PCR

THE INTERNATIONAL EPD SYSTEM EPD®

Argentina EPD®

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025:2006 FOR

ELECTRICITY GENERATED AT SAN JORGE - EL MATACO WINDFARM

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1. INTRODUCTION

1.1 Environmental Product Declaration and the EPD system

Environmental labelling is of growing importance and cuts across trade, as consumers demand more sustainable products and rigorous, quantitative information, while companies require environmental supply chain information from their suppliers and governments introduce environmental accounting into their legislation to protect their markets.

An Environmental Product Declaration is defined in ISO 14025 as the quantification of a product's environmental data with the categories and parameters specified in the ISO 14040 series of standards, but without excluding additional environmental information. The International EPD System® (Environdec) aims primarily to help and support organisations to communicate the environmental impact of their products (goods and services) in a credible and understandable way.

This EPD has been developed in accordance with the International EPD System®. The International EPD® System is an operator of Type III Environmental Declarations in accordance with ISO 14025:2006. The system and its uses are described in the General Programme Instructions (GPI).

The documents on which this EPD is based are, in order of hierarchical relevance:

- Product Category Rules, PCR 2007:08 version 5.0.1 CPC 171 & 173: Generation and Distribution of Electricity, Steam and Hot/Cold Water, 2015-02-05.
- General Programme Instructions for Environmental Product Declarations, Ver. 4.0
- General Programme Instructions for Environmental Product Declarations, Ver. 5.0.1
- ISO 14025:2006 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures.
- ISO 14040:2006 and ISO 14044:2006 on Life Cycle Assessment (LCA).

This EPD contains an environmental performance statement based on the LCA. It also contains additional environmental information in accordance with the relevant PCR 2007:08 - Electricity, steam, and hot water generation & distribution - Version 5.0.1:

- **Information on biodiversity protection;**
- **Information on land use and land cover classification;**
- **Information on environmental risks;**
- **Information on the generation of electromagnetic fields;**
- **Information on product noise;**
- **Information on the visual impact of the wind farm.**

1.2 PCR Energy

With more than 100 years of experience, we are an Argentinean energy company engaged in the exploration and production of crude oil and natural gas, and currently the largest cement producer in Patagonia.

In a context of global energy transition, in the last 7 years, we have expanded our business to the construction and operation of wind farms and the commercialisation of electricity from renewable sources.

We seek sustainable development with a strong commitment to caring for the natural environment surrounding our operations and minimising any negative impact of the activities of the Group's companies. We promote management that respects diversity and complies with occupational health and safety. At the same time, we promote the development of quality of life and respect for the local culture of the communities in which we operate.

We are convinced that renewable energies are the technologies with the greatest expectations for growth in the 21st century, given that only they offer an economically, socially and environmentally sustainable solution to the energy that the world needs to drive its development.

1.2.1 Commitment to the environment

We manage our business through practices and procedures that contribute to the care of the environment, the efficient use of resources and the fight against climate change. We materialise our commitment in policies and guidelines designed to ensure responsible, efficient and sustainable management and development. In all our business units, we are committed to complying with legal regulations, reducing negative impacts, promoting continuous environmental improvement, allocating resources efficiently, preventing pollution, raising staff awareness, and assessing risks and opportunities.

The Renewables division has an Integrated Policy that establishes the guidelines for daily actions considering the fundamental points of Quality of service, Environment and Health and Safety.

1.2.2 Environmental management system

We have Environmental Management Systems (EMS) in place in each of our business units to ensure that activities comply with sector-specific impact control and optimisation targets. The systems include processes, measurement mechanisms, training plans, risk management, emergency preparedness and crisis management for business continuity. The Environmental Management System at San Jorge - El Mataco is ISO 14001 certified.

In general terms, these cover the management of:

- Emissions
- Water
- Energy
- Spills
- Waste
- Care for biodiversity

Based on these processes, we measure and monitor the actions and performance indicators for the fulfilment of the assumed objectives.

1.2.3 Environmental impact assessment

In order to continuously improve our environmental management and comply with legal requirements, we conduct environmental impact assessments and studies at our operations.

For each project we manage the corresponding Environmental Impact Statements (EIS) before the corresponding authorities and thus, we determine whether a project is environmentally suitable or not.

Under this framework, the San Jorge - El Mataco Wind Farm was declared **"environmentally suitable"**.

1.2.4 Climate change and emissions

Aware of the impact of our business on climate change, at PCR we work to ensure that the management of our operations is as efficient as possible in terms of caring for resources and the planet, particularly in relation to our emissions and carbon footprint. True to our commitment, PCR promotes the development of technologies and the use of alternative materials that minimise our greenhouse gas emissions. In particular, we highlight our renewable energy business unit, which makes a positive contribution to the fight against climate change.

1.2.5 Efficient energy management (renewables only)

The renewables division aims at the efficient and sustainable design of all its projects, considering the appropriate equipment to be able to air-condition and illuminate spaces. In this line, we carry out lighting studies and heat balances to precisely define the necessary equipment. As a result, we define the minimum quantities required and select the most efficient equipment for air conditioning.

As a complement to the design and selection of equipment, we promote good practices for the optimization of electrical energy consumption and develop measurement indicators with the aim of establishing reduction and efficiency targets. We work on raising awareness among employees about good environmental practices, signage to turn off lights, appliances, and others when they leave the offices, optimizing electrical equipment for greater efficiency, and investing in the construction of renewable energy parks.

1.2.6 Waste Management

We work to minimise waste generation and improve our environmental impact through circular economy practices and proper separation of materials.

