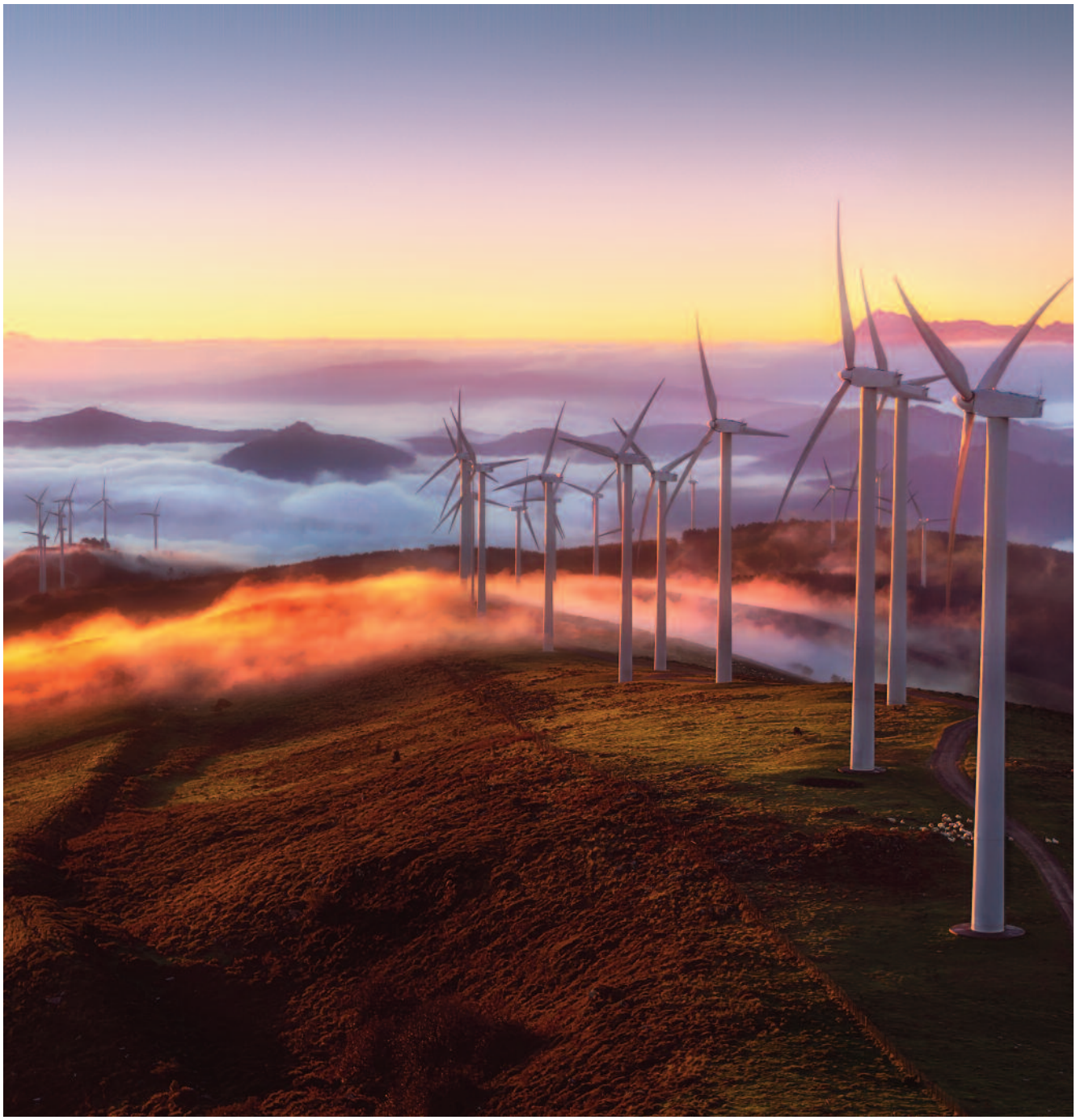
Practical example of impact measurement

"If you can't measure it, you can't manage it."
- Attributed to Peter Drucker[55]

"It is wrong to suppose that if you can't measure it, you can't manage it – a costly myth."
- William Edwards Deming[56]



A practical example is provided to illustrate the previously defined methodology.

The example illustrates how an energy company decides to measure the impact of building a new wind farm consisting of 11 wind turbines of the SG 132 model and an installed capacity of 39 MW

Screening

First, the company defines the impact it wants to measure as: those tangible and intangible changes experienced by people and the planet that are caused by the investment, directly or indirectly.

It therefore decides to create an impact framework based on the definition of three horizontal impact axes: social, environmental and economic.

