ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025

Electricity generated at

Mt. Gellibrand 132 MW windfarm

Version: 1.0

Publication date: 2018-11-29

Validity: 2021-11-16

Registration number: S-P-01430

UN CPC 171 – Electrical energy

PCR 2007:08 UN CPC 171 & 173 - Version 3.0 - Electricity, steam, and hot/cold water generation and distribution

EPD®

acciona Energía

Content

1. Introduction

1.1

Environmental product declarations and the epd system

This document contains a declaration of the environmental impact (EPD) of the energy generated at Mt. Gellibrand wind farm in Australia, based on a Life Cycle Assessment (LCA). It also contains additional environmental information not based on the LCA according to the requirements of the relevant product category rules (PCR), including biodiversity protection measures in the area, on-site land use, main environmental risks and mitigation actions, generation of electromagnetic fields, noise and visual impact.

An Environmental Product Declaration is defined in the ISO 14025:2006 standard as the quantifying of the environmental data of a product according to the categories and parameters specified in the ISO 14040 family of Life Cycle Assessment standards, including additional environmental information when relevant.

The main objective of the International EPD® System is to help and support organisations communicating the environmental behaviour of their products (goods and services) in a credible and understandable manner.

The system thus offers a complete programme aimed at any organisation interested in developing and communicating EPDs according to ISO 14025:2006 as well as supporting other EPD programmes (e.g., national, sectorial, etc), seeking their cooperation and harmonisation and helping different kind of organisations to encourage the use of environmental assertions in the international market.

Environmental Product Declarations add a new dimension to the market, offering public information on the environmental behaviour of the products and services. The use of EPDs brings a great number of benefits both for the organisations developing them for their products as well as for those using the information published in them.

This EPD was prepared according to the rules of the International EPD System. The International EPD® System is a system for the international use of Type III Environmental Declarations, in accordance with ISO 14025:2006. Both the system and its uses are described in the General Programme Instructions (GPI).

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

- Product Category Rules, PCR 2007:08 version 3.0 CPC 171 & 173: Electricity, Steam and Hot/Cold Water Generation and Distribution, 2015-02-05.
- General Programme Instructions for Environmental Product Declarations, Ver. 3.0.
- 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)

Figure 1

Nordex-Acciona Windpower AW3000 Wind Turbine

1.2

ACCIONA Energy

Acciona Energy is a global operator in renewable energies, and one of the biggest in the world in terms of clean energies not linked to conventional electric power generation companies.

We produce clean, emissions-free power for more than six million homes throughout the planet, thus contributing to progress towards a more sustainable energy system that favours development without putting the environment at risk.

The company carries out this task increasingly competitively thanks to a permanent commitment to innovation, aimed at increasing the efficiency of their technological solutions in areas such as the remote operation and maintenance of facilities, energy storage and grid integration, among others.

With more than 20 years' experience in the sector, we are present in the main renewable technologies, covering activities involving the entire value chain – development, engineering and construction, operation and maintenance and the sale of energy.

All of this is joined by a global vocation with implementation in more than 20 countries on all continents, especially aimed today at the emerging markets with needs for sustainable solutions to drive their development.

acciona Energía

Solvency, reliability, experience and a global dimension are essential features in our corporate profile, making us a benchmark pure player in renewables as a developer, partner or service provider all over the world.

At Acciona we are convinced that renewables are the technologies with the greatest growth expectations in the 21st century given that only these offer a sustainable economical, social and environmental solution to the energy required by the world to drive its development.

Acciona Energy's business management system is certified according to the following international standards:

- **ISO 9001:2015**
  Quality management systems.
- **ISO 14001:2015**
  Environmental management systems.
- **OHSAS 18001:2007**
  Occupation health and safety management systems

1.3
Unit declared

This document represents the certified Environmental Product Declaration for the energy generated at Mt. Gellibrand windfarm.

In this context, the declared 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 declared unit, which in this case is:

"1 KWh of energy generated at the Mt. Gellibrand windfarm, distributed to a high voltage grid (66 KV) in Victoria, Australia".

The amount of energy used as reference flow has been 8,678,121 MWh. This reference flow represents the total net energy that the power plant is able to distribute to the grid during its 20 years of planned operation. This reference flow is the value that allows the subsequent referencing of all inputs and outputs, mentioned in the next sections, to the functional unit defined in the previous paragraph.

1.4
Description of the Product System Analysed

The product system analyzed is the Mt. Gellibrand windfarm, located in the Australian State of Victoria. The plant is located 25 km east of Colac and 17 km west of Winchelsea in the Colac Otway Shire on Victoria's Western Plains. The wind site area has been constructed around the southern and western sides of Mt. Gellibrand itself. These open and partly elevated plains make the site an ideal location for a wind farm.

The project boundaries have a total extension of 3,422 hectares, of which only 26.8 hectares are occupied by artificial elements (wind turbines, roads, buildings...). Mt. Gellibrand windfarm is characterized as a medium wind location, according to IEC classification (IEC-IIB Class).

Figure 2
Mt. Gellibrand location and lay-out

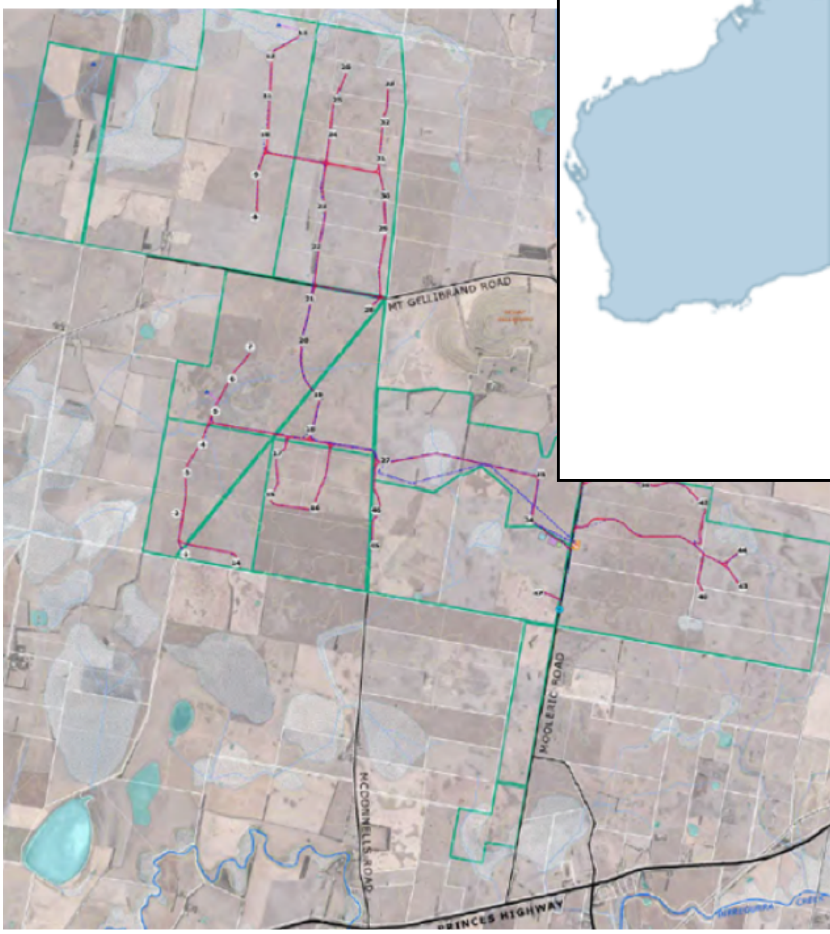
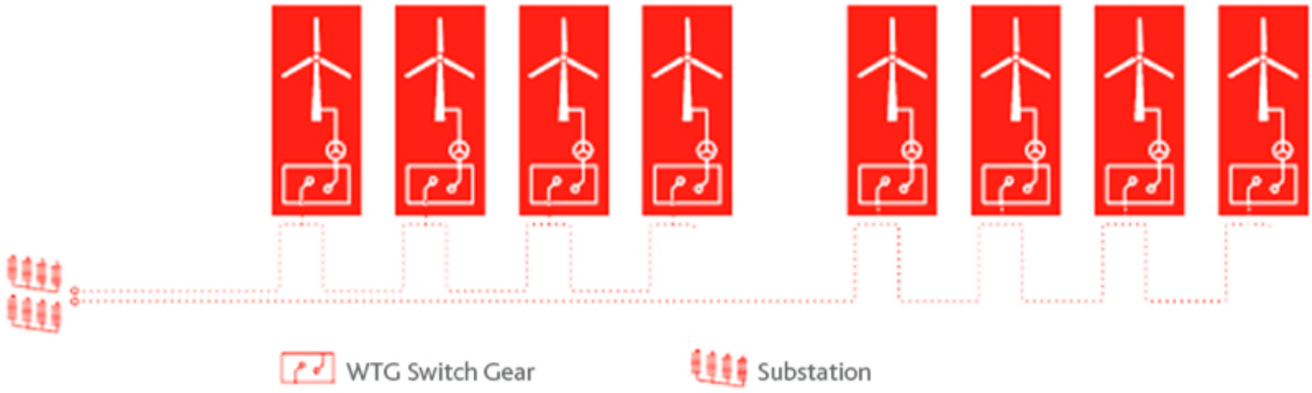


Figure 3

Wind turbine scheme



The Mt. Gellibrand windfarm, consists of 44 units of the AW125 / 3000 wind turbine of 3 MW nominal power and a rotor diameter of 125 meters, manufactured by Nordex-Acciona Windpower. Therefore, the resulting nominal power installed at Mt. Gellibrand is 132 MW. All the wind turbines are sustained using 87.5 meters high steel towers.