Our wind farms have waste management instructions as part of their Environmental Management System, which controls the containers for waste collection and temporary storage, manages the removal of waste and the records generated, and systematises the legal documentation of the authorised waste transporters and treaters. The chamber is cleaned annually and the waste is disposed of through an authorised supplier. In the process, a manifest and a certificate of final disposal are required from the transport and disposal companies. The activity that generates the largest volume of waste is the maintenance of wind turbines carried out by VESTAS, which includes the generation of special waste such as Y8, Y9, Y13 and Y34. In 2022. In terms of waste from sewage effluents, cleaning of facilities and canteen, we segregated waste from the operations area into recyclable, organic and inert waste, reducing final disposal. Within the works, the waste accounted for is divided into the categories of: special waste, inert waste and solid urban waste. In this sector, we have details of the special waste generated by each contractor in each of the works divided by stream (Y), hazardousness (H) and a detail of the authorised transport and final disposal suppliers together with the transport manifests and final disposal certificates. In all cases, contractors report on a monthly basis the generation and type of treatment given to the waste generated.

1.2.7 Spill Management

In the event of a spill, **the Renewables division acts in accordance with the Emergency Response document included in the Environmental Management System.** We also manage in accordance with the Spill Control and Waste Management processes within the same system.In 2022, there were no significant spills at SJM and PEBSA (more than 200 litres). It should be noted that, at SJM, the storage sites for special substances and waste have measures such as anti-spill kits, containment basins, fire extinguishers and eyewash. In addition, the chemical and special waste sites have a perimeter gutter and secondary containment basin.

1.2.8 PCR Renewables

In 2016 we began our journey into renewable energy and in 2023 we commissioned the three wind farms we had been developing since 2022 (Vivoratá, San Luis Norte and Mataco III), **bringing the PCR Group's total installed capacity to 527.4 MW.** All our wind farms are equipped with state-of-the-art equipment and technology, with world-leading equipment suppliers. Through our subsidiaries Luz de Tres Picos S.A., Parque del Bicentenario S.A. and Generación Eléctrica Argentina Renovable I S.A., **we have 6 wind farms in operation with a total generation capacity of 527.4 MW** in the provinces of Santa Cruz, Buenos Aires and San Luis:

527.4 MW
PCR Group's total generation capacity
› Summation of the Mataco III, Vivoratá, San Luis Norte, Biventenario I, Bicentenario II and SanJorge El Mataco wind farms.

203.4 MW
from the San Jorge El Mataco (SJM) wind farm*
› Capacity factor of **50.96%** (vs. 51.68% in 2022); and an annual production of **907.96 GWh.**

38,56% | 527.4 MW

*This EPD refers to San Jorge - El Mataco.

On the other hand, in terms of commercialisation, PEBSA I and SJM sell all of their generated energy to the Compañía Administradora del Mercado Mayorista Eléctrico S.A. (CAMMESA). (CAMMESA), while the energy generated by PEBSA II, Mataco III, Vivoratá and San Luis Norte is sold to large consumers through supply contracts under the renewable energy forward market (MATER): Acindar SA, Minas Argentinas SA, Quitral, Arcos Dorados RENOVABLES S.A. Stellantis, Papel Prensa S.A., GlaxoSmithkline Argentina S.A., Air Liquide Argentina S.A., Scania Argentina S.A., Rigolleau, Cattorini, Rayen Curá SAIC, Dow (PBBPolisur S.R.L), BBVA, Banco Galicia, Bridgestone, Bunge Argentina S.A., and the cement division of PCR. The San Luis Norte project was executed through the subsidiary GEAR I S.A. in partnership with Acindar Industria Argentina de Aceros S.A. ("Acindar") (51% PCR Group and 49% Acindar). As of December 2023, we have no projects under construction, but we have been assigned 550 MW of dispatch priority under the MATER, through subsidiaries, for which we have been working since last year on the engineering of these projects, a process that will continue during the first months of 2024.

1.3 Functional Unit

This document represents the Environmental Product Declaration for the energy generated at the San Jorge-El Mataco wind farm.

In this context, the Functional Unit is the reference that exactly defines the element being analysed and assessed from the environmental point of view in the declaration. All the information in this document is referenced to the Functional Unit, which in this case is:

"1 kWh net generated and distributed to the 132 kV electricity grid in Argentina by an on-shore wind farm of PCR S.A. in Buenos Aires".

The amount of energy used as reference flow has been 921,132.81 MWh. This reference flow represents the total net energy that the wind farm can distribute to the grid during its expected 25 years of operation and is the value that allows all the inputs and outputs, mentioned in the following sections, to be subsequently referenced to the functional unit defined in the previous paragraph.

1.4 Allocation of environmental burdens

Environmental load allocation is a mandatory step in the calculation of the environmental footprint of a product based on the life cycle analysis methodology, whenever there are other by-products in addition to the object of study. It consists of dividing the input or output flows of a process or a product system between the product system under study and one or more other product systems (ISO 14044 2008).

The physical allocation criterion was defined according to PCR 2007:08 v 5.0.1, where the 100% rule indicates that the sum of the impacts of all individual products must equal the total load of the process, all allocated to energy generation.

1.5 Description of the product system analysed

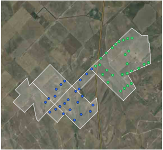
The reference system studied is the San Jorge - El Mataco wind farm, with a total of 51 wind turbines (24 of 4.2 MW and 27 of 3.8 MW), totalling an installed capacity of 203.4 MW, located in the town of Tornquist.

1.5.1 Location

The San Jorge - El Mataco wind farm and its 132 kV power lines are located in the districts of Tornquist and Bahía Blanca, respectively, both located in the southeast of the province of Buenos Aires, in a predominantly rural area. No project component enters urban areas. The agricultural and livestock farm on which it is located has a total area of approximately 3,214 hectares. This area is considered gross, not net, since the actual land use of the farm, including roads and wind turbine foundations, is approximately 30 hectares (0.9% of the total property).

