ENVIRONMENTAL PRODUCT DECLARATION

In compliance with ISO 14025

Product Name: Goldwind GWH182-5.3/6.2/7.2/7.5

Wind Turbine

Site Plant: Dafeng, Jiangsu Province, China

Program Operator:	EPDItaly
Publisher:	EPDItaly

Declaration Number	4
Registration Number	EPDITALY0508

Issue Date	30/11/2023
Valid to	30/11/2028

www.epditaly.it

1. General information

Program Information

Program Operator	EPDItaly Via G. De Castillia, 10 20124 Milan, Italy www.epditaly.com
Applied Standards	ISO 14040 & ISO 14044 – Life cycle assessment ISO 14025 - Environmental labels and declarations - Type III environmental declarations - Principles and procedures
PCR Information	ELECTRICITY PRODUCED BY WIND TURBINES EPDItaly 013 – rev. 1, issue date: 16-03-2020; validity: 15-03-2025;
CPC Code	UN CPC: 171 "Electrical energy"
Reference EPD System Document	Regulation of the EPDItaly Programme – rev. 5.2, issue date: 16-02-2022
Comparability	EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.
Liability	The owner of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any liability regarding the manufacturer's information data.
External Audit	This declaration has been developed referring to EPDItaly, following the Regulation of the EPDItaly Programme; further information and the document itself are available at: www.epditaly.it. Independent verification of the declaration and data, according to EN ISO 14025:2010. ☐ INTERNAL ☒ EXTERNAL Third Party Verifier: ICMQ Via Gaetano De Castillia, 10 20124 Milan, Italy www.icmq.it Accredited by ACCREDIA

EPD Owner Information

EPD owner	Goldwind Science & Technology Co., Ltd. www.goldwind.com.cn
Company Address	No.8 Boxing Yi Road, Beijing Economic & Technological Development Zone, Yizhuang, Beijing 100176, P. R. China
Company Contact	Yang Liwen yangliwen@goldwind.com
Product Name	Goldwind GWH182-5.3/6.2/7.2/7.5 wind turbine
Production Site	No.5, Xiang Feng Road, Dafeng Economic & Technology Development Zone, Yanchen, Jiangsu Province, P. R. China

2. Introduction

2.1 Company Information

Goldwind Science Technology company is the pioneer and witness in the growth and development of wind power industry in China. Today, with operations in strategic global markets, Goldwind is dedicated to leading clean energy development, energy conservation and environmental protection. As of April 2023, Goldwind has more than 100 GW of installed capacity of wind power, with more than 47 000 wind turbines operating worldwide. Goldwind Technology has been operating business in 6 continents and 38 countries and regions in the world, with close to 10 000 employees globally.

2.2 Scope and Type of EPD

Product name: GWH182-5.3/6.2/7.2/7.5 medium-speed permanent-magnet wind turbine
Product description: Goldwind GWH182-5.3/6.2/7.2/7.5 wind turbine features horizontal axis, three blades, upwind rotor, variable-speed variable-pitch regulation, medium speed drive train, and full-power converter. Goldwind GWH182-5.3/6.2/7.2/7.5 wind turbine is the third generation of the product route of medium speed and permanent magnet and features excellent power generation performance, high reliability, grid friendliness, and high adaptability. The wind turbine is also highly deliverable based on its modular design and the mature global supply chain of wind turbine components. The general details of the wind turbine can be seen in the Table 1 below.

