transit produced by construction works. The highest emission corresponds to MP10 related to vehicle transit on non-paved roads inside the wind farm. It is recorded at 104 kg/month during the first phase and 112.4 kg/month on the second phase. All emissions have been calculated and can be found at the atmospheric emission studies. No information has been provided according to other criteria pollutants.
		<i>Source:</i> Donoso, Correa Gonzalo. <i>Estimación de Emisiones Atmosféricas</i> . (Chile, 2011.)
CR2.1 Assess	0	<i>RECOMMENDATIONS:</i> Pollutants damage human health, property, and the environment. It is recommended to document and analyze all reduction emissions as this is one of the project's main assets as well as the rest of criteria according to the California Ambient Air Quality Standard (CAAQS). These studies can also support the creation of similar projects in Chile by presenting it along a set of best practices developed throughout Ucuquer's wind farm project.
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Climate Threat		<p>This credit measures the steps taken by the project team to prepare for climate variation and natural hazards. The project team should provide a comprehensive Climate Impact Assessment Plan and Adaptation Plan. No climate impact assessment and adaptation plan has been developed.</p> <p><u>Source:</u> N/A</p> <p><i>RECOMMENDATIONS: Climate change specialist notes that mean temperatures are expected to rise around the world. Higher average temperatures will not only increase water evaporation rates, but also change the quantity, intensity, and timing of precipitation. All of these changes have important implications to agriculture, irrigation, hydropower, flood management, fisheries, recreation and navigation. These changes are important factors in infrastructure design. Although the project's main objective is to create renewable energy to reduce greenhouse emissions; the project team has not submitted a climate impact assessment and adaptation plan. Changes on temperature might affect precipitation and wind patterns. The most important recommendation is to create a Climate Impact Assessment and Adaptation Plan that identifies climate change risks and possible responses.</i></p> <p>-</p>
CR2.2 Avoid Traps And Vulnerabilities	0	<p>No score</p> <p>Considering possible resource constraints regarding energy production in Chile, Ucuquer Wind Farm's main objective is to inject energy to Chile's Central Grid. Ucuquer's strategic location in proximity to Rapel's Central enhances the project's energy transmission efficiency. The team revised local regulations and standards with plans to address ecological restoration projects at the site during the project's lifespan. This action gives the project's team the possibility of planning long-term adaptability measures for the site and analyze vulnerabilities. As the project located on a rural area, the project doesn't imply any future impact on nearby communities. Despite of all actions taken, the project team requires to address long-term vulnerability issues that must be included under their climate change and adaptation plan.</p> <p><u>Source:</u> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS: This credit refers to projects that undertake long-term views on the effects of resource depletion, extreme natural or human-caused events or economic changes. It recognizes design and delivery of infrastructure that avoid high long-term costs or additional risk and vulnerabilities to affected communities. It is recommended to document possible changes in Chile's VI Region that might affect the project. Provide an analysis of potential traps and vulnerabilities associated with costs and risks. For example, analyzing what risks the project faces - such as changing temperature patterns or any change on the Rapel River - can affect the site.</i></p> <p>-</p>
CR2.3 Prepare For Long-Term Adaptability	0	<p>No score</p> <p>The project team has not provided documentation on long-term adaptability. However, the design of the project allows to undertake certain actions and programs for long-term planning, as only 4.3% of the site has been intervened. Areas on the project referring to forestry and agricultural activities have the potential to integrate long-term adaptability strategies. Nonetheless, the project team has delineated neither a climate change plan nor an adaptation strategy in order to prepare for future disturbances. The project is located in a rural area, therefore most of adaptation strategies would refer to ecological restoration</p>