The area designated as the "**project area of influence**" for the purposes of the Environmental Impact Assessment (EIA) is necessarily larger and is associated with the scope of the project's direct and indirect effects. In this regard, the towns of Tornquist, Punta Alta, and Bahía Blanca, the adjacent fields, and the Bahía Blanca, Bahía Falsa, and Bahía Verde Multiple Use Nature Reserves are included.

The access point to the San Jorge - El Mataco field is located at coordinates:
38°17'8.5"S; 62°13'13.5"W



1.5.2 Technical Specifications

The system comprises 51 VESTAS wind turbines model V-136. 24 units are 130 m high and have a rated output of 4.2 MW and 27 V-136 units are 127 m high and have a rated output of 3.8 MW.

2. ENVIRONMENTAL INFORMATION BASED ON LCA

2.1 Life cycle assessment methodology

As stated in ISO 14025:2010 (Environmental labels and declarations – Type III environmental declarations – Principles and procedures), the environmental impact data collected in an Environmental Product Declaration (EPD) are part of the results obtained from an analysis conducted following the Life Cycle Assessment (LCA) methodology.

The LCA methodology followed for this study is a **procedure based on the international standards ISO 14040, ISO 14044, and the Product Category Rules (PCR) 2007:08** - Generation and distribution of electricity, steam, and hot water - Version 4.2. The evaluated product category code is UN CPC 171, corresponding to electricity generation.

Using the LCA method, **we can obtain a complete breakdown of the elementary inputs and outputs that compose our product system throughout its entire life cycle.** These inputs and outputs occur in the form of raw material consumption or different types of emissions and are the indicators that show the actual interaction of the analyzed product with nature.

Additionally, the LCA methodology allows us to obtain global results associated with various environmental impact categories, such as global warming potential, acidification potential, eutrophication potential, or photochemical ozone creation potential, if different characterization methods are applied.

LCA only quantifies information about environmental impacts, excluding social and economic indicators. Similarly, certain environmental impacts associated with the product's life cycle, such as land use, biodiversity impacts, electromagnetic fields, noise, visual impact, or accidental risks, cannot be identified from the LCA perspective. Therefore, these environmental impacts will be analyzed separately in Section 3 of this EPD ("Additional Environmental Impacts").

2.2 Analysed system boundaries

This EPD is based on a comprehensive life cycle analysis of the energy generated at the San Jorge - El Mataco wind farm, which is distributed to the 132 kV grid. Therefore, the environmental impacts declared include the entire life cycle of wind energy, from cradle to grave, as defined in the PCR of the International EPD System.

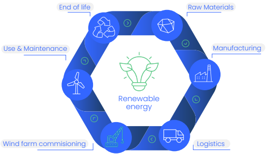
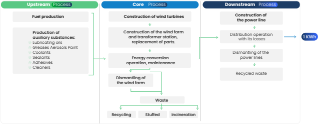


Figure 6
The life cycle of the energy generated in San Jorge - El Mataco

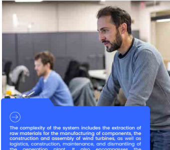
Regarding the temporal scope of the inventory, the information from the energy generation production system corresponds to the period from January to December 2022.

As required by the reference PCR, the complete life cycle has been divided into three major modules to clearly define the boundaries of the evaluated system: "upstream," "core," and "downstream." Additionally, the core and downstream modules have been further divided into the subdivisions "process" and "infrastructure." The following figure illustrates the boundaries of the evaluated system:

Ilustración Nº 3: Esquema descriptivo del sistema



System limits



The complexity of the system includes the extraction of raw materials for the manufacturing of components, the construction and assembly of wind turbines, as well as logistics, construction, maintenance, and dismantling of the generation plant. It also encompasses the infrastructure related to the electrical grid, both within and outside the wind farm, including the transformer substation and the connection to the 132 kV network. The wind farm operates under medium wind conditions (IEC II) and has a lifespan of 25 years.

The data used to create the LCA model in the Simapro 9.4 software were obtained directly by PCR or by its suppliers and contractors. This information ensures that the declared results accurately reflect the reality of the equipment installed at the San Jorge - El Mataco wind farm. The data used to create the LCA model are fully traceable, and their accuracy and consistency were reviewed during the verification process.

2.2.1 Upstream

The "upstream" module considers all environmental impacts related to the manufacturing of auxiliary substances necessary for the proper functioning of the San Jorge - El Mataco wind farm throughout its 25 years of operation.

Since wind energy does not require fuel for its operation, this module only includes the consideration of substances required during the preventive maintenance phase and their transportation to the installation site.

2.2.2 Core processes

Core module includes the stages of "core infrastructure" and "core operation."

Core Infrastructure

This stage represents the largest part of the life cycle of the energy generated at the wind farm, including all stages related to the construction and dismantling of the wind farm and its components. All impacts associated with the acquisition of raw materials, the manufacturing of installed equipment, its transportation, site construction, and final dismantling are part of this stage. The transportation of these elements to their final destination and the environmental impacts of their handling as waste are also included.

01

Wind Turbine Construction

The company Gri-Calviño Towers Argentina S.A. is responsible for the construction of steel towers and their transportation to the wind farms. All information related to this stage was collected from primary data provided by this company. Regarding the moving parts of the wind turbines, the supplier is Vestas Wind System A/S, and construction information was obtained from Ecoinvent 3.8 databases. The moving parts are designed to have a lifespan of 25 years; however, occasional failures requiring component replacement may occur. This estimated replacement has been considered in the study for the same number of years. The information was provided by the company through statistical data on the operational time of the wind farm, weighted over 25 years.