Table 1. The general details of the wind turbine GWH182-5.3/6.2/7.2/7.5

General details		
Item	**Unit**	**Parameters**
Basic data of wind turbine		GWH 182-5.3/6.2/7.2/7.5
Manufacturer/Model		Goldwind Science & Technology Co., Ltd GWH 182-5.3/6.2/7.2/7.5
Rated power	kW	5,300 (GWH 182-5.3) 6,200 (GWH 182-6.2) 7,200 (GWH 182-7.2) 7,500 (GWH 182-7.5)
Class of wind zone		S
Design service life	year	≥ 25
Altitude of area where wind turbine is installed	m	0-2,000 (included)
Blades		
Manufacturer/Model		Sinoma90.2
Material of blade		Glass fiber reinforced resin
Swept area of wind turbine rotor	m2	26,016

Generator		
Manufacturer		Goldwind Science & Technology Co.,Ltd
Generator type		Permanent magnet
Rated power	kW	5,600 (GWH 182-5.3) 6,500 (GWH 182-6.2) 7,500 (GWH 182-7.2) 7,800 (GWH 182-7.5)
Rated voltage	V	1380V
Frequency range of generator	Hz	55~102 (GWH 182-5.3) 55~102 (GWH 182-6.2) 55~102 (GWH 182-7.2) 55~104 (GWH 182-7.5)
Protection class		IP54
Tower		
Type		Tapered steel tower (equipped with ladders and fall protection inside).
Anti-corrosion class		Internal: C3; external: C4
Electrical control system		
Type of control unit		PLC
Control type		Distributed control
Main switch cabinet		Beijing Etechwin Electric Co.,Ltd
Converter		
Number of phases	phases	3
Converter type		Full-power liquid-cooled converter
Main materials for the wind turbine production		
Fiberglass, Resin (polyester), Resin (Voltacast 3200), Balsa wood		
Stainless steel, Cast iron, Aluminium alloy, Alloy steel (42CrMo4), Q235-A steel, S355/S325 low alloyed steel, Copper, 65WH600 silicon steel sheet, Galvanized steel sheet.		

Geographical scope:

The study reflects production of GWH182-5.3/6.2/7.2/7.5 in China. The country grid average "CN: Electricity grid mix 1kV-60kV (China electric power yearbook)" of electricity applied for the manufacturing and assembling activities. The data for the production of electricity applied represent the country average. The data are based on the Gabi database and the mix of energy sources are presented in Figure 1.

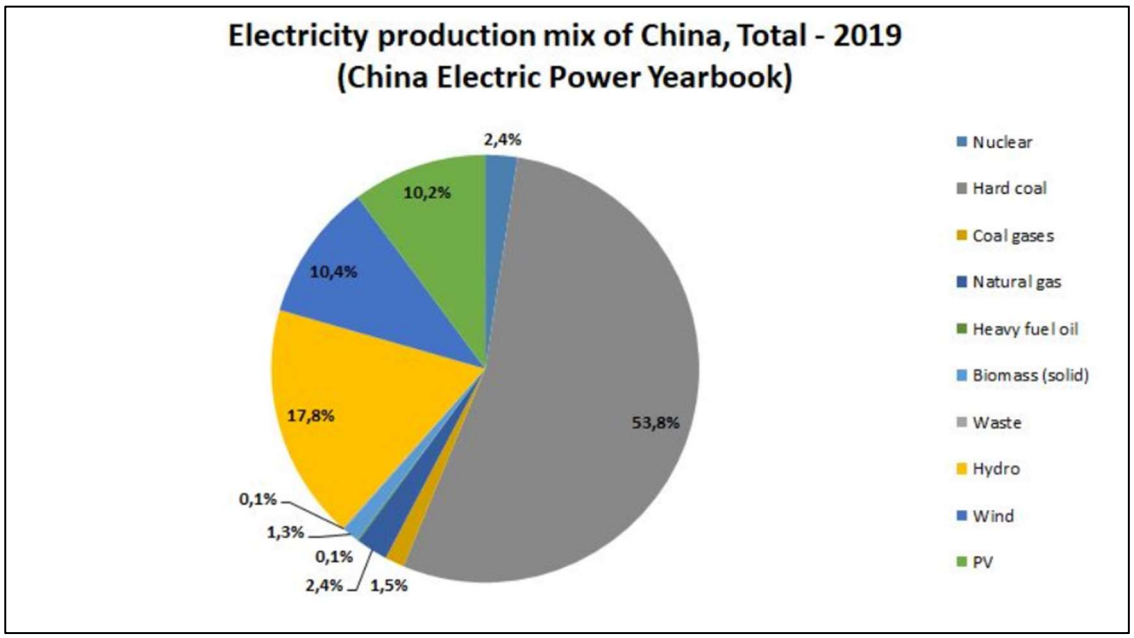

Figure 1. Mix of energy sources for electricity production.