To describe the scope of these impacts, the company considers the different phases of the project life cycle:

- Construction phase of the wind farm.
- Operation and maintenance phase of the wind farm.
- Dismantling of the wind farm and management of materials and waste at the end of their useful life.

The vertical axes are assigned narratives that make it possible to relate the project to the horizontal axes of analysis, as shown with some examples below:

- The commissioning of the wind farm has entailed the hiring of personnel, after defining a remuneration policy appropriate to the needs and social characteristics of the region.
- Social reintegration and cohesion are being promoted based on the economic reactivation of the region caused by the creation of indirect employment and the payment of taxes.
- The construction of the wind farm will lead to an increase in CO2 emissions into the atmosphere, which are certainly offset by the emissions avoided during the operation phase, as it is a renewable energy source.
- Etc.

The following is an executive approach to the framework for these impacts (table 1):

Assessment

The company then launches the impact measurement phase, selecting and implementing the methodologies best suited to each type of impact and defining the variables that will serve as qualitative or quantitative indicators of the different impacts to be measured.

In this case, and based on the framework of impacts, the analysis and measurement of four positive and/or negative, direct and/or indirect impacts, belonging to the different previously defined axes, will be exemplified (table 2).

[55] Peter Drucker (1909-2005), Austrian-American author, founder of modern business management.
[56] William Edwards Deming (1900-1993), American engineer and professor at New York University and Columbia University.

Table 1. Executive example of a project impact framework

ACTIVITY/ PROCESS	AREAS OF ANALYSIS: TYPE OF IMPACT			AREAS OF ANALYSIS: STAKEHOLDERS	IMPACT NARRATIVES
GLOBAL	Social	Positive	Direct	Workers	Recruitment of new personnel under conditions determined by a fair remuneration policy.
				Country	Payment of taxes arising from the construction of the new wind farm, payment of licenses, etc., and later from the profits obtained by the company.
	Economic			Society	Socioeconomic impact on the region through the generation of direct and indirect employment.
			Indirect		Impact on GDP growth at the local, regional and national levels.
CONSTRUCTION	Social	Negative	Direct	Planet	Increase in occupational accidents and injuries as a result of the risk generated by the presence of machinery, clearing, earthmoving and grading tasks.
	Environmental				GHG emissions produced during the wind turbine manufacturing process, during the transport of wind turbines from the factory to the wind farm and during the wind farm construction process.
					Worsening of air quality in the area due to heavy traffic on unpaved areas, earthworks, excavations, etc., and noise pollution (while wind turbines are generating power).
					Changes in geomorphology due to the design of roads for accessing the wind turbines and electrical substation, as well as to stockpile areas or land levelling.
					Worsening of water quality due to clearing, earthmoving and the transit of machinery that produce dust, increasing the amount of suspended particles in the water.
					Impact on irrigated crops due to erosive processes resulting from the removal of the existing vegetation cover, earthworks or excavations.
OPERATION AND MAINTENANCE	Social	Positive	Direct	Customer	Increase in green, accessible and affordable (low pool price) energy sources for consumers.
	Environmental			Planet	Contribution to climate change mitigation through renewable energy generation.
		Negative			Increased mortality of avifauna and bats due to collisions with the windmills when the blades are in motion.
		Positive	Indirect		Reduction of GHG emissions as a consequence of green energy generation, favoring the decarbonization of energy production.
		Negative	Direct		Erosive processes in the areas cleared and removed during the construction process due to land preparation for the construction of the wind turbines, access to the wind turbines and the stockpile area.
					GHG emissions from transportation of components from the wind farm to the recycling/waste management plants.
		Positive			Morphological restoration to pre-operational levels of all areas affected by the presence of the wind farm that will not be used in the future.

Social · Economic · Environmental · Positive · Negative

Workers · Society · Country · Planet · Customer

1. Positive economic impact in terms of contribution to GDP

The economic impact in terms of GDP is a global impact that can be quantified at any stage of the project. This calculation uses the Leontief model, a method that analyzes the relationships between different production and consumption sectors in the economy, based on the economic correlations between the outputs of one industry and the inputs of another.

The total economic impact generated throughout the project life cycle (wind farm construction phase, wind farm operation and maintenance phase, wind farm decommissioning and end-of-life materials and waste management) is determined by the sum of direct, indirect and induced impacts on GDP, as shown below:

- The direct impact is calculated .through the income or remuneration of productive factors[57] approach, from the sum of production as gross value added (the income generated by the company), plus the value of direct job creation (measured as the sum of remunerations paid on account of the employment generated throughout the project)[58], together with the tax contribution (measured as the value of taxes directly levied on the economic activity in question).