The construction of the site took place from April 2017 to August 2018, with the milestone of the grid connection and the beginning of the testing stage taking place in July 2018.

The basic operation of the windfarm may be divided into several well differentiated aspects. First, the wind energy is captured by the blades, which provide the rotating impulse to the main shaft of the wind turbine. The main shaft is connected to the gearbox, where the speed is increased before entering the electric generator.

AW wind turbines are designed to generate electricity at 12,000 volts, instead to the 690 volts common to other manufacturers. Once generated, the energy goes through the power cables installed inside the wind turbine tower until it reaches the transformer kiosks installed outside the tower, where the voltage level is increased to 33 KV. Subsequently, the energy is transported using 33 KV underground wires until the Mt. Gellibrand electrical substation, also located within the boundaries of the windfarm. In the substation, the energy is transformed to 66 KV in order to minimize the electrical losses that occur when transporting energy. Finally, from this point, the energy travels 4.7 additional kilometers through two high voltage lines reaching the already existing electrical energy network. This last point constitutes the limit of the analyzed system.

AW125/3000 WIND TURBINES

The AW3000 platform is the most advanced machine developed by Nordex-Acciona Windpower and its ultimate exponent in reliability and performance. The wide range of AW3000 wind turbines provide a low-cost generation of energy, which has been valued by the market with a remarkable commercial success all around the world.

The AW125 / 3000 wind turbine is the ideal solution for medium and low winds with low turbulence, being certified for IEC II-b and IEC III-a class wind locations. This platform is available with 87.5 meters high steel towers or concrete towers of 100m, 120m or 137.5m of hub height. For the specific case of Mt.Gellibrand, the towers used are 87.5 meters high steel towers.

We can divide the wind turbine system mainly into four large groups:

- The blades, which are responsible for capturing the energy from the wind and rotating the rotor. Each blade is 61 meters long, achieving a total rotor diameter of 125 meters with a sweep area of 12,305 m².
- The rotor or hub, is the rotating part in which the three blades of each wind turbine are fitted. It serves as connection piece with the nacelle.
- The nacelle constitutes the brain of the machine. Some of the critical systems for the correct operation of the wind turbine such as the gearbox or the electric generator are inside this sub-system.
- Finally, the tower is the main supporting element of the wind turbine. It allows the rotor to reach the necessary height to optimize the resource harvest. This sub-system is composed of four separate steel sections that are assembled on-site.

Table 1

Suppliers of the main groups of the turbine and their origin

GROUP	QUANTITY	ORIGIN	SUPPLIER
BLADES	132 units	Dafeng - China	tpi composites
AW3000 HUB	44 units	Val D'uixó - Spain	acciona Windpower
AW3000 NACELLE	44 units	Val D'uixó - Spain	acciona Windpower
87.5 m TOWER	22 units	Portland - Australia	Keppel Prince
	22 units	Banten - Indonesia	KORINDO WIND

ADDITIONAL ON-SITE ELEMENTS

Obviously, the wind turbine generators are the main assets installed at Mt.Gellibrand, in addition, a series of auxiliary elements are needed when building the wind farm. These additional elements, were also considered within the system boundaries when making the LCA model supporting this EPD.

We are referring to the underground foundations of the wind turbines, the transformer kiosks, the geotextile mesh used for the soil adaptation and the wiring networks common to all wind turbines.

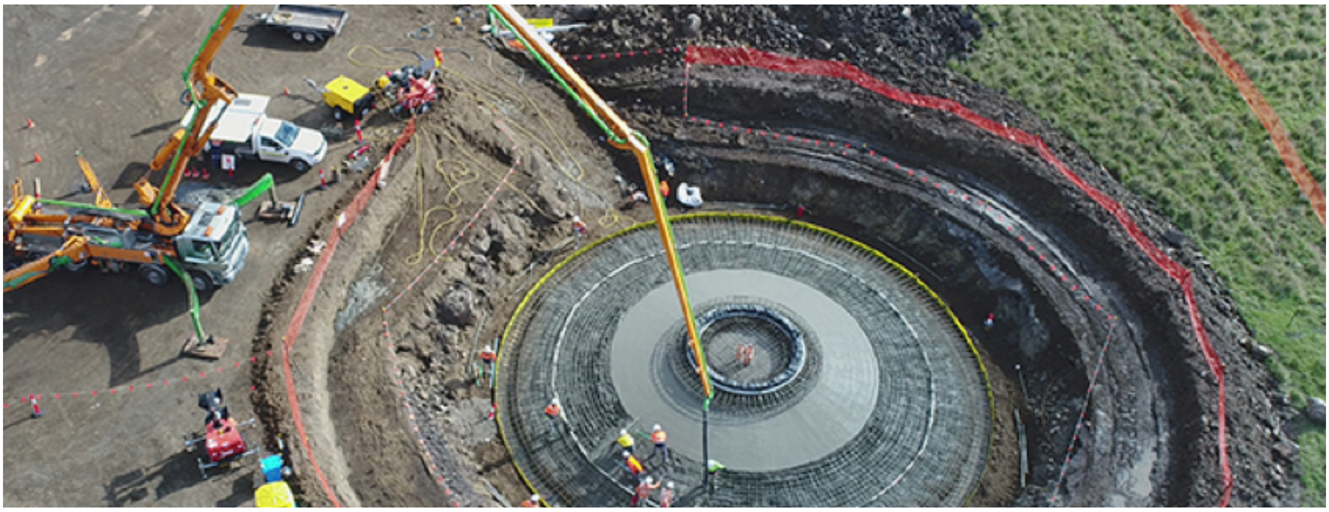
Table 2

Suppliers of the additional on-site elements

GROUP	QUANTITY	ORIGIN	SUPPLIER
WIND TURBINE GENERATOR FOUNDATIONS	44 units	On-site manufactured	CIVILEX
GEOTEXTILE MESH	170.82 Tonnes	Albury - Australia	TENCATE
TRANSFORMER KIOSKS	44 units	Wodonga – Australia	WILSON TRANSFORMER
UNDERGORUND 33KV WIRES	113.39 Km	Qidu – China	
EARTHING NETWORK	35.39 Km	Lilydale - Australia	Olex

Figure 4

Foundations at Mt.Gellibrand



MT. GELLIBRAND ELECTRICAL SUBSTATION

After leaving the wind turbines, the electricity generated is directed through the underground medium voltage wiring up to an electrical substation specifically built in Mt. Gellibrand to evacuate the generated energy from the windfarm into the general electricity grid. The information regarding the assets installed in the electrical substation has been gathered in order to include this group into the EPD. The following table, contains the main equipment installed in the Mt. Gellibrand electrical substation, identifying the providers and their location.