02

Wind Farm Construction

This stage considered the construction of foundations and management areas, with the necessary materials and energy consumption. It also included the construction of roads within the park, land adjustments, as well as the hours of crane and excavator work required for the installation of the wind turbines. The transportation of all wind turbine components includes both land and maritime transport. All necessary inputs for the construction of the transformer substation and the underground power lines connecting the wind turbines to the substation were included. It should be noted that the operation of the transformer substation is not part of PCR S.A., but its construction has been considered according to PCR 2007:08 v **5.0.1.**

03

Wind Farm Dismantling

This stage involves an end-of-life scenario for the wind farm, including the dismantling of the wind turbines and electrical installations within the park. Data for the end-of-life components were based on a hypothesis provided by the company, as no park has been dismantled to date. If the site were to be restored to its original state, part of the foundations above ground would need to be demolished. This concrete could be recycled, with foundations assumed to remain in place and covered with soil and vegetation.provided by the company through statistical data on the operational time of the wind farm, weighted over 25 years.

Core Operation

This stage encompasses the energy generation estimated over the 25-year lifespan. It includes the technical characteristics of the wind turbines, such as performance, efficiency, and the amount of energy they can extract from the wind.

To calculate the amount of energy the wind farm can generate annually, a specific energy generation report was requested. The analysis was carried out in different stages to ensure precision and reliability in the estimates.

01 Installation and On-Site Measurement

To obtain accurate data about the wind resource, a measurement mast was installed in the project area. The data collected were considered in the analysis only after at least two years of measurement with high availability.

02 Correlation with Long-Term Data

The on-site measured data were correlated with long-term series from the ERA5 dataset, allowing for a more robust projection of the wind resource over time.

03 Internal Evaluation

Based on the collected information, our team of wind energy specialists conducted a preliminary study using measured data and proprietary simulation models.

04 Local Validation

Subsequently, a locally specialized third party was hired to refine the analysis and adjust projections to the specific site conditions.

05 Independent Confirmation

Before seeking financing and finalizing project development, we consulted international specialized firms, such as Mott MacDonald, TÜV, or DNV. These firms conducted an independent validation of the studies, ensuring that the generation estimates meet the standards required by investors and financiers.

The analysis considered key factors impacting energy production, such as:

- **Wind Conditions at the Site:** Evaluation of wind speed, direction, and variability at different heights.
- **Turbine Power Curve:** Relationship between wind speed and the energy generated by each wind turbine.
- **Los Factors:** Including aspects such as wake effects, losses in electrical transmission and transformation, grid availability, blade soiling, and degradation.

2.2.3 Downstream processes

The "downstream processes" module encompasses all impacts that occur from the moment the energy is transmitted from the wind farm substation to the **132 kV high-voltage electrical grid**. This module represents two impacts:

01 Operation

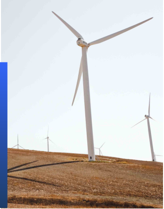
The environmental impact related to the unavoidable energy losses that occur along the line connecting the wind farm to the electrical grid, caused by the Joule effect. In Argentina, these losses represent approximately 3.9% of the kWh generated in the 132 kV network (CAMMESA, Annual Statistics 2005–2023, 2024).

02 Infrastructure

This impact involves two significant aspects: **the construction of the power line to the high-voltage grid** and **its subsequent dismantling**. For the San Jorge - El Mataco Wind Farm, the distance from the transformer substation to the connection with SADI (Argentine Interconnection System) in Bahía Blanca is 50 km, a line shared with other users.

The data used to model the construction of the line were taken from the Ecoinvent 3.8 database, calculated for Argentina based on the electricity transported via high voltage (133,228 GWh) over a distance of 53,360 km with a lifespan of 40 years, resulting in a value of 1.0E-08 km per kWh transported.

For the dismantling of the lines, the required energy was mainly diesel (Gervasio & Dimova, 2018), considering the crane work needed for the disassembly of the tons of double-circuit aluminum and steel high-voltage lines.



2.3 Assumed conditions, omissions and exclusions

2.3.1 Assumed conditions

The following are the main assumptions that influence the environmental impact results of the San Jorge - El Mataco Wind Farm:

- **The lifespan of the wind farm is estimated at 25 years. This applies to all components of the park,** except for the steel towers and their foundations, for which a lifespan of 50 years was considered. All components related to cabling and the transformer substation were considered to have a 25-year lifespan, although they may have a longer useful life. Vestas Wind System A/S is aware that its turbines may last longer than the period considered; some turbines reach 30 years or more, which could affect the results and was considered in the sensitivity analysis developed.
- **For transportation associated with end-of-life waste to the recycling operator,** a distance of 380 km is assumed.
- **For transportation associated with end-of-life waste to landfill disposal**, a distance of 58 km is assumed.
- **For inspection vehicle transportation**, a weight of 500 kg was assumed.
- **For crane transportation**, a weight of 500 tons was assumed.
- **SF6 is a potent greenhouse gas present in the transformer substation as an electrical insulator for switches.** Under normal operation, it can release 0.1% w/w of SF6 per year (Vestas, 2017). At the end of the wind farm's life cycle, the gas is collected and recovered for reuse; it is assumed that 95% of the gas can be recovered, while 5% is released into the atmosphere.
- **Although primary data on crane working hours for dismantling the wind turbines is available,** bibliographic information on demolition detailed in the core infrastructure was chosen for being a more conservative estimate. This approach generated 0.2% more environmental impact in the Climate Change category.
- **Regarding emissions or consumption derived from biogenic sources,** the storage of biogenic carbon is not permitted when calculating the results of the GWP-biogenic parameter. Instead, a virtual emission of biogenic CO2 is added during the final life stage to balance absorption and emission.