		<p>activities and other environmental programs.</p> <p><i>Source: N/A</i></p> <p><i>RECOMMENDATIONS: Infrastructure projects designed under today's conditions might not function correctly in the future. Climate change leads changes in weather patterns, such as changes in temperatures, humidity, precipitation, seasonal hydrology, flooding, increased sea levels, etc. As such, projects should be designed to withstand a range of conditions that may result from climate change. As the VI Region an agricultural one, it is relevant to analyze changes on the region that may affect the functioning of the wind farm. These changes could include changes on wind patterns and on vegetation. As the site is already under degradation, it is recommended to analyze possible threats regarding ecological degradation. The project team has stated that forestry and agricultural activities would take place on site; therefore, it is recommended to delineate a plan for mitigating possible risks and vulnerabilities associated to the region in the context of climate change.</i></p> <p>-</p>
CR2.4 Prepare For Short-Term Hazards	0	<p>No score</p> <p>Chile is an earthquake-prone region, therefore the project team has analyzed and designed according to Chile's structural regulations. The wind generators foundations have been designed according to structural norms in order to address future earthquakes. The project team has taken a lead in short-term hazards. Nonetheless, the project lacks documentation on structural design and other implemented measures. The project site is not inhabited and is located on a rural area, minimizing risk for nearby communities. The project team has not provided documentation regarding other short-term natural hazards or any other human related activity that might affect the project's performance.</p> <p><i>Source: Ljubetic, Villanueva Luis, Declaración de Impacto Ambiental Parque Eólico Ucuquer (Chile: 2011).</i></p> <p><i>RECOMMENDATIONS: Besides climate-related hazards, infrastructure projects are subject to short-term events such as earthquakes, flooding or fire. It is recommended to generate an analysis of all vulnerabilities that may occur in the site. The main concerns of the project are earthquakes, since Chile has a long history on such hazards. Nonetheless, there are other aspects that should be analyzed such as fires or flooding from the Rapel River. It is highly recommended to consider which types of natural and human-induced hazards may appear in the region and their frequency and severity. Such events might occur several times during the project's life span; therefore it is relevant to analyze how these events can be addressed. It is also suggested to analyze the extent of building codes on the wind generators. Since it is a specific structure, regulations may not correctly address the structural norms that the project requires. The project team has already developed some strategies regarding this credit, specifically earthquakes; it is important to document all strategies that have already been implemented and enhance it through a risk and vulnerability analysis that can be developed in parallel to a climate change action and adaptation plan.</i></p> <p>-</p>
CR2.5 Manage	0	<p>No score</p>

Heat Island Effects		<p>The Ucuquer wind farm occupies 4.3% of the site. The remaining area has been designated for forests and agricultural areas, which do not produce a heat island effect. Roads on the project have not been paved, alleviating surfaces with a low solar reflectance index to reduce localized heat accumulation and manage microclimates. The project team contemplates reforestation and ecological restoration effort, which also supports endeavors to combat a heat island effect. The project is located in a rural area; therefore the low-impact on non-permeable surfaces of the project enhance the region's potential of adaptability toward climate change and other threats. Even though all this parameters affect the heat island effect, no specific consideration or measurements according to solar reflectance index (SRI) have been provided.</p> <p><i>Source:</i> Ljubetic, Villanueva Luis, <i>Declaración de Impacto Ambiental Parque Eólico Ucuquer</i> (Chile: 2011).</p> <p><i>RECOMMENDATIONS:</i> It is important to document and develop calculations demonstrating that the landscape and other areas meet the requirements. This is one of the main assets of the project and must be completely documented. The project's design and low impact on the site is outstanding, and it is highly recommended to develop metrics and policies to address this aspect. The project has the potential of becoming one of Chile's best practices, yet the project team needs to document and develop certain environmental standards. As Energías Ucuquer S.A. is analyzing possibilities for developing similar projects in the area, this aspect is a crucial one that must be evaluated in detail.</p>
CR0.0 Innovate Or Exceed Credit Requirements		N/A
	18	

OVERALL SCORE	112
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APPENDIX E: SOURCES

DOCUMENTATION PROVIDED
General Information.
Acustec, Soluciones de Ingeniería a Problemas Acústicos. <i>Evaluación de Impacto Acústico. Proyecto Eólico, Ucuquer, Vestas, General Power.</i> (Santiago de Chile: 2011).
CONAF, Corporación Nacional Forestal, <i>Plan de Manejo OO.CC. DL N° 701</i> (Chile: 2012).
CONAF, Corporación Nacional Forestal, <i>Plan de trabajo Xerofíticas</i> (Chile: 2012).
Consultoría Víctor Lucero S.EIRL, <i>Estudios Patromoniales, Arqueológicos y Antropológicos.</i> (Chile: 2011).
Donoso, Correa Gonzalo. <i>Estimación de Emisiones Atmosféricas.</i> (Chile, 2011).
Geodiversa, Consultores Ambientales, <i>Plano General de Ubicación del Proyecto</i> (Chile, 2012).
Ibarra, Hector, Miranda, Leonardo and Quintana, Victor. <i>Medio Biótico. Parque Eólico Ucuquer.</i> (Chile: 2011.)
Izquierdo, Roberto, Energías Ucuquer S.A., <i>Compromisos Ambientales, Dia Parque Eólico Ucuquer</i> (Chile, 2012).
Ljubetic, Villanueva Luis, Energías Ucuquer S.A., <i>Anexo F. Estudio Arqueológico, Declaración de Impacto Ambiental</i> (Chile: 2011).
Ljubetic, Villanueva Luis, Energías Ucuquer S.A., <i>Declaración de Impacto Ambiental Parque eólico Ucuquer</i> (Chile: 2011).
Tomé, Alvaro R. <i>Informe Paisaje. Parque Eólico Ucuquer, Rapel, VI Región,</i> (Chile: 2011.)
Tebal, Ucuquer S.A., <i>Informe de Rescate y Relocalización de Fauna Terrestre Proyecto "Parque Eólico Ucuquer, Fase II"</i> (Chile, 2012).