Figure 5

Mt. Gellibrand electrical substation & switchroom

Table 3

Main equipment installed in the Mt. Gellibrand electrical substation

GROUP	QUANTITY	ORIGIN	SUPPLIER
80 MVA POWER TRANSFORMER	2 units	Glen Waverley – Australia	WILSON TRANSFORMER
72.5 KV DEAD TANK CIRCUIT BREAKER	2 units	San Luís de Potosí – Mexico	ABB
72.5 KV DOUBLE BREAK DISCONNECTOR	2 units	Beijing - China	ABB
VOLTAGE TRANSFORMER	6 units	Ludvika - Sweden	ABB
42 KV SURGE ARRESTER	6 units	Wettingen - Switzerland	ABB
25 KV SURGE ARRESTER	6 units	Wettingen - Switzerland	ABB
150 KVA KIOSK TRANSFORMER	1 unit	Yangpu – China	ETSS
BLACK START GENERATOR	1 unit	Caidian – China	Cummins
NEUTRAL EARTHING RESISTOR	2 units	Ferntree Gully - Australia	CAPTECH POWER QUALITY SOLUTIONS
SWITCHROOM	1 unit	Lonsdale - Australia	RJE

CONNECTION LINE
TO THE GENERAL ELECTRICITY GRID

Finally, after reaching the Mt. Gellibrand electrical substation the energy has to be transported to the connection point with the general electricity grid in Victoria. In this case, the connection point is 4.7 km away, between the existing substation of Colac and Winchelsea. This connection line which is outside the Mt. Gellibrand boundaries, has been included in the LCA under the "downstream module".

Those 4.7 Km have been covered using two 3-phase AC overhead lines of aluminium conductors. The lines are supported using wooden poles and galvanized steel crossarms. Some additional electrical elements such as circuit breakers, disconnectors and transformers were needed to be installed in an extension of the Mt. Gellibrand electrical substation. All the elements related to this line have been built by the company Powercor. Despite not being under the direct responsibility of Acciona Energy, these additional elements were also included in the EPD within the downstream module.

Table 4

Origin of the materials for the connection line

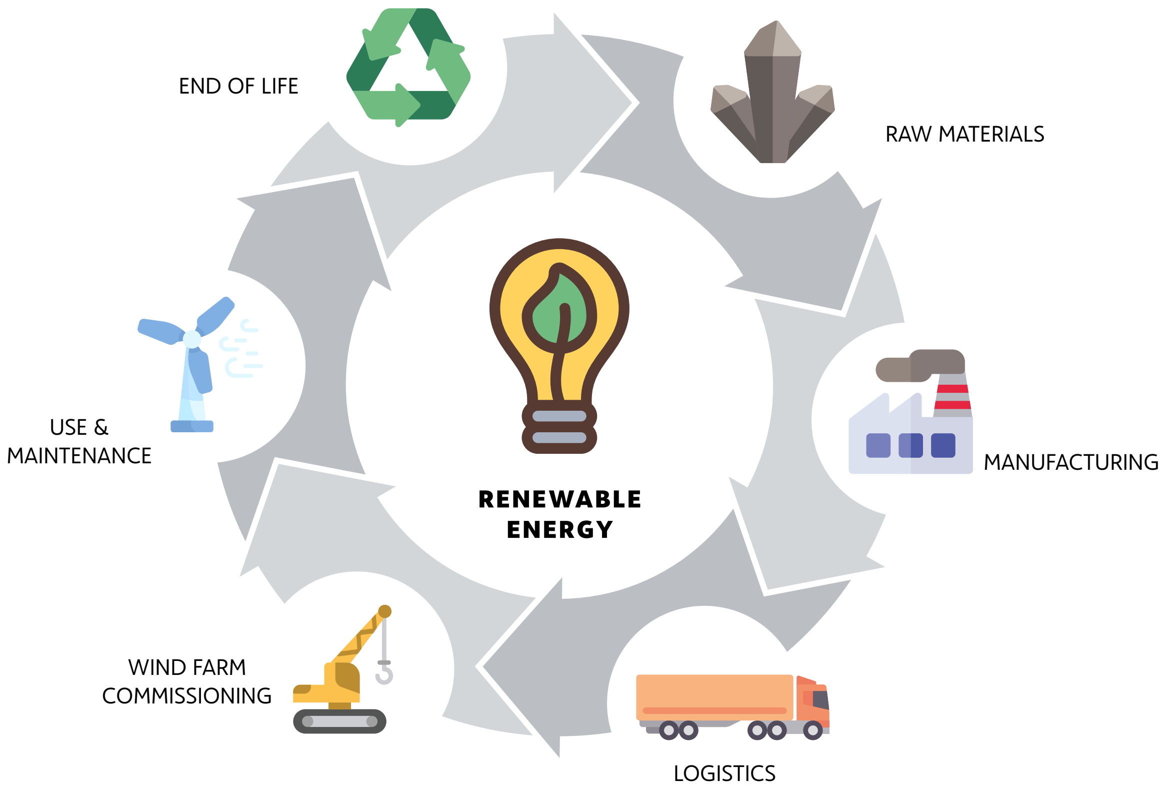
GROUP	QUANTITY	ORIGIN	SUPPLIER
WOODEN POLES	148.8 Tonnes	Trenayr - Australia	Koppers Wood Products
CROSSARMS & FITTINGS	12.1 Tonnes	Various	Powercor
CABLES & BUSBARS	37.8 Tonnes	Various	Powercor
ELECTRICAL EQUIPMENT	12.7 Tonnes	Various	Powercor
INSULATORS	30.3 Tonnes	China	Powercor
STRUCTURES	14.7 Tonnes	Geelong - Australia	Powercor

2. Environmental information based on LCA

2.1
Analysed system boundaries

This EPD is based on an exhaustive analysis of the life cycle of the energy generated at Mt. Gellibrand windfarm, which is distributed to the high-voltage Victorian grid. Because of this, the environmental impacts declared include the entire life cycle of the wind energy from cradle to grave.

Figure 6
The life cycle of the energy generated in Mt. Gellibrand windfarm

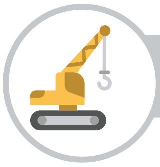


As required in the reference PCR, the complete life cycle has been divided into three large blocks to be able to clearly define the limits of the system assessed. These blocks are called upstream, core and downstream. In addition, the core and downstream blocks have been further split into the "process" and "infrastructure" sub-divisions. The following figure shows the limits of the system assessed.

Figure 7
System boundaries

UPSTREAM
Production of auxiliary substances

- Auxiliary substances production for maintenance.
- Infrastructures of the auxiliary substances suppliers.



CORE INFRASTRUCTURE
Construction and dismantling

- Raw materials consumption for the equipment
- Equipment Manufacturing

- Raw materials consumption in the construction stage
- Use of machinery at the construction site
- Waste management at the construction site
- Water consumption at the construction site

- Transport of equipment and materials

- Corrective and preventive maintenance

- Decommissioning of the plant and waste management

CORE PROCESS
Operation of the plant

- Electricity generation
- Maintenance travels
- Waste management under operation stage

DOWNSTREAM
Connection to the electrical grid

- Losses at the connection line
- Construction and decommissioning of electrical infrastructure

The data used to create the LCA model in the Simapro 8 software were obtained directly by Acciona Energy or by its suppliers and contractors. This information ensures that the declared results match the reality of the equipment installed in Mt. Gellibrand windfarm. The data used to create the LCA model are fully traceable and were reviewed during the external audit process, to verify the EPD's accuracy and consistency.

Acciona Energy's objective, was to include all the available information in the Life Cycle Assessment. At the end of the study, environmental information for 99.58% of the total mass flows of the wind power station was included.

Table 5

MT. Gellibrand Windfarm Total

GROUP	TOTAL THEORETICAL [Kg]	TOTAL COLLECTED [Kg]	% COLLECTED
AW3000 NACELLE / ROTOR	8,127,354.29	8,027,943.03	98.78%
87.5m TOWERS	10,031,679.79	9,852,846.86	98.22%
OTHER ELEMENTS	58,600,675.09	58,573,000.80	99.95%
ELECTRICAL SUBSTATION	910,457.38	889,283.60	97.67%
CONNECTION LINE	260,690.53	256,050.53	98.22%
TOTAL	**77,926,386.78**	**77,599,124.81**	**99.57%**

Starting from these site-specific data, the Ecoinvent 3.3 database was used to prepare the LCA model.

Ecoinvent is the life cycle inventories database most widely-used world-wide and contains consistent and transparent information. This database contains industrial level life cycle inventories on energy sources, resources extraction, provision of materials, chemicals, metals, waste handling and transport services, among others.

Likewise, in the verification audit it was found that less than 10% of the environmental impact came from values with a low-quality level, also called "proxy". These are data coming from commonly available data sources (e.g. commercial databases and free databases), used when no high-quality data are available at some point of the LCA.

The following sections detail the elements included in each module of the EPD, giving greater emphasis on the data sources and on their geographical and time validity.

2.1.1 UPSTREAM

The "upstream" module considers all the environmental impacts relating to the manufacture of auxiliary substances needed for the correct operation of Mt. Gellibrand wind farm throughout its 20 years of operation.