2.3.2 Cut-off criteria

All elements from which information was obtained have been included. However, given the complexity of the system and the amount of information required, the following 1% cut-off rules were applied:

01 The sum of all material flows excluded from the analysis is less than 1% of the total material flows: entries related to small parts.

02 The sum of all energy flows excluded from the analysis is less than 1% of the total energy flows.

03 If a flow meets the exclusion criteria but has environmental relevance (i.e., the environmental impact of that flow exceeded 1% of the total environmental impact for that category), it was included.

2.4 Environmental profile

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

The CFs are based on version 3.1 of the reference package for CFs used in the PEF framework (EF 3.1). The results have been divided into different stages, as described in the previous sections. The EPD verifier had detailed access to the Life Cycle Assessment information supporting this statement. It is important to remember that the Functional Unit to which all values in the tables refer is: ***1 KWh of energy generated at the San Jorge - El Mataco wind farm, distributed to a 132 kV high voltage grid.***

RESULTS OF THE ENVIRONMENTAL PERFORMANCE INDICATORS

IMPACT CATEGORY INDICATORS									
FU: 1 kWh net of electricity generated and distributed			Upstream	Core	Core	Total Generated	Downstream	Downstream	Total Distributed
Parameter		Unit	Process (U)	Operation (C)	Infraestructure (C)		Operation (D)	Infraestructure (D)	
Global Warning Potential (GWP)	Fossil	kg CO_2 eq.	4.22E-05	4.34E-04	5.22E-03	**5.69E-03**	2.22E-04	1.23E-03	**7.14E-03**
	Biogenic	kg CO_2 eq.	4.75E-08	1.37E-05	1.15E-04	**1.29E-04**	5.03E-06	3.77E-06	**1.38E-04**
	Land use and land transfomrmation	kg CO_2 eq.	2.17E-06	4.80E-06	6.59E-06	**1.36E-05**	5.29E-07	2.70E-06	**1.68E-05**
	Total	**kg CO_2 eq.**	**4.44E-05**	**4.53E-04**	**5.34E-03**	**5.84E-03**	**2.28E-04**	**1.23E-03**	**7.30E-03**
Ozone Layer Fepletion (ODP)		kg CFC-11 eq.	1.51E-11	6.01E-11	8.47E-10	**9.22E-10**	3.60E-11	9.52E-11	**1.05E-09**
Acidication Potential (AP)		mol H⁺ eq.	2.89E-07	1.76E-06	4.58E-05	**4.78E-05**	1.86E-06	8.35E-06	**5.80E-05**
Eutrophication Potential (EP)	Aquatic freshwater	kg P eq.	1.17E-08	3.97E-08	9.40E-07	**9.91E-07**	3.86E-08	4.37E-07	**1.47E-06**
	Aquatic marine	kg N eq.	5.12E-08	4.70E-07	1.64E-05	**1.69-05**	6.60E-07	1.62E-06	**1.92E-05**
	Aquatic terrestrial	mol N eq.	4.87E-07	5.06E-06	1.80E-04	**1.86E-04**	7.24E-05	1.78E-05	**2.11E-04**
Photochemical Oxidant Creation Potential (POCP)		kg NMVOC eq.	5.80E-07	1.64E-06	5.03E-05	**5.25E-05**	2.05E-06	5.28E-06	**5.98E-05**
Eutrophication Potential (EP)	Metals and minerals**	kg Sb eq.	6.04E-10	3.67E-09	6.66E-08	**7.09E-08**	2.76E-09	5.20E-08	**1.26E-07**
	Fossil resources**	MJ, net calorific value	1.50E-03	6.39E-03	6.98E-02	**7.77E-02**	3.03E-03	1.22E-02	**9.29E-02**
Water deprivaion Potential (WDP)**		m^3 world eq. deprived	1.65E-05	2.92E-04	2.25E-03	**2.56E-03**	9.97E-05	3.48E-04	**3.01E-03**

Table No. 4: Results of mandatory impact categories San Jorge - El Mataco

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

RESOURCE USE INDICATORS

USE OF RESOURCES									
FU: 1 kWh net of electricity generated and distributed			Upstream	Core	Core	Total Generated	Downstream	Downstream	Total Distributed
Parameter		Unit	Process (U)	Operation (C)	Infraestructure (C)		Operation (D)	Infraestructure (D)	
Primary energy resources - Renewable	Use as energy carrier	MU, net calorific value	2.26E-05	7.21E-04	2.02E-03	**2.76E-03**	1.09E-04	6.53E-04	**3.52E-03**
	Used as raw materials	MU, net calorific value	3.22E-05	2.74E-05	6.27E-04	**6.87E-04**	2.72E-05	2.23E-04	**9.37E-04**
	Total	**MU, net calorific value**	**5.48E-05**	**7.48E-04**	**2.64E-03**	**3.45E-03**	**1.36E-04**	**8.76E-04**	**4.46E-03**
Primary energy resources - Non Renewable	Use as energy carrier	MU, net calorific value	2.57E-06	2.33E-07	9.11E-06	**1.19E-05**	4.71E-07	7.81E-06	**2.02E-05**
	Used as raw materials	MU, net calorific value	1.50E-03	6.39E-03	7.36E-02	**8.15E-02**	3.32E-03	1.22E-02	**9.70E-02**
	Total	**MU, net calorific value**	**1.50E-03**	**6.39E-03**	**7.36E-02**	**8.15E-02**	**3.32E-03**	**1.22E-02**	**9.70E-02**