The installation and operation site were chosen as the wind farm located in an exemplary Egypt wind scenario, while the purpose of this EPD is mainly to give an overall picture of the wind power production, which is the direct business of Goldwind, rather than focus on any particular wind farm location. For the power output, it is based on the theoretical calculation of the selected Egypt wind farm.

The Goldwind GWH182-5.3/6.2/7.2/7.5 wind turbine has been designed to operate under special design conditions（IEC S）. The GWH182-5.3/6.2/7.2/7.5 wind turbine's target markets meet North America, South America, Europe, Asia, Africa, and Australia. The Egypt wind farm is an exemplary scenario, which has been analyzed for mean WTG results and hub heights, which optimizes the produced energy.

Time representativeness: The reference year for this study is from Jun. 2022 to Jun. 2023. The data collected in the production process of each wind turbine components was based on the data of factory production in the whole year from Jun. 2022 to Jun. 2023.

Database(s) and LCA software used: The LCA-systems are modelled in the Gabi LCA software, with Gabi TS database and professional Ecoinvent 3.9.1 database.

Product system description

This study is a cradle-to-grave LCA, assessing the potential environmental impacts associated with electricity generated from GWH182-5.3/6.2/7.2/7.5 wind turbine and fed to the grid. An overview of the life cycle stages included in the LCA study are presented by the figure below.

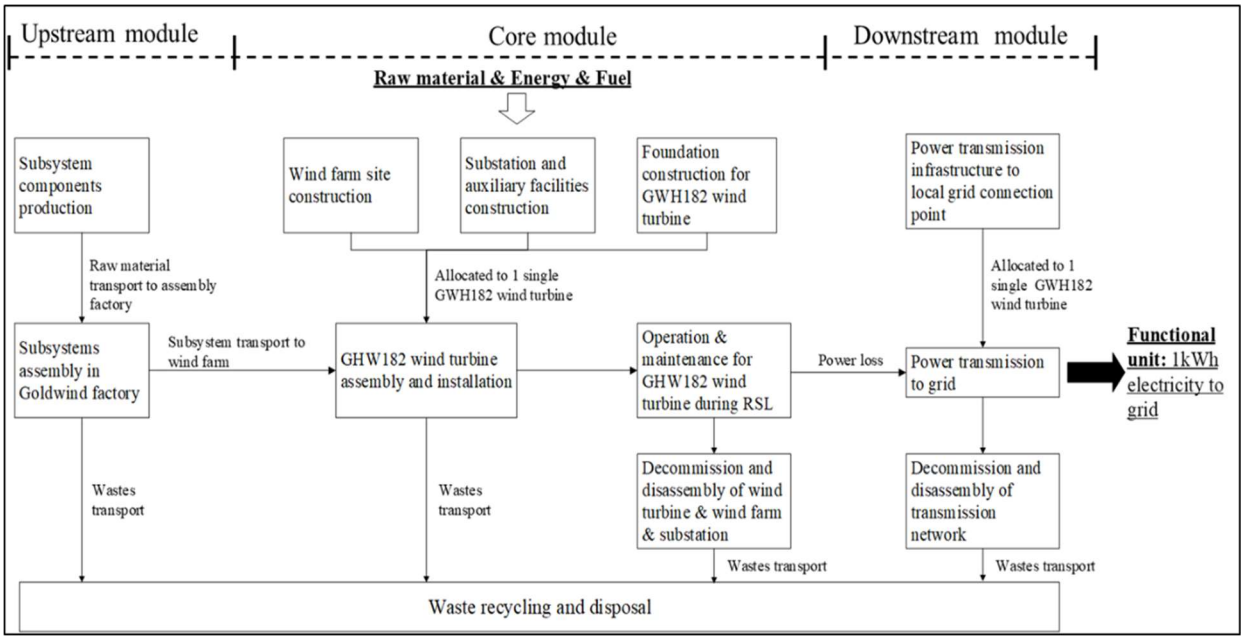

Figure 2. GWH182-5.3/6.2/7.2/7.5 wind turbine product system for LCA

Function Unit:

The functional unit of this LCA study is defined as:

1 kWh of electricity delivered to the grid by a 200MW wind farm of GWH182-5.3/6.2/7.2/7.5 wind turbines located in Ras Ghareb City, Egypt.

Total reference flow is 728,448.76 MWh for GWH182-5.3MW, 797,814.25 MWh for GWH182-6.2MW, 852,570.86 MWh for GWH182-7.2MW and 876,662.40 MWh for GWH182-7.5MW. They have been used to refer all the inputs and outputs of the system to 1 single kWh. This reference flow represents the whole net electricity generation from one GWH182-5.3/6.2/7.2/7.5 WTG under wind speed 9.3 m/s during its reference service life (RSL). A constant fixed RSL of 25 years was set.

Cut-off rules:

In this study, the cut-off criteria have been controlled of no more than 1% of materials and energy flows within the system controlled by the EPD holder. It follows the regulation of PCR and EPDItaly system.

3. Environmental performance

The environmental impact indicators determined by EN 15804:2012+A2:2019 are applied for the LCIA study. The total life-cycle environmental impact results of GWH182-5.3/6.2/7.2/7.5 wind turbine are shown by Table 2.

Table 2. The total environmental impact results of GWH182-5.3/6.2/7.2/7.5 wind turbine

GWH182-5.3MW						
Impact indicator	**Unit per declared unit**	**Upstream stage**	**Core-process**	**Core-infrastructure**	**Downstream stage**	**Total environmental impact**
Global Warming Potential total (GWP-total)	**kg CO_2 eq**	3.39E-03	2.29E-05	8.97E-04	1.04E-04	**4.41E-03**
Global Warming Potential total (GWP-fossil)	**kg CO_2 eq**	3.39E-03	2.29E-05	8.91E-04	1.04E-04	**4.41E-03**
Global Warming Potential total (GWP-biogenic)	**kg CO_2 eq**	-5.10E-06	3.76E-08	6.17E-06	1.09E-07	**1.22E-06**
Global Warming Potential total (GWP-luluc)	**kg CO_2 eq**	1.07E-06	1.08E-08	4.09E-07	1.84E-07	**1.67E-06**
Depletion potential of the stratospheric ozone layer (ODP)	**kg CFC-11 eq**	7.72E-12	8.93E-14	2.65E-12	1.49E-12	**1.19E-11**
Acidification potential, Accumulated Exceedance (AP)	**Mole of H+ eq**	1.08E-05	1.16E-07	4.50E-06	1.06E-06	**1.65E-05**
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	**kg P eq**	4.21E-08	2.94E-09	6.27E-08	5.75E-08	**1.65E-07**
Formation potential of tropospheric ozone (POCP)	**kg NMVOC eq**	7.44E-06	7.08E-08	3.71E-06	7.76E-07	**1.20E-05**
Abiotic Depletion for non-fossil resources potential (ADP-minerals & metals)	**kg Sb eq**	3.55E-08	7.81E-11	1.08E-08	5.83E-09	**5.23E-08**
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	**MJ**	4.60E-02	6.97E-04	9.32E-03	1.37E-03	**5.74E-02**
Water deprivation potential, deprivation-weighted water consumption (WDP)	**m^3**	8.32E-04	6.23E-06	1.82E-04	3.68E-05	**1.06E-03**
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	**MJ**	1.09E-02	9.61E-06	4.91E-04	9.39E-05	**1.15E-02**
Use of renewable primary energy resources used as raw material (PERM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	**MJ**	1.09E-02	9.61E-06	4.91E-04	9.39E-05	**1.15E-02**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	**MJ**	4.60E-02	6.97E-04	9.32E-03	1.37E-03	**5.74E-02**
Use of non-renewable primary energy resource used as raw material (PENRM)	**MJ**	MND	MND	MND	MND	**MND**

Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	**MJ**	4.60E-02	6.98E-04	9.32E-03	1.37E-03	**5.74E-02**
Use of secondary raw materials (MS)	**Kg**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of renewable secondary fuels (RSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of non-renewable secondary fuels (NRSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Net use of fresh water (FW)	**m^3**	2.48E-05	1.46E-07	4.47E-06	8.56E-07	**3.03E-05**
Hazardous landfill waste (HWD)	**Kg**	4.05E-11	1.17E-16	1.10E-13	1.79E-20	**4.06E-11**
Non-hazardous waste disposed (NHWD)	**Kg**	1.74E-04	4.26E-09	3.38E-05	9.54E-13	**2.08E-04**
Radioactive waste disposed (RWD)	**Kg**	6.17E-07	1.35E-10	2.42E-08	7.58E-15	**6.41E-07**
Components for reuse (CRU)	**Kg**	MND	MND	MND	MND	**MND**
Materials for recycling (MFR)	**Kg**	1.96E-06	0.00E+00	4.20E-04	1.26E-06	**4.23E-04**
Material for energy recovery (MER)	**Kg**	MND	MND	MND	MND	**MND**
Exported electrical energy (EEE)	**Kg**	MND	MND	MND	MND	**MND**
Exported thermal energy (ETE)	**Kg**	MND	MND	MND	MND	**MND**

GWH182-6.2MW

Impact indicator	Unit per declared unit	Upstream stage	Core-process	Core-infrastructure	Downstream stage	Total environmental impact
Global Warming Potential total (GWP-total)	**kg CO_2 eq**	3.09E-03	2.09E-05	8.26E-04	1.09E-04	**4.05E-03**
Global Warming Potential total (GWP-fossil)	**kg CO_2 eq**	3.10E-03	2.09E-05	8.20E-04	1.09E-04	**4.05E-03**
Global Warming Potential total (GWP-biogenic)	**kg CO_2 eq**	-4.65E-06	3.44E-08	5.66E-06	1.14E-07	**1.15E-06**
Global Warming Potential total (GWP-luluc)	**kg CO_2 eq**	9.75E-07	9.88E-09	3.82E-07	1.94E-07	**1.56E-06**
Depletion potential of the stratospheric ozone layer (ODP)	**kg CFC-11 eq**	7.05E-12	8.15E-14	2.50E-12	1.56E-12	**1.12E-11**
Acidification potential, Accumulated Exceedance (AP)	**Mole of H+ eq**	9.88E-06	1.06E-07	4.14E-06	1.11E-06	**1.52E-05**
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	**kg P eq**	3.85E-08	2.69E-09	5.92E-08	6.05E-08	**1.61E-07**
Formation potential of tropospheric ozone (POCP)	**kg NMVOC eq**	6.79E-06	6.47E-08	3.40E-06	8.16E-07	**1.11E-05**
Abiotic Depletion for non-fossil resources potential (ADP-minerals & metals)	**kg Sb eq**	3.24E-08	7.13E-11	1.07E-08	6.13E-09	**4.93E-08**
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	**MJ**	4.20E-02	6.37E-04	8.58E-03	1.44E-03	**5.26E-02**
Water deprivation potential, deprivation-	**m^3**	7.60E-04	5.68E-06	1.68E-04	3.87E-05	**9.72E-04**