Given that wind energy requires no fuel for its functioning, this module only includes in consideration the needs for substances that must be consumed during the preventive maintenance stage and their transport to the site location.

The Acciona Energy operation and maintenance department, has defined a series of operational instructions that describe the main actions to be undertaken during this stage in the power station. These maintenance instructions are the main source used for the requirement of consumables. In this case, the following elements have been considered as the main preventative maintenance necessities.

Table 6

Preventive maintenance actions

Lubricating oil change
Hydraulic oil change
Grease lubrication
Air filters replacement
Oil filters replacement
UPS batteries replacement

2.1.2 CORE – INFRASTRUCTURE

The "core-infrastructure" module represents the greatest part of the life cycle of the energy generated at Mt.Gellibrand, including all the stages related to the construction and decommissioning of the Mt. Gellibrand power plant. All the impacts associated with the raw materials acquisition, the manufacture of the installed equipment, its transport to Australia, the site construction and its final decommissioning, compose this "core-infrastructure" module.

After the decommissioning of the power station, a series of equipment and materials which have to be handled appropriately as waste will appear. The transport of these items to their final destination and the environmental impacts of their handling as waste, are also part of the "core-infrastructure" module.

This module also includes the expected needs for corrective maintenance in the wind farm, including the reinvestment of some of the wind turbine components according to their estimated failure rates. Corrective maintenance activities have been considered for the following list of components.

Table 7

Component reinvestment

MAJOR COMPONENTS	MINOR COMPONENTS
Blade	Pitch cylinder
Gearbox	Pitch accumulator
Generator	Converter
Auxiliary services transformer	Top electronic boards
Kiosk transformer switchgear	Ground electronic boards
Main bearings	Yaw gear
Blade bearings	

All the data used for the Mt. Gellibrand LCA, were compiled during the period from April 2017 to August 2018, during the construction of the site. These data are nowadays considered fully representative of the reality of the power plant throughout its 20 years of operation. In future updates of this EPD, it will be checked that the representativeness of the critical data in the study remains at a suitable level.

MANUFACTURE OF THE EQUIPMENT AND TRANSPORT TO MT.GELLIBRAND

During the life cycle inventory preparation stage, in which the necessary information on the assets installed in Mt. Gellibrand was compiled, the relevant information was requested to all the involved suppliers and contractors. The main equipment suppliers provided Acciona Energy all the necessary information for preparing the wind farm's infrastructure LCA model. This included the suppliers of the nacelles and its subsystems, hubs, blades, supporting steel towers, kiosk transformers, the underground wiring and the equipment in the electrical sub-station.

The received information included data on material breakdowns, specific life cycle assessments of their products, detailed drawings, technical specifications, safety records and information on energy, water and raw material consumption during the manufacturing processes.

The information compiled for those equipment items, faithfully represents the technology actually installed at Mt.Gellibrand, so that the results can be considered representative of the life cycle of the wind farm as long as the equipment installed is not substantially modified.

For the logistics stage, the actual distances travelled by each item of equipment from its supplier to Mt. Gellibrand were analysed, also taking into account the transport means used. This information was obtained from the delivery dockets for each item of equipment acquired by Acciona Energy, and from the warehouse inventory records.

CONSTRUCTION WORK AND INSTALLATION OF THE SITE

Information on the environmental aspects during the site construction phase such as materials consumption, fuel consumption, water consumption and the handling of the wastes generated was collected on-site by the Acciona Energy team in Australia and the contractors involved in the work during the construction period of Mt.Gellibrand. Thanks to this effort, the results of the environmental impact are a faithful representation of the technological systems used for this stage in Mt. Gellibrand wind farm.

DECOMMISSIONING AND WASTE HANDLING

The decommissioning and end of life stage for Mt. Gellibrand is planned for 2039. It is evident that, despite there is a planning by Acciona Energy for undertaking this task, the eventual modifications in the waste treatment systems or in the Australian waste regulations requires us to adopt a theoretical destination for the waste flows that will be generated.

To estimate the end-of-life destination for all the materials and equipment at Mt.Gellibrand, the chapter "Decommissioning and rehabilitation plan" in the Mt. Gellibrand EMP (Environmental Management Plan) prepared by Acciona Energy before beginning the construction works was used as starting point. In addition, the wind turbine generator manufacturer (Nordex-Acciona Windpower), provided a specific wind turbine dismantling plan for the AW3000 model, which also served as a source of information. Likewise, to calculate the environmental impact of moving all the waste to each authorised manager, the current distance between Mt. Gellibrand and the main waste handling options in the area has been considered.

During the project decommissioning stage, all the current legal and environmental requirements will be met. The mechanical and other unused elements, will be removed and transferred for re-use, recycling or deposited in an authorised place in accordance with Australian waste regulation. After dismantling the equipment at Mt. Gellibrand, the previously occupied areas will be restored. This is a worst-case scenario, which ignores that the foundations and other infrastructure parts could be reused in their entirety.

A destination for each of the elements in the power station has been considered. For informative purposes, the following table contains the end of life scenario considered for the main elements in Mt. Gellibrand windfarm.

Table 8
Dismantling scenario

SYSTEM	END OF LIFE SCENARIO
Nacelle main frame	Composed entirely of spheroidal cast steel. This system is totally recyclable.
Main shaft assembly	This assembly is mainly formed by different steel pieces. The main shaft is made of high-alloyed forged steel, like the main bearings. The bearing frames are made of spheroidal cast steel while the rest of the lower weight elements are mainly made of common steel. The whole system is recyclable after dismantling.
Gearbox	First, the lubricating oil deposit must be emptied to be handled as a hazardous waste, taking the appropriate safety measures to minimize the risk of spillage. The oil can be recycled through companies dedicated to reprocessing, which regenerate it as another type of oil. The gearbox can be repaired and / or reused, according to its state of conservation at the end of service, so this route must be the priority. In case the route of repair is not considered interesting or viable, once the lubricant has been removed, the gear unit is composed of steel parts that can be dismantled and recycled. Finally, the remaining small rubber elements will be sent to a manager for disposal.
Generator	After disassembly, copper windings are usually recycled. The generator can be sent for repair. By replacing the copper windings, the generator can usually return to service, minimizing the loss of added value of the system. In case this option is not considered viable, the cover and the other elements made of steel, aluminium, copper or brass can be recycled as scrap. An authorized WEEE (waste electrical and electronic equipment) manager should manage the electric and electronic equipment. The GRP pieces, as well as the materials used for isolation purposes are assumed to be sent to landfill.
Nacelle cover	Currently, plastic pieces with a fiberglass matrix are not easily recyclable. It has been assumed that they will be disposed through landfill.
Blades	The blades are mainly composed of fiberglass, to which some other components of the family of the resins are added. Currently, these materials do not have viable processes of proven performance for their controlled recovery. It has been considered that their final destination will be the disposal in an authorized landfill.
Hub	The hub is entirely made of spheroidal cast steel, so it can be completely recycled. Due to the loads supported over its service life, the option to reuse it in other machines it is not usually considered.
Blade bearings	The blade bearings are made of steel, and therefore they can be completely recycled. It is not usual to repair them for their reuse.
Rotor cover	The pieces forming the rotor cover are entirely made of GRP (glass fiber reinforced plastic) and are not easily recyclable. These pieces will be disposed in an authorized landfill.
Tower sections	The sections, once dismantled and lowered at ground level, must be separated in order to facilitate its recycling as steel scrap.
Electrical cabinets	Once disconnected, the electrical cabinets can be disassembled. The cabinet cover and other metal elements can be recycled as scrap while the electrical and electronic components must be managed by an authorized WEEE manager for their proper recovery. The cables can also be recycled to recover the high-value metal conductors.
Transformer	The auxiliary transformer in the base of the tower, can usually be repaired for reuse by replacing the winding materials. In addition, the materials used to manufacture this type of equipment are metals with high added value for their recycling. It is recommended to look for a specialized manager in this kind of equipment.
Foundations	In case of needing to restore the site to its original state, it will be necessary to demolish all or at least part of the foundation footings, in order to be able to reestablish the original vegetation in the soil. The demolished concrete can be recycled as a granular material of filling, or as aggregate in new concrete used in activities of lesser demand (non-structural concrete). Turbine foundations for Mt. Gellibrand are assumed to stay in the ground as they can be covered.
Underground wiring	The underground electrical cables will remain in-situ after the windfarm decommissioning.
Electrical substation equipment	Equipment installed in the Mt. Gellibrand electrical substation must be safely removed from the station to be dismantled in parts. The oil contained in the transformers is a hazardous waste, which must be properly separated to be regenerated by an authorized manager. The porcelain in the insulators will be managed through an authorized landfill. Metal pieces can be recycled as scrap metal. It has been considered for the LCA that the rest of materials for which there is no pre-established destination, (small cables, small electronics, other plastics), will be sent to a landfill.