Table No. 5: Results of the use of primary resources San Jorge - El Mataco

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

IMPACT CATEGORY INDICATORS								
FU: 1 kWh net of electricity generated and distributed		Upstream	Core	Core	Total Generated	Downstream	Downstream	Total Distributed
Parameter	Unit	Process (U)	Operation (C)	Infraestructure (C)		Operation (D)	Infraestructure (D)	
Particulate matter emissions (PM)	Disease incidence	2.35E-12	2.68E-11	9.04E-10	**9.33E-10**	3.64E-11	9.65E-11	**1.07E-09**
Ionizing radiation, human health (IRP)*	kBq U235 eq.	5.87E-06	4.26E-05	4.22E-04	**4.71E-04**	1.84E-05	4.75E-05	**5.37E-04**
Eco-toxicity - freshwater (ETP-fw)**	CTUe	1.20E-03	1.16E-02	1.60E-01	**1.73E-01**	6.74E-03	4.03E-02	**2.20E-01**
Human toxicity, cancer effect (HTP-c)**	CTUh	3.33E-14	4.27E-13	1.10E-11	**1.15E-11**	4.47E-13	2.17E-12	**1.41E-11**
Human toxicity, non-cancer effect (HTP-nc)**	CTUh	8.43E-13	5.14E-12	1.60E-10	**1.66E-10**	6.48E-12	4.81E-11	**2.21E-10**
Land use related impacts/Soil quality (SQP)**	dimensionless	3.41E-04	6.02E-02	5.65E-02	**1.17E-01**	4.57E-03	1.57E-02	**1.37E-01**

Table No. 6: Results of additional impact categories San Jorge - El Mataco.

*This impact category primarily addresses the potential impacts of low doses of ionizing radiation on human health from the nuclear fuel cycle. It does not consider effects due to potential nuclear accidents or occupational exposure from radioactive waste disposal at underground facilities. The ionizing radiation potential of soil, due to radon or some building materials, is also not measured by this parameter.
**The results of this environmental impact indicator should be used with caution, as the uncertainties in these results are high or experience with the indicator is limited.

RESULTS OF THE ENVIRONMENTAL PERFORMANCE INDICATORS

Mandatory environmental information describing waste categories					
Results per 1 kWh net of electricity distributed (FU) - San Jorge - El Mataco					
Environmental information describing waste categories	Unit	Upstream	Core	Downstream	Total
Hazardous waste disposed (HWD)	kg	0.00E+00	1.60E-05	0.00E+00	
Non hazardous waste disposed (NHWD)	kg	0.00E+00	1.10E-04	0.00E+00	
Radiactive waste disposed (RWD)	kg	0.00E+00	0.00E+00	0.00E+00	
Volume of final repository necessary to deposit radioactive waste emanating from nuclear electricity used in up-and downstream processes, in case of nuclear power	m^3	0.00E+00	N/A	0.00E+00	

Table No. 8: Results of indicators describing waste for the Upstream and Downstream of San Jorge - El Mataco

RESULTS OF THE ENVIRONMENTAL PERFORMANCE INDICATORS

Mandatory environmental information describing output flows								
Results per 1 kWh net of electricity distributed (FU) - San Jorge - El Mataco		Upstream	Core	Core	Total Generated	Downstream	Downstream	Total Distributed
Environmental information describing output flows	Unit	Process (U)	Operation (C)	Infraestructure (C)		Process (D)	Infraestructure (D)	
Components for reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	0.00E+00	1.00E-06	9.70E-04	**9.71E-04**	0.00E+00	1.18E-09	**9.71E-04**
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table No. 9: Results of indicators describing outflows from San Jorge - El Mataco.

2.5 Interpretation of the results and conclusions

In order to identify the aspects that are mainly causing the environmental impacts stated in the previous section, it is necessary to examine each phase of the entire life cycle from a holistic perspective.

2.5.1 Interpretation of results

The following are the main environmental impact categories calculated for the San Jorge - El Mataco Wind Farm:

Global Warming Potential (kg CO2 eq) - GWP-total: The estimated total global warming potential resulted in an emission of 7.30E-03 kg CO2 eq to the atmosphere per functional unit. The most significant impact corresponds to the park's infrastructure stage, representing 73.17% of the GHG emissions of distributed energy. The downstream infrastructure contributed 16.90%, while the generation operation contributed only 6.20%.

Ozone Depletion Potential (kg CFC11 eq) - ODP: The ODP impact was 1.05E-09 kg CFC 11 eq per functional unit. As in all cases, the most relevant emissions originated from the park infrastructure, contributing 80.41%, followed by emissions from the construction of the power line distribution (9.03%) and the core generation (5.70%).

Acidification Potential (mol H eq) - AP: The estimated AP value was **5.80E-05 mol H+ eq,** where the park construction was the **primary critical point (78.86%),** followed by emissions generated by the downstream infrastructure (14.38%).

Eutrophication Potential - EP: The eutrophication potential values were 1.47E-06 kg P eq for EP-freshwater, 1.92E-05 kg N eq for EP-marine, and 2.11E-04 mol N eq for EP-terrestrial. In all three subcategories, emissions during park construction were the highest contributor. The EP-freshwater was affected by phosphorus emissions to water, generated by core infrastructure (64.08%) and downstream infrastructure (29.78%). The EP-marine was affected by nitrogen oxides (NOx) emitted to water and air, also influenced by the construction of the wind farm (85.42%). In the EP-terrestrial, like the previous ones, the highest incidence corresponded to the construction of the wind farm (85.50%), followed by emissions from the construction and dismantling of power lines in transmission (8.43%).