weighted water consumption (WDP)						
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	**MJ**	9.94E-03	8.78E-06	4.56E-04	9.88E-05	**1.05E-02**
Use of renewable primary energy resources used as raw material (PERM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	**MJ**	9.94E-03	8.78E-06	4.56E-04	9.88E-05	**1.05E-02**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	**MJ**	4.20E-02	6.37E-04	8.58E-03	1.44E-03	**5.26E-02**
Use of non-renewable primary energy resource used as raw material (PENRM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	**MJ**	4.20E-02	6.37E-04	8.58E-03	1.44E-03	**5.26E-02**
Use of secondary raw materials (MS)	**Kg**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of renewable secondary fuels (RSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of non-renewable secondary fuels (NRSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Net use of fresh water (FW)	**m³**	2.27E-05	1.33E-07	4.12E-06	9.00E-07	**2.78E-05**
Hazardous landfill waste (HWD)	**Kg**	3.70E-11	1.07E-16	1.01E-13	1.94E-20	**3.71E-11**
Non-hazardous waste disposed (NHWD)	**Kg**	1.59E-04	3.89E-09	3.11E-05	1.03E-12	**1.90E-04**
Radioactive waste disposed (RWD)	**Kg**	5.63E-07	1.23E-10	2.26E-08	8.22E-15	**5.86E-07**
Components for reuse (CRU)	**Kg**	MND	MND	MND	MND	**MND**
Materials for recycling (MFR)	**Kg**	1.79E-06	0.00E+00	3.84E-04	1.37E-06	**3.87E-04**
Material for energy recovery (MER)	**Kg**	MND	MND	MND	MND	**MND**
Exported electrical energy (EEE)	**Kg**	MND	MND	MND	MND	**MND**
Exported thermal energy (ETE)	**Kg**	MND	MND	MND	MND	**MND**

GWH182-7.2MW

Impact indicator	Unit per declared unit	Upstream stage	Core-process	Core-infrastructure	Downstream stage	Total environmental impact
Global Warming Potential total (GWP-total)	**kg CO_2 eq**	2.90E-03	1.96E-05	7.81E-04	1.21E-04	**3.82E-03**
Global Warming Potential total (GWP-fossil)	**kg CO_2 eq**	2.90E-03	1.95E-05	7.75E-04	1.20E-04	**3.81E-03**

Global Warming Potential total (GWP-biogenic)	**kg CO_2 eq**	-4.36E-06	3.22E-08	5.32E-06	1.26E-07	**1.13E-06**
Global Warming Potential total (GWP-luluc)	**kg CO_2 eq**	9.12E-07	9.25E-09	3.68E-07	2.14E-07	**1.50E-06**
Depletion potential of the stratospheric ozone layer (ODP)	**kg CFC-11 eq**	6.59E-12	7.63E-14	2.44E-12	1.72E-12	**1.08E-11**
Acidification potential, Accumulated Exceedance (AP)	**Mole of H+ eq**	9.24E-06	9.88E-08	3.91E-06	1.22E-06	**1.45E-05**
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	**kg P eq**	3.60E-08	2.51E-09	5.79E-08	6.67E-08	**1.63E-07**
Formation potential of tropospheric ozone (POCP)	**kg NMVOC eq**	6.36E-06	6.05E-08	3.20E-06	8.99E-07	**1.05E-05**
Abiotic Depletion for non-fossil resources potential (ADP-minerals & metals)	**kg Sb eq**	3.04E-08	6.67E-11	1.11E-08	6.76E-09	**4.82E-08**
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	**MJ**	3.93E-02	5.96E-04	8.12E-03	1.58E-03	**4.96E-02**
Water deprivation potential, deprivation-weighted water consumption (WDP)	**m^3**	7.11E-04	5.32E-06	1.59E-04	4.27E-05	**9.18E-04**
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	**MJ**	9.30E-03	8.21E-06	4.35E-04	1.09E-04	**9.86E-03**
Use of renewable primary energy resources used as raw material (PERM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	**MJ**	9.30E-03	8.21E-06	4.35E-04	1.09E-04	**9.86E-03**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	**MJ**	3.93E-02	5.96E-04	8.12E-03	1.59E-03	**4.96E-02**
Use of non-renewable primary energy resource used as raw material (PENRM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	**MJ**	3.93E-02	5.96E-04	8.13E-03	1.59E-03	**4.96E-02**
Use of secondary raw materials (MS)	**Kg**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of renewable secondary fuels (RSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of non-renewable secondary fuels (NRSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Net use of fresh water (FW)	**m^3**	2.12E-05	1.24E-07	3.90E-06	9.93E-07	**2.62E-05**