2.1.3 CORE – PROCESS

The "core-process" module represents the operation stage of Mt. Gellibrand. As well as including the wind turbines' technical features such as performance, efficiency and the amount of energy they can obtain from the wind, this module also includes the maintenance travel by the workers on-site during the service life of the wind farm as well as the appropriate handling of the generated waste during its 20 years of operation.

One of the critical factors of the analysis is the energy that the power station will be able to generate throughout its operational period. It has been estimated that the service life of the site will be 20 years, which is the time for which its operation licence lasts.

To calculate the amount of energy that the wind farm is able to generate annually, a specific energy generation report was requested to Acciona Energy's resource department. That energy generation report is based on over ten years of historic data from three meteorological towers located in the project area. The most critical factors related to energy generation in a windfarm were included, such as the wind class at the site, the availability and the power curve of the turbines. In addition, the energy losses caused by wake effects, electrical transport and transformation, grid availability, blade soiling and degradation were also considered when calculating the net energy generation.

To represent the reality of the environmental behaviour of Mt. Gellibrand wind farm more reliably, Acciona Energy plans to revise the LCA every three years to include actual generation data from the previous period.

The information used to simulate the workers' maintenance travel, includes the estimated fuel consumption of the 4x4 diesel vehicles on-site during 20 years. This aspect has been calculated based on the average fuel consumption of the vehicles actually present at the site and the expected annual use of every vehicle for maintenance purposes.

2.1.4 DOWNSTREAM

Finally, the "downstream" stage covers all the impacts that occur from the moment at which the energy leaves the Mt. Gellibrand sub-station transformer until it reaches the connection point with the Victorian electricity grid at 66 kV, located between the neighbouring sub-stations of Colac and Winchelsea.

This downstream module represents two separate impacts. The first one, is the environmental impact related to the unavoidable power losses that occur in the line connecting Mt. Gellibrand with Colac and Winchelsea, caused by the Joule effect. This first impact is called specifically "downstream – process" in the context of the EPD.

The second environmental impact is associated with the construction and dismantling of the connection line. This second impact is called "downstream – infrastructure."

The high voltage overhead power line that had to be built, has a total length of 4.7 km and allows the energy generated by the wind farm to be delivered to the Victorian electricity grid. The model includes the wires and wooden poles, with information provided by the contractor who built this network. The power losses in this line were considered to be 0.638% of the total energy generated in Mt. Gellibrand.

2.2 KEY ASSUMPTIONS, CHOICES AND LIMITATIONS

According to the EPD system general rules, in the points of the LCA model where multifunctional processes were found, the cut-off allocation approach was used to resolve multifunctionality issues, including the allocation regarding waste treatment burdens. When modelling the reused and recycled outflows of the system, the allocation procedure according to the polluter pays principle described in Annex A.6.2 of the EPD System General Programme Instructions was used. No system expansion was used within this study, meaning that no benefits or credits beyond the system boundaries were included in the results.

Likewise, a 1% cumulative cut-off criterion was used when making the life cycle inventory. Nonetheless, all the elements for which information was available have been included in the LCA, even if they were below a 1% individual cut-off. 99.57% of the material flows and all the energy flows of the system were considered in the study.

2.3 ENVIRONMENTAL PROFILE

The following tables contain the environmental performance of the energy generated by the Mt. Gellibrand wind farm from a complete life cycle perspective. The characterization factors for each of these impact categories have been extracted from the CML-IA environmental impact assessment methodology (version 4.8 - August 2016), the Intergovernmental Panel on Climate Change (IPCC 2013 – AR5) and the LOTOS-EUROS methodology as applied in the ReCiPe LCIA method 2008. See section 5, links and references, for more information.

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 that supports this declaration.

It is important to remember that the declared unit to which all the values in the tables are referred, is:

> *"1 KWh of energy generated at the Mt. Gellibrand windfarm, distributed to a high voltage grid (66 KV) in Victoria, Australia"*

Table 9

Environmental profile of the MT. Gellibrand Windfarm

Environmental profile	Unit	MT. GELLIBRAND 132 MW WIND FARM						
Potential environmental impact		1 kWh of electricity generated and distributed to a consumer at 66 kV						
		Upstream	Core process	Core Infrastructure	TOTAL GENERATED	Downstream process	Downstream Infrastructure	TOTAL DISTRIBUTED
POTENTIAL ENVIRONMENTAL IMPACTS								
Global warming potential (100 years)	g CO_2 eq	4.55E-02	2.48E-02	1.13E+01	**1.14E+01**	7.25E-02	5.69E-02	**1.15E+01**
Photochemical oxidation potential	g NMVOC eq	3.24E-04	3.33E-04	5.45E-02	**5.51E-02**	3.52E-04	4.42E-04	**5.59E-02**
Acidification potential	g SO_2 eq	2.67E-04	2.35E-04	7.62E-02	**7.67E-02**	4.89E-04	3.88E-04	**7.75E-02**
Eutrophication potential	g PO_4^{-3} eq	9.83E-05	4.26E-05	3.74E-02	**3.76E-02**	2.40E-04	1.99E-04	**3.80E-02**
EMISSIONS TO AIR WITH THE GREATEST CONTRIBUTION TO THE ENVIRONMENTAL IMPACT CATEGORIES								
Carbon dioxide, fossil	g	2.68E-02	2.41E-02	1.01E+01	**1.02E+01**	6.50E-02	4.57E-02	**1.03E+01**
Carbon dioxide, land transformation	g	3.46E-05	3.43E-06	2.35E-02	**2.36E-02**	1.50E-04	1.37E-04	**2.38E-02**
Carbon dioxide, biogenic	g	5.88E-04	5.96E-05	3.29E-01	**3.29E-01**	2.10E-03	7.93E-03	**3.39E-01**
Methane, fossil	g	1.04E-04	1.85E-05	3.31E-02	**3.32E-02**	2.12E-04	2.01E-04	**3.36E-02**
Methane, biogenic	g	2.27E-06	1.38E-07	2.67E-03	**2.67E-03**	1.71E-05	4.10E-06	**2.70E-03**
Carbon monoxide, fossil	g	5.80E-05	8.69E-05	8.40E-02	**8.41E-02**	5.37E-04	2.52E-04	**8.49E-02**
Dinitrogen monoxide	g	8.42E-07	8.54E-07	3.55E-04	**3.57E-04**	2.28E-06	1.60E-06	**3.61E-04**
Sulfur dioxide	g	2.01E-04	3.61E-05	4.42E-02	**4.44E-02**	2.84E-04	2.29E-04	**4.50E-02**
Sulfur hexafluoride	g	6.54E-07	2.08E-10	7.74E-07	**1.43E-06**	9.12E-09	1.65E-07	**1.60E-06**
Nitrogen oxides	g	8.24E-05	2.83E-04	3.48E-02	**3.52E-02**	2.24E-04	1.44E-04	**3.55E-02**
Benzene	g	5.56E-07	1.59E-07	6.56E-04	**6.57E-04**	4.19E-06	4.20E-06	**6.65E-04**
Ethane	g	9.96E-07	1.91E-07	2.90E-04	**2.91E-04**	1.86E-06	1.77E-06	**2.95E-04**
Pentane	g	2.21E-06	5.57E-07	1.65E-04	**1.68E-04**	1.07E-06	5.89E-07	**1.69E-04**
Ethanol	g	2.79E-08	5.48E-10	1.99E-04	**1.99E-04**	1.27E-06	1.11E-08	**2.00E-04**
Ammonia	g	2.18E-06	2.38E-07	9.54E-04	**9.56E-04**	6.10E-06	2.12E-05	**9.83E-04**
Hydrogen chloride	g	2.47E-06	2.48E-07	1.01E-03	**1.02E-03**	6.48E-06	1.39E-05	**1.04E-03**
Hydrogen fluoride	g	7.64E-07	2.90E-08	1.46E-04	**1.47E-04**	9.35E-07	3.81E-06	**1.51E-04**
NMVOC, non-methane volatile organic compounds	g	2.16E-04	4.12E-05	1.10E-02	**1.12E-02**	7.15E-05	2.61E-04	**1.15E-02**