Tropospheric Ozone Formation Potential (kg NMVOC-eq) - POCP: The tropospheric ozone formation potential parameter is another impact that accounts for emissions to the atmosphere. The POCP was 5.98E-05 kg NMVOC eq, contributing significantly to the construction and end of life of the wind farm with 84.04 %.

Abiotic Resource Depletion Potential - minerals and metals (kg Sb-eq) - ADPminerals&metals: In the case of impacts related to resource consumption, ADPminerals&metals accounted for 1.26E-07 kg Sb eq, where depleted resources from infrastructure accounted for 53.02% and those from downstream infrastructure accounted for 41.37% of the impact. To a lesser extent, generation operation and transmission losses contributed 2.93% and 2.20%, respectively.

Abiotic Resource Depletion Potential - fossil resources (MJ, net calorific value) - ADPfossil: depleted resources resulted in 9.29E-02 MJ net calorific value, where resources from wind farm infrastructure depleted resources by 75.13 %, followed by resources depleted by downstream infrastructure (13.12 %) and by generation and maintenance operations (6.87 %).

Water deprivation potential (m3 global private eq.) - WDP: the water deprivation potential parameter, which includes the weighted water deprivation consumption affected by the availability of the water resource at the location where the process occurs, represented 3.01E-03 m3 global private eq. with a significant contribution coming from the construction of the park (74.84 %), being the main critical point. To a lesser extent (11.58%) the contribution from the construction of the downstream pipeline and 9.71% from the core of the operation.

As for the total non-renewable indicator (PENRT), it registered a value of 9.70 E-02 MJ distributed between the use of energy as raw materials (PERM) with a value of 9.70 E-02 MJ and the use as carriers (PERE) with a value of 2.02 E-05 MJ. The largest significant contribution to the PERM is made by infrastructure (75.86 %), followed by downstream infrastructure (12.58 %) and the generation process (6.58 %). While for the PERE the wind farm infrastructure contributed 45.11 % and downstream infrastructure 38.66 %, generation contributed 1.16 %.

3. ADDITIONAL ENVIRONMENTAL INFORMATION

As part of the application for the development of the San Jorge - El Mataco wind farm, numerous environmental studies have been carried out to inform the environmental impact assessment of the project.

The development of the project in a purely rural area means that there are virtually no potential receptors of potential impacts from the project. No dwellings near the wind turbines or third party activities that could be affected by the project were identified.

3.1 Biodiversity protection

We are committed to minimising our environmental impacts, preserving the environment and complying with all relevant environmental requirements.

In line with the care and preservation of the environment, we conduct 4 annual field surveys of birdlife and biodiversity in SJM park with specialised biologists (one for each station). Through the surveys, by the end of 2022, we developed ecological health indicators for SJM from the data collected during the year. In the studies, we monitor the coexistence between birds and wind turbines considering the migratory times of the park's species, protected species, breeding and nesting times. In addition, the park has a preventive programme for birds of prey, where, through the response to findings, carcasses are removed from the areas of influence to avoid collisions due to predation by birds of prey. As a result of the surveys, we found 10 bird and chiropteran carcasses in the park.

Habitat restoration or forest recovery policies occur mainly in the construction stages, where the quarry and construction site areas are remediated and, if trees are removed, at least an equivalent amount of the same or another species is planted.

In all works related to the renewable energy sector, we carry out an environmental baseline of birdlife and biodiversity, use of airspace, migratory birds, conservation status, abundance, richness, etc. Four monitoring activities are carried out per park, one at each station.

The biodiversity reports carried out in the works are for both bats and birds and study flights in the park, nesting areas, species with conservation category or vulnerable by means of vandage point, bats by means of mist nets, ultrasonic sonar, among other techniques.

The implementation of wind energy as an alternative to other traditional energy generation options has clear benefits for the environment. However, the implementation of this type of installation must always be carried out with the utmost care to protect the biodiversity of the area. Following detailed studies of the project, the proposed route was modified several times to avoid or minimise the impact on high quality native vegetation and important wildlife habitats, as well as reducing the overall size of the project to reduce the impact on native vegetation.

Wildlife

Migratory birds are one group that could be affected by the presence of the wind farm. Taking into account the spaced arrangement of the equipment in the field, this situation is minimised. It is considered that migratory birds follow routes that they frequent regularly; however, from the information available and based on sources consulted (Asociación Ornitológica del Plata), due to the lack of studies related to this subject, it is not possible to affirm the existence of migratory routes in the project area. The migratory routes of birds in Argentina are extensive. Another type of bird that may be affected are birds of prey, as collisions may occur if there are feeding points (carrion and/or dead animals) at the bases of the wind turbines. Finally, due to the presence of a marshland in the project area, consideration should be given to the potential impact on birds that, due to their feeding and/or nesting habits, use this sector and collide with part of the equipment during their ascent/descent. According to the baseline study of fauna in the EIA, no species with conservation risk status were identified in the project area.

Flora

According to the flora baseline study, no species with conservation risk status were identified in the project area.

3.2 Land use

Land use/land quality - SQP: the value was 1.34 E-01 with the energy generated accounting for 85.03% of the impact and the rest (14.97%) corresponding to transmission.

The land area occupied by the 51 wind turbines of the wind farm is **approximately 143,055 m2, which will be mainly occupied for 25 years by foundations, turbines and manoeuvring areas.** The areas affected by the construction of the wind farm were mainly pasture areas.

3.3 Environmental Risk Assessment

An environmental risk assessment was conducted to identify potential risks and their impacts, particularly those activities that, if not properly managed, could cause significant or long-term damage. The most likely risks during construction and operation activities are hydrocarbon spills; however, both transformers and wind turbines are equipped with containment systems and alert sensors.