Hazardous landfill waste (HWD)	**Kg**	3.46E-11	9.98E-17	9.47E-14	2.08E-20	**3.47E-11**
Non-hazardous waste disposed (NHWD)	**Kg**	1.48E-04	3.64E-09	2.94E-05	1.11E-12	**1.78E-04**
Radioactive waste disposed (RWD)	**Kg**	5.27E-07	1.15E-10	2.17E-08	8.79E-15	**5.49E-07**
Components for reuse (CRU)	**Kg**	MND	MND	MND	MND	**MND**
Materials for recycling (MFR)	**Kg**	1.68E-06	0.00E+00	3.61E-04	1.47E-06	**3.64E-04**
Material for energy recovery (MER)	**Kg**	MND	MND	MND	MND	**MND**
Exported electrical energy (EEE)	**Kg**	MND	MND	MND	MND	**MND**
Exported thermal energy (ETE)	**Kg**	MND	MND	MND	MND	**MND**

GWH182-7.5MW

Impact indicator	Unit per declared unit	Upstream stage	Core-process	Core-infrastructure	Downstream stage	Total environmental impact
Global Warming Potential total (GWP-total)	**kg CO_2 eq**	2.82E-03	1.90E-05	7.61E-04	1.22E-04	**3.72E-03**
Global Warming Potential total (GWP-fossil)	**kg CO_2 eq**	2.82E-03	1.90E-05	7.56E-04	1.21E-04	**3.72E-03**
Global Warming Potential total (GWP-biogenic)	**kg CO_2 eq**	-4.24E-06	3.13E-08	5.18E-06	1.27E-07	**1.11E-06**
Global Warming Potential total (GWP-luluc)	**kg CO_2 eq**	8.87E-07	8.99E-09	3.61E-07	2.16E-07	**1.47E-06**
Depletion potential of the stratospheric ozone layer (ODP)	**kg CFC-11 eq**	6.41E-12	7.42E-14	2.39E-12	1.74E-12	**1.06E-11**
Acidification potential, Accumulated Exceedance (AP)	**Mole of H+ eq**	8.99E-06	9.60E-08	3.81E-06	1.23E-06	**1.41E-05**
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	**kg P eq**	3.50E-08	2.44E-09	5.69E-08	6.72E-08	**1.62E-07**
Formation potential of tropospheric ozone (POCP)	**kg NMVOC eq**	6.18E-06	5.88E-08	3.12E-06	9.07E-07	**1.03E-05**
Abiotic Depletion for non-fossil resources potential (ADP-minerals & metals)	**kg Sb eq**	2.95E-08	6.49E-11	1.10E-08	6.82E-09	**4.74E-08**
Abiotic Depletion for non-fossil resources potential (ADP-fossil)	**MJ**	3.82E-02	5.80E-04	7.92E-03	1.60E-03	**4.83E-02**
Water deprivation potential, deprivation-weighted water consumption (WDP)	**m^3**	6.91E-04	5.17E-06	1.55E-04	4.30E-05	**8.95E-04**
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	**MJ**	9.05E-03	7.99E-06	4.26E-04	1.10E-04	**9.59E-03**
Use of renewable primary energy resources used as raw material (PERM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of renewable primary energy resources (primary	**MJ**	9.05E-03	7.99E-06	4.26E-04	1.10E-04	**9.59E-03**