Table 9

Environmental profile of the MT. Gellibrand Windfarm

Environmental profile / Potential environmental impact	Unit	Upstream	Core process	Core Infrastructure	TOTAL GENERATED	Downstream process	Downstream Infrastructure	TOTAL DISTRIBUTED
		MT. GELLIBRAND 132 MW WIND FARM						
		1 kWh of electricity generated and distributed to a consumer at 66 kV						
EMISSIONS TO WATER WITH THE GREATEST CONTRIBUTION TO THE ENVIRONMENTAL IMPACT CATEGORIES								
Phosphate	g	7.68E-05	3.53E-06	3.06E-02	**3.07E-02**	1.96E-04	1.66E-04	**3.10E-02**
Nitrate	g	2.17E-05	9.83E-07	7.68E-03	**7.70E-03**	4.91E-05	3.74E-05	**7.79E-03**
Hydrogen sulfide	g	4.22E-07	1.85E-08	2.45E-03	**2.45E-03**	1.56E-05	3.10E-07	**2.46E-03**
COD, Chemical oxygen demand	g	3.22E-04	8.05E-05	4.33E-02	**4.37E-02**	2.79E-04	1.00E-04	**4.41E-02**
EMISSION OF RADIOACTIVE ISOTOPES[1]								
C-14	Bq	6.40E-04	1.57E-04	3.71E-02	**3.79E-02**	2.42E-04	1.81E-04	**3.83E-02**
Rn-222	Bq	1.04E+00	1.08E-01	3.13E+02	**3.14E+02**	2.00E+00	2.06E+00	**3.18E+02**
Kr-85	Bq	1.22E-05	1.21E-06	3.04E-03	**3.05E-03**	1.95E-05	2.96E-05	**3.10E-03**
OTHER EMISSIONS TO AIR								
Particulates, <2,5 um to air	g	2.86E-05	2.80E-05	2.08E-02	**2.08E-02**	1.33E-04	7.14E-05	**2.11E-02**
Particulates, >10 um to air	g	2.32E-05	5.81E-06	1.92E-02	**1.92E-02**	1.23E-04	8.80E-05	**1.94E-02**
Particulates, >2,5 um and <10 um to air	g	1.00E-05	3.12E-06	1.25E-02	**1.25E-02**	8.00E-05	3.34E-05	**1.27E-02**
EMISSIONS OF TOXIC SUBSTANCES								
PAH, polycyclic aromatic hydrocarbons to air	g	9.84E-09	2.11E-08	4.32E-06	**4.35E-06**	2.78E-08	6.77E-08	**4.45E-06**
PAH, polycyclic aromatic hydrocarbons to water	g	8.72E-09	2.34E-09	2.12E-06	**2.17E-06**	1.36E-08	3.12E-09	**2.14E-06**
Arsenic to air	g	6.32E-08	5.60E-10	1.82E-05	**1.83E-05**	1.17E-07	6.60E-08	**1.84E-05**
Cadmium to air	g	2.25E-08	4.57E-10	5.70E-06	**5.73E-06**	3.65E-08	2.10E-08	**5.78E-06**
Dioxins to air	g	3.29E-13	3.85E-15	2.04E-11	**2.07E-11**	1.32E-13	4.63E-14	**2.09E-11**
EMISSIONS OF OIL TO WATER AND SOIL[2]								
Oils, unspecified to water	g	9.27E-05	2.41E-05	2.49E-03	**2.61E-03**	1.66E-05	1.13E-05	**2.64E-03**
Oils, unspecified to soil	g	1.00E-04	2.61E-05	2.56E-03	**2.69E-03**	1.72E-05	1.06E-05	**2.72E-03**

[1] No direct emissions of radio-active isotopes occur on site. These are indirect emissions from the electricity mix value chain.

[2] No direct emissions of oil occur on site. These are indirect emissions from the electricity mix and the materials supply value chains.

Table 9

Environmental profile of the MT. Gellibrand Windfarm

Environmental profile	Unit	MT. GELLIBRAND 132 MW WIND FARM						
Use of resources		1 kWh of electricity generated and distributed to a consumer at 66 kV						
		Upstream	Core process	Core Infrastructure	TOTAL GENERATED	Downstream process	Downstream Infrastructure	TOTAL DISTRIBUTED
NON-RENEWABLE MATERIAL RESOURCES								
Gravel	g	3.69E-03	8.18E-04	4.32E+01	**4.32E+01**	2.76E-01	1.44E-02	**4.35E+01**
Iron	g	5.43E-04	4.12E-04	2.47E-00	**2.47E-00**	1.58E-02	2.75E-03	**2.49E-00**
Calcite	g	8.86E-04	1.74E-04	1.72E-00	**1.72E-00**	1.10E-02	1.20E-03	**1.73E-00**
Clay, unspecified	g	5.16E-04	2.69E-05	4.33E-01	**4.34E-01**	2.77E-03	1.34E-03	**4.38E-01**
Sodium chloride	g	3.55E-04	4.38E-06	1.76E-01	**1.76E-01**	1.12E-03	5.99E-04	**1.78E-01**
Chromium	g	1.44E-05	3.98E-06	7.58E-02	**7.58E-02**	4.84E-04	5.92E-05	**7.64E-02**
Colemanite (Ore)	g	3.22E-06	2.56E-09	7.36E-02	**7.36E-02**	4.70E-04	6.78E-08	**7.41E-02**
Nickel	g	2.49E-05	3.07E-06	4.46E-02	**4.47E-02**	2.85E-04	3.97E-05	**4.50E-02**
Manganese	g	1.32E-04	2.73E-06	4.12E-02	**4.13E-02**	2.63E-04	3.84E-05	**4.16E-02**
Gypsum	g	1.01E-05	1.91E-06	3.57E-02	**3.57E-02**	2.28E-04	2.60E-05	**3.60E-02**
Clay, bentonite	g	1.36E-05	6.50E-06	2.78E-02	**2.78E-02**	1.77E-04	3.24E-05	**2.80E-02**
Magnesite (Ore)	g	9.73E-06	2.89E-06	2.29E-02	**2.29E-02**	1.46E-04	5.59E-05	**2.31E-02**
Aluminium	g	1.35E-04	1.24E-06	2.02E-02	**2.04E-02**	1.30E-04	1.01E-03	**2.15E-02**
Other non-renewable resources	g	5.95E-04	3.66E-05	6.76E-02	**6.82E-02**	4.35E-04	1.28E-03	**6.99E-02**
RENEWABLE MATERIAL RESOURCES								
Wood	g	4.89E-04	3.70E-05	2.35E-01	**2.36E-01**	1.50E-03	3.55E-02	**2.73E-01**
RESOURCES FROM RECYCLED ORIGIN								
Steel	g	-	-	5.66E-01	**5.66E-01**	3.61E-03	1.08E-03	**5.71E-01**
Aluminium	g	-	-	3.27E-02	**3.27E-02**	2.09E-04	3.17E-03	**3.61E-02**
Copper	g	-	-	8.06E-03	**8.06E-03**	5.15E-05	4.21E-04	**8.54E-03**
NON-RENEWABLE ENERGY RESOURCES								
Hard coal	MJ	8.83E-05	1.16E-05	4.96E-02	**4.971E-02**	3.17E-04	3.27E-04	**5.04E-02**
Brown coal	MJ	1.88E-05	1.71E-06	1.07E-02	**1.069E-02**	6.82E-05	4.18E-05	**1.08E-02**
Crude oil	MJ	1.34E-03	3.47E-04	4.02E-02	**4.190E-02**	2.67E-04	1.56E-04	**4.23E-02**
Natural gas	MJ	1.31E-04	1.83E-05	3.18E-02	**3.196E-02**	2.04E-04	1.40E-04	**3.23E-02**
Nuclear	MJ	3.14E-05	3.10E-06	1.05E-02	**1.056E-02**	6.74E-05	6.51E-05	**1.07E-02**