Other identified risks include the occurrence of fires, both in installations and in open fields, which may result in soil degradation due to the loss of vegetation cover, thereby promoting erosion and the disappearance or alteration of wildlife habitats. The wind farm is equipped with detection methods and corrective actions.

3.4 Electromagnetic fields

The results of simulations and calculations carried out indicate that all environmental parameters analyzed for the 132 kV High Voltage Transmission Line (LAT), as adopted according to the Environmental Impact Assessment (EIA) of the San Jorge - El Mataco Wind Farm, comply with the requirements established by Resolution 77/98 of the Secretariat of Energy.

3.5 Noise

The main sources of noise during the operation stage of the project correspond to the noise generated by the wind turbines. Below are the noise propagation calculations carried out by Luz de Tres Picos SA in order to determine the potential impact generated by the wind farm on the surrounding areas.

The noise propagation calculations have been carried out with the DECIBEL module of the WindPRO 3.1 software, using the methodology established by ISO standard (ISO 9613-2).

The figure shows the results obtained by Luz de Tres Picos in the map of equivalent noise level lines (isophones) perceived by a receiver at a height of 1.5 m above ground level:

The noise generated in the different stages of the park's life cycle is detailed below:

01 Construction

Construction activities, such as the building of foundations and bases, cable installation, machinery operation, traffic movements, and turbine assembly, generally cause temporary increases in local noise levels. These disturbances during the construction phase are expected to be sporadic and discontinuous within the immediate vicinity of the project area. No disturbance to the population of Tres Picos is anticipated.

02 Operation

During the operation stage, mechanical and aerodynamic noise will be generated as a result of the operation of the wind turbines, which are evaluated in accordance with IRAM 4062 Standard to determine whether or not they qualify as noise nuisance to the environment. The sources of mechanical noise will be the gearbox, the transmission shafts and the wind turbine generator. The sources of aerodynamic noise will be the wind flow over the blades. This collision of the wind with the smooth surface of the rotor blades is called white noise. The simulations carried out in the theoretical study (ISO 9613-2, considering the wind speed in a westerly direction at 8 m/s) determined that the 45 dB(A) isophone was practically maintained within the wind farm site and that with the use of the STE (Serated Trailing Edge) noise reduction technology, the town of Tres Picos was not reached by the noise from the wind turbines. For this reason, this impact was considered to be neutral. In addition, compared with the baseline noise nuisance to the neighbourhood, it has been determined that there will be no impact on the population, especially because there are no settlements near the wind farm.

03 Dismantling

Noise generation in the abandonment stage is similar to that of the construction stage.

3.6 Visual impact

The impact on the local population through flickering indicated that, in the operation stage, the wind turbines as well as the rest of the tall structures will cast a shadow on the neighbouring areas when the sun is clear. The shadow modelling carried out showed that the project had no shadow and flickering impact on the town of Tres Picos, as it is not reached by the 0 (zero) hours/year (no shadows) isoline.

The visual impact of wind farms is directly proportional to the number of wind turbines, their size (tower height, blade length) and the distance of the colour of the cladding from the colour range of the surrounding area, and inversely proportional to the distance of the potential observer from the landscape scene where the wind turbines are located. The area is not located within a mountainous setting, which is considered to be of greater landscape sensitivity.

The wind turbines will be visible because there are no natural visual obstructions in the surrounding area. However, from distant distances, the stylised shape of the wind turbines contributes to blending into the landscape, partially mitigating the visual impact on the skyline. The simplicity of the layout pattern of the wind turbines makes them easily perceived as an orderly arrangement, which may or may not appeal to the observer. To this, other elements of the wind farm, such as ancillary buildings and internal roadways, must be added.

The beaconing is required as a way to make the wind turbines visible, according to the type and quantity required by the ANAC (National Civil Aviation Association). On the other hand, nearby populations can see these flashing lights at night, although this is not the case due to the distances to the nearest population centres.

The reflection and flashes produced by a wind turbine are due to the incidence of sunlight on the blades. As a way of quantifying this, the colour of the rotor and the distance to the nearest urban settlements are considered. To minimise this effect, anti-reflection paints are used on the equipment and distances of more than 10 times the rotor diameter from settlements.

The shadow cast by the tall structures can potentially affect motorists and/or casual passers-by, as the rotor blades intermittently cut off sunlight, generating a flicker known as shadowflicker. While these shadowflickers are harmless in terms of health and safety, they can be annoying in certain circumstances. This effect is mitigated by low rotation rates on three-bladed wind turbines and remoteness from population centres and/or external roads.

LINKS AND REFERENCES

PCR ENERGY
www.pcr.energy

PCR RENOVABLES
www.pcr.energy/renovables

PCR REPORTE DE SUSTENTABILIDAD 2023
www.pcr.energy/wp-content/uploads/2024/11/PCR-Reporte-de-Sustentabilidad-2023-baja_compressed-7mb.pdf

GRI CALVIÑO TORRES ARGENTINA
www.gri.com.es/localizacion/gri-calvino-torres-argentina

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
www.iso.org

ECOINVENT CENTRE
www.ecoinvent.org

INTERNATIONAL EPD SYSTEM
www.environdec.com

GENERAL PROGRAMME INSTRUCTIONS
GPI 4.0, 2021; GPI 5.0.1, 2024.

PRODUCT CATEGORY RULES
PCR 2007:08 versión 5.0.1. Electricity, Steam and Hot/Cold Water Generation and Distribution (Product Category Rules (PCR), 2024).

IMPACT METHODS AND CLASSIFICATION FACTORS USED
www.environdec.com/Creating-EPDs/Steps-to-create-an-EPD/Perform-LCA-study/Characterisation-factors-for-default-impact-assessment-categories