energy and primary energy resources used as raw materials) (PERT)						
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	**MJ**	3.82E-02	5.80E-04	7.92E-03	1.60E-03	**4.83E-02**
Use of non-renewable primary energy resource used as raw material (PENRM)	**MJ**	MND	MND	MND	MND	**MND**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	**MJ**	3.82E-02	5.80E-04	7.92E-03	1.60E-03	**4.83E-02**
Use of secondary raw materials (MS)	**Kg**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of renewable secondary fuels (RSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Use of non-renewable secondary fuels (NRSF)	**MJ**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
Net use of fresh water (FW)	**m^3**	2.06E-05	1.21E-07	3.81E-06	1.00E-06	**2.55E-05**
Hazardous landfill waste (HWD)	**Kg**	3.37E-11	9.71E-17	9.22E-14	2.09E-20	**3.38E-11**
Non-hazardous waste disposed (NHWD)	**Kg**	1.44E-04	3.54E-09	2.87E-05	1.12E-12	**1.73E-04**
Radioactive waste disposed (RWD)	**Kg**	5.12E-07	1.12E-10	2.12E-08	8.87E-15	**5.34E-07**
Components for reuse (CRU)	**Kg**	MND	MND	MND	MND	**MND**
Materials for recycling (MFR)	**Kg**	1.63E-06	0.00E+00	3.51E-04	1.48E-06	**3.54E-04**
Material for energy recovery (MER)	**Kg**	MND	MND	MND	MND	**MND**
Exported electrical energy (EEE)	**Kg**	MND	MND	MND	MND	**MND**
Exported thermal energy (ETE)	**Kg**	MND	MND	MND	MND	**MND**

(1) This table presented the impact value with scaled to 1 kWh as the declared unit.

(2) "MND" is the abbreviation for "*Module not declared*".

Based on the LCIA study of GWH182-5.3/6.2/7.2/7.5, the most significant contribute processes for each environmental impact categories are identified and summarized in Table 3.

Table 3 - Significant contribute processes for environmental impact categories

Impact indicator	Top 3 contributors
Global Warming potential-total	Tower manufacture, blade manufacture, foundation construction & wind turbine installation
Depletion potential of the stratospheric ozone layer (ODP)	Blade manufacture, foundation construction & wind turbine installation, electricity transmission network construction
Acidification potential, Accumulated Exceedance (AP)	Tower manufacture, Blade manufacture, foundation construction & wind turbine installation
Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	Electricity transmission network construction, foundation construction & wind turbine installation, electrical control components production
Formation potential of tropospheric ozone (POCP)	Tower manufacture, Blade manufacture, foundation construction & wind turbine installation
Consumption of abiotic resources -	Production of Electrical control system components, production of

minerals and materials	drivetrain components, substation construction
Consumption of abiotic resources - fossil resources	Blade manufacture, tower manufacture, foundation construction & wind turbine installation
Water deprivation potential, deprivation-weighted water consumption (WDP)	Blade manufacture, tower manufacture, foundation construction & wind turbine installation

4. References

Regulations of EPDItaly programme, Revision 5.2, issue date: 16-02-2022.

EPDItaly013, PCR Title: ELECTRICITY PRODUCED BY WIND TURBINES, rev. 1, issue date: 16-03-2020; validity: 15-03-2025.

The EPDItaly system, https://www.epditaly.it.

Gabi database. The February 2021 Edition.

Gabi LCA software. The Gabi LCA software and corresponding database are provided by Sphera in Leinfelden-Echterdingen, Germany. Gabi February 2021 Edition was used.

LCA database published by the Ecoinvent association originally known as the Ecoinvent Centre, the Swiss Centre for Life Cycle Inventories. Since June 2013 Ecoinvent is a not-for-profit association founded by institutes of the ETH Domain and the Swiss Federal Offices. The version 3.9.1 was used.

ISO (2006a). ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

ISO (2006b). ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework.

ISO (2006c). ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines.

Sphera. The provider of the Gabi LCA software and database.

World Steel Association (World steel) is an industry association, with members in every major steel-producing country, representing steel producers, national and regional steel industry associations, and steel research institutes.

Technical Specification, GWH182-5.3/6.2/7.2/7.5 Wind Turbine Technical Specification, Goldwind Science & Technology Co., Ltd.