Table 9

Environmental profile of the MT. Gellibrand Windfarm

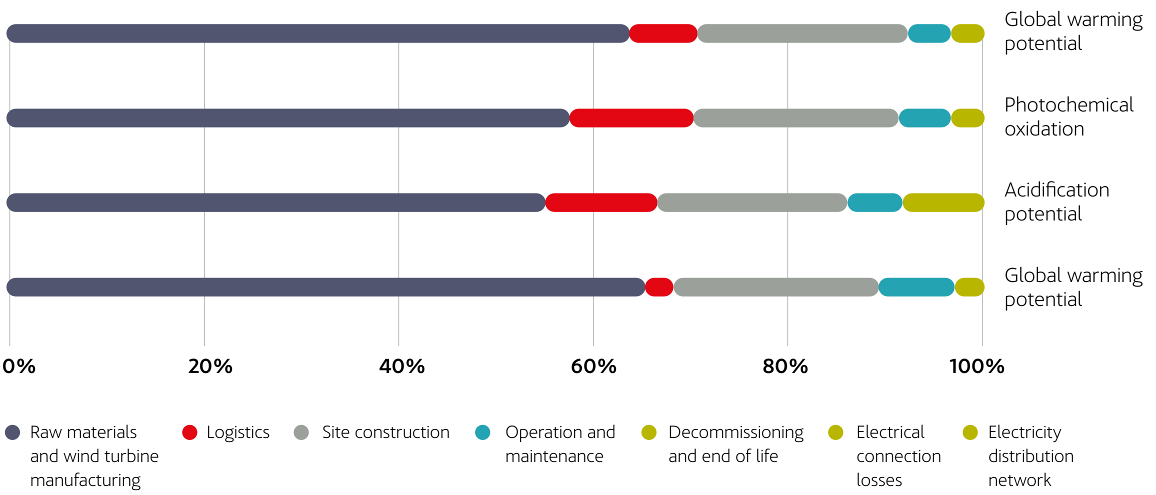
Environmental profile	Unit	MT. GELLIBRAND 132 MW WIND FARM						
Use of resources		1 kWh of electricity generated and distributed to a consumer at 66 kV						
		Upstream	Core process	Core Infrastructure	TOTAL GENERATED	Downstream process	Downstream Infrastructure	TOTAL DISTRIBUTED
RENEWABLE ENERGY RESOURCES								
Energy from hydropower	MJ	1.54E-05	1.35E-06	7.03E-03	**7.04E-03**	4.49E-05	4.04E-05	**7.13E-03**
Energy from biomass	MJ	8.64E-06	6.87E-07	4.40E-03	**4.41E-03**	2.82E-05	5.57E-04	**5.00E-03**
Wind energy	MJ	1.74E-06	1.70E-07	6.03E-04	**6.04E-04**	3.86E-06	3.60E-06	**6.12E-04**
Geothermal energy	MJ	1.02E-07	3.17E-08	1.26E-04	**1.26E-04**	8.05E-07	4.96E-07	**1.27E-04**
Solar energy	MJ	1.14E-08	2.10E-09	4.88E-05	**4.88E-05**	3.11E-07	8.75E-09	**4.91E-05**
Electricity use in Mt.Gellibrand	kWh	-	3.84E-04	-	**3.84E-04**	2.45E-06	-	**3.87E-04**
WATER USE								
Total amount of water used	m3	2.07E-07	3.30E-08	1.17E-04	**1.18E-04**	7.50E-07	3.31E-07	**1.19E-04**
Direct water use during operation	m3	-	-	-	**-**	-	-	**-**
HAZARDOUS WASTE – NON-RADIOACTIVE								
Hazardous waste - To landfill	g	-	-	4.15E-04	**4.15E-04**	2.65E-06	-	**4.18E-04**
Hazardous waste - To recycling	g	-	4.50E-04	4.20E-02	**4.24E-02**	2.71E-04	1.45E-03	**4.41E-02**
HAZARDOUS WASTE – RADIOACTIVE [3]								
Volume for deposit of low-active radioactive waste	m^3	3.95E-12	1.01E-12	1.40E-10	**1.45E-10**	9.24E-13	6.74E-13	**1.46E-10**
Volume for deposit of radioactive waste	m^3	2.25E-14	2.27E-15	6.36E-12	**6.39E-12**	4.08E-14	4.23E-14	**6.47E-12**
OTHER WASTE								
Non-hazardous waste - To landfill	g	-	1.81E-06	6.90E+00	**6.90E+00**	4.40E-02	3.96E-03	**6.95E+00**
Non-hazardous waste - To re-cycling	g	-	-	2.03E+00	**2.03E+00**	1.30E-02	2.44E-02	**2.07E+00**

[3] No direct radio-active waste is generated on site. These are indirect emissions from the electricity mix and the materials supply value chains.

2.4
Interpretation of the results and conclusions

In order to identify the aspects that are mainly causing the environmental impacts declared in the previous section, it is needed to look into every phase of the whole Mt. Gellibrand life cycle from an integral perspective.

Figure 8
Energy generated at Mt. Gellibrand windfarm



As can be seen in the figure above, the environmental profile is clearly dominated by two stages, the raw materials acquisition and wind turbine manufacturing and the site construction stage. These stages together, entail an impact between the 76% and 87% (depending on the category considered) of the total environmental impact for each KWh generated at Mt.Gellibrand.

It can be said that the tower, the blades and the main shaft assembly stand out as the most relevant environmental aspects of the raw materials life cycle stage. For the site construction stage, the construction of the foundation is the most relevant aspect.

Of the other stages of the life cycle, it should be noted that the logistics and the operation & maintenance stages also have a considerable impact. Logistics contributes 8.2% on average (2.8 – 12.6%, depending on the category considered), while operation & maintenance has an average contribution of a 5.6% (4.3 – 7.6%). The impacts related to these two stages, are mostly associated with the long-distance transport of the main components from Spain and Indonesia, as well as to the corrective maintenance activities expected for the components installed in the Mt. Gellibrand wind farm during its 20 years of operation.

The end-of-life stage, the electrical connection losses and the electricity distribution network stage, have a less significant contribution to the global results, as shown in the figure above.

3. Additional environmental information

As part of the Mt. Gellibrand wind farm development application, numerous environmental studies have been undertaken in order to inform the environmental impact assessment of the project.

3.1 Biodiversity protection

The implementation of wind energy as an alternative to other traditional power generation options, has evident benefits for the environment. However, the commissioning of this kind of facility must always be undertaken with great care to protect the biodiversity in the area. Several iterations were made to the proposed layout after detailed surveys for the project were undertaken to avoid, or minimise impacts on high quality native vegetation and significant fauna habitat, along with an overall reduction in project size to reduce the impact on native vegetation.

FAUNA MANAGEMENT PLAN

The Mt. Gellibrand wind farm site contains patches of native grassland which support native fauna. The Striped Legless Lizard (Delma impar) and the Golden Sun Moth are the only threatened fauna species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been located on the wind farm site.

The area in which the Striped Legless Lizard has been sighted has been excluded from development. A salvage protocol was developed, to be applied in the event of identifying any specimen within the development area during the construction phase. However, no Striped Legless Lizards were sighted during construction so the exclusion area was successful. During construction, native fauna is at risk of falling into and becoming trapped in open cable trenches or turbine footings, , so procedures to minimise this risk were followed. These procedures were effective, and no native fauna or livestock became trapped in excavations.

Impacts on native fauna during the operational phase are primarily associated with potential impacts on birds and bats arising from blade strike. A Bat and Avifauna Management Plan has been developed that outlines the inspection and management measures that will be implemented on the site during the first two years of operation to ensure the wind farm does not have a significant impact on birds or bats.

In addition to the native fauna protective measures, a pest animal management plan has also been implemented, seeking to ensure that the construction and operation of the Mt. Gellibrand wind farm does not lead to an increase in European Rabbit and Red Fox populations on the site. This plan, sets out a series of control and monitoring measures focused on ensuring that there is no increase in habitat or food supplies during construction and operation of the wind farm, preventing the number of pest animal species increasing.

VEGETATION MANAGEMENT PLAN

The wind farm site is located in the Victorian Volcanic Plain bioregion. The field assessment recorded fifty-nine flora species (37 indigenous and 22 non-indigenous) within the study area.

Adverse impacts on native vegetation were avoided where possible, particularly removal of vegetation. Where impacts cannot be avoided, impacts have been minimised through responsive planning and design, with input from relevant experts. Finally, appropriate offsets need to be identified to compensate for native vegetation removal. The proposed turbine layout for the project has been designed to meet the avoid and minimise principles of Victoria's Biodiversity Assessment Guidelines.

Vegetation at the Mt. Gellibrand wind farm site consists of the following:

- Introduced pasture across most of the site, supporting introduced species such as Cape Weed, Common Heron's-bill, Toowoomba Canary-grass, Rye grasses, Yorkshire Fog, Brown-top Bent, Spear Thistle and Flatweed.
- A combination of extensive and scattered areas of low to moderate quality native grassland vegetation. The most abundant native species in these areas includes Basalt Tussock-grass, Common Wheat Grass, Kangaroo Grass, Wallaby grasses, Spear grasses and Blue Devil. These areas occurred mostly amongst rocky outcrops.
- Scattered areas of low to moderate quality wetland vegetation within wet depressions.

Two species listed as poorly known were recorded within the study area during the assessments, Slender Bindweed and Basalt Tussock Grass. Two additional State- significant flora species, Pale Swamp Everlasting and Purple Blown-grass, were recorded during the assessments. Two national listed ecological communities were recorded within the study area (Natural Temperate Grassland of the Victorian Volcanic Plain and Seasonal Herbaceous Wetlands of the Temperate Lowland Plains). In addition, two state significant ecological communities were recorded within the study area (Western Basalt Plains Grassland Community and Western Basalt Plains (River Red Gum) Grassy Woodland).

Infrastructure has been sited, where possible, to avoid the listed flora species. Some native vegetation impacts cannot be avoided by the construction of turbines and associated infrastructure but, in these instances, habitat hectare calculations have been undertaken and offset requirements established. Emphasis is placed on avoiding and minimising impacts, and only after these steps have been taken, should offsets be considered.

3.2 Land use

The area on which the Mt. Gellibrand wind farm lies, is classified as "grazing modified pasture (code 3.2.0)" in the Australian Land Use and Management Classification (ALUM v8.0). The total area delimited by the project is 3,422.59 hectares of which 3,395.81 will remain unaffected after the construction of the site.

Table 10

Australian Land Use and Management Classification

	Area occupied (m²)	Area occupied (m²)
	Before the project	After construction
Pasture and grassland Livestock production (Sheep)	26,231,722	26,043,285
Pasture and grassland Livestock production (Beef cattle)	4,287,189	4,241,836
Pasture and grassland Mixed farming and grazing	3,413,740	3,379,754
Roads and tracks	293,274	467,231
Artificial elements	-	93,819
TOTAL	**34,225,925**	**34,225,925**

The 0.8% areas in which the wind farm construction has modified their initial classification, are now occupied by the following elements:

- Wind turbine foundations.
- Switching electrical sub-station.
- Control and storage buildings.
- Tracks and roads.

It should be noted that after the project decommissioning stage, planned for 2039, it is intended to restore all the affected areas of land to their original state.

3.3 Environmental risks

Acciona Energy always undertakes a risk assessment at the corporate level to identify the potential environmental impacts associated with the construction and operational activities and the risk these impacts present to existing environmental values.

The risk assessment considers raw or unmitigated risk, to clearly identify those activities, which unmanaged, are likely to cause major or long-term environmental damage. Implementation of some management actions will reduce the raw risk and result in the residual risk being within acceptable limits (as determined by legislation, guidelines or the relevant regulatory authority). It is thus possible to act before the occurrence of an unexpected event to minimise both the frequency of the possible risks and their possible effect on the natural environment.

Both the corporate standard and the internal procedure used indicate that the risk must be assessed by multiplying two factors, probability (forecast frequency of the accident scenario) and consequences (in environmental terms). Considering these two factors, 43 potential raw environmental risks were identified for Mt. Gellibrand, none of them classified as an extreme risk nor with catastrophic consequences. However, appropriate management and control actions were taken for every risk in the list, mitigating them to guarantee that Mt. Gellibrand is a low environmental risk installation.

3.4 Electromagnetic fields

An electromagnetic interference assessment was conducted by the energy resources department of Acciona Energy, in order to guarantee the fulfilment of all the requirements in the wind farm planning permit, including that a 50 metres clearance must be maintained to all the microwave point-to-point transmission paths. The electromagnetic interference assessment report concluded that with the current layout, no electromagnetic interferences will be generated by the Mt. Gellibrand wind farm.

3.5 Noise

CONSTRUCTION STAGE

Construction activities such as benching, footing construction, cable installation, operation of machinery, traffic movements and turbine erection generally cause temporary increases in local noise levels. In addition, in rocky terrain where the use of conventional excavation for turbine footings and cable installation was not feasible, blasting was used. Blasting results in both noise and vibration which may affect sensitive receptors.

The nearest noise receptors to the wind farm were analysed, and a noise control and reduction plan was set up in order to minimise the potential for nuisance or disturbance to sensitive receptors during the Mt. Gellibrand construction stage.

OPERATION STAGE

Noise during operations will be generated from the wind turbines and the substation. The Noise Impact Assessment confirms that the wind farm complies with the noise limit of 40dBA in the standard NZS6808:1998 'Acoustics – The Assessment

and Measurement of Sound from Wind Turbine Generators', currently in place in Victoria, at all assessed wind speeds and at all identified noise sensitive receptors.

DECOMMISSIONING STAGE

During the Mt. Gellibrand decommissioning phase, the main sources of sound pressure will be the use of machinery during disassembly and earthmoving and the movement of trucks on the access tracks. Since the operations are similar to those in the construction stage, the noise emissions for this stage are not considered a relevant aspect.

3.6 Visual impact

Before the start of the work, a complete landscape and visual analysis was made to identify, classify and assess the landscape reality of the spaces that would be affected in the project area.

Given the scale of the wind turbines, visual screening of them is not considered feasible. Landscape and visual impacts associated with some of the permanent above ground infrastructure (namely the operations and maintenance facility and switching and metering Substation) can however be effectively mitigated through the provision of appropriate screen planting.

Planted linear windrows are a central element of the predominating rural character of the project area, and as such linear planting bands suitably oriented will serve to effectively screen the above ground elements and simultaneously integrate them into the rural character of the area.

4. Information on the verification and contact

4.1
Information on the verification

Table 11

EPD Programme	EPD International AB Box 210 60, SE-100 31 Stockholm, Sweden www.environdec.com
Registration number	S-P-01430
Publication date	2018-11-29
Validity	2021-11-16
Geographical validity of the declaration	This declaration is valid for Mt. Gellibrand wind farm in Victoria, Australia
Scope of the declaration	From cradle to grave
Reference period for data used in LCA	April 2017 to August 2018
Independent verification of the data and declaration, as per ISO 14025:2006	⊗ EPD external verification ◯ EPD process certification
External individual verifier	Rob Rouwette, start2see Pty Ltd rob.rouwette@start2see.com.au
LCA study undertaken by	IK Ingenieria ik@ik-ingenieria.com
Reference product category rules (PCR)	PCR 2007:08 UN CPC 171 & 173 Version 3.0 Electricity, steam and hot/cold water generation and distribution
PCR review prepared by	Technical Committee of the International EPD® System Full list of members of the TC www.environdec.com/TC
PCR prepared by	Technical Committee of the International EPD® System PCR moderator: Mikael Ekhagen - Vattenfall mikael.ekhagen@vattenfall.com
Name of the company and contact	Acciona Energy Av. Ciudad de la Innovación, 5 – 31621 Sarriguren, Navarra (Spain) Phone number: +34 948 00 60 00 e-mail: maria.montero.tineo@acciona.com www.acciona-energia.com

4.2
ADDITIONAL CLARIFICATIONS

- Neither the verifier nor the program operator are responsible for the legality of the product.
- Environmental Product Declarations of the same product category but from different programmes may not be comparable.
- In accordance with the reference PCR, the use stage of the electricity has been omitted, given that it may have various functions in different contexts.
- The links and references section, contains sources to obtain additional material on the methods used.

5. Links and references

Acciona Energía España
www.acciona-energia.com/es

Acciona Energy in Australia
www.acciona-energia.com/in-the-world/oceania/australia/

Mt. Gellibrand Windfarm
www.acciona.com.au/projects/energy/wind-power/mt-gellibrand-wind-farm/

Nordex Acciona Windpower
www.nordex-online.com/en

International Organization for Standardization
www.iso.org

Ecoinvent centre
www.ecoinvent.org

Institute of environmental science / Leiden University
www.cml.leiden.edu

International EPD system
www.environdec.com

General Programme Instructions
https://www.environdec.com/The-International-EPD-System/General-Programme-Instructions/

Product Category Rules
https://www.environdec.com/PCR/Detail/?Pcr=5802

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/

Global warming potential: CML 2001 baseline Version: January 2016.

Photochemical oxidant formation potential: LOTOS-EUROS as applied in ReCiPe 2008.

Acidification potential: CML 2001 non-baseline (fate not included), Version: January 2016.

Eutrophication potential: CML 2001 baseline (fate not included), Version: January 2016.

ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025

Electricity generated at
Mt. Gellibrand 132 MW windfarm

Version: 1.0
Publication date: 2018-11-29
Validity: 2021-11-16
Registration number: S-P-01430

UN CPC 171 – Electrical energy
PCR 2007:08 UN CPC 171 & 173 - Version 3.0 - Electricity, steam, and hot/cold water generation and distribution