  According to the latest data published by the Spanish Wind Energy Association[59], the wind energy sector accounted for 0.3% of Spanish GDP in 2020, contributing 1,778.5 million euros to direct GDP and 1,327.9 million euros to indirect GDP.

  In this specific case, and based on an average value of the direct economic impact generated in terms of GDP, it is estimated to generate around 20 million euros per year, of which approximately 9.5 million are attributed to direct jobs created.

- The indirect impact corresponds to the production and employment generated in the sectors that indirectly benefit from the distribution of the investments (CAPEX) and expenditure (OPEX) of the project in question, which have an impact on other industries, such as construction, equipment and component manufacturers, transportation, machinery and equipment repair and installation, among others.

  This indirect impact in terms of GDP is calculated from the Leontief inverse matrix, which in turn is fed by the input-output tables published by the respective institutes of national statistics[60] or by international organizations such as the OECD[61]. From this matrix, the value of the sum of the production impacts of the sectors concerned can be extracted, according to the average breakdown of expenses, represented mainly by purchases from suppliers, and the average breakdown of investments (tangible and intangible fixed assets).

[57] Macroeconomic study on the impact of the wind energy sector in Spain. Wind Energy Business Association

[58] If, as shown below in this example, the social impact created by the quality of employees' salaries is to be assessed as an independent impact variable, the direct job creation value must be subtracted from this direct impact on GDP in order to avoid "double-counting". In this example, and as indicated in the following section, this value is approximately 9.5 million euros.

[59] ESA (2020).

[60] In the case of Spain, see the information published by the Spanish Office for National Statistics.

[61] These updated tables are published in periods of 5/6 years.

Table 2. Examples of impact narratives to be evaluated

ACTIVITY/ PROCESS	AREAS OF ANALYSIS			IMPACT NARRATIVES	CALCULATION METHODOLOGY APPLIED
	TYPE OF IMPACT		STAKEHOLDERS		
GLOBAL	Indirect	Positive	Workers	Impact on GDP at local, regional and national levels.	Input-output matrices (Leontief model).
	Direct	Positive	Workers	Recruitment of new personnel under conditions determined by a fair remuneration policy.	Impact-Weighted Account Initiative (Harvard Business School).
CONSTRUCTION	Direct	Negative	Planet	GHG emissions produced during the wind turbine manufacturing process.	GHG Protocol / Impact-Weighted Account Initiative.
OPERATION AND MAINTENANCE	Indirect	Positive	Planet	Reduction of CO_2 emissions as a result of green energy generation, favoring the decarbonization of energy production.	Impact-Weighted Account Initiative (Harvard Business School).

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In the case of this particular project, it is estimated that the company generates around 15 million euros per year in terms of indirect GDP.

- The induced impact corresponds to the production and employment generated from the consumption of goods and services by employees, both company employees and employees in the supply chain.

  These personnel expenses must be weighted by the marginal propensity to consume (MPC), a theoretical mathematical relationship indicating to what extent that part of the income that is increased is allocated to consumption or savings. This increase is usually taken as a unit . In this case, and using the OECD as a source, this ratio is calculated from macroeconomic information on total expenditure and the money available to households, to determine a MPC for Spain of approximately 65%.

  In turn, the total remuneration expenditure of both the supply chain (estimated from the expenditure on purchases from suppliers weighted by a percentage allocated to salaries) and the expenditure on own salaries are added and multiplied by this marginal propensity to consume, generating induced impacts in terms of GDP of around 4 million euros per year.

2. Positive and direct social impact from the generation of quality employment.

The construction phase of the wind farm has involved the hiring of 220 workers. In this case, and with this basic information, it was decided to measure the social impact that is being generated from the promotion of quality employment, applying Harvard Business School's Impact-Weighted Account Initiative methodology, taking into account that it allows quantifying the economic value of this impact from the evaluation of wages.

As can be seen in the table 3, the calculation of the economic value of the impact generated from job creation is determined, on the one hand, by the amount of the salaries of the workers that will be hired for the construction of the plant, and on the other, by an indicator of the quality of the wages:

- Total Unadjusted Salaries: the calculation is based on the total sum of wages paid to all workers hired for the new wind farm (distributed by average salaries classified according to the three salary bands of the company in this case).

- Adjusted (Living) Wage: beyond the minimum national wage established by the regulations of each country, the IWAI methodology developed by Harvard University aims to take into account the payment of living wages adjusted for the economic needs of each region. For this purpose, tools from external sources such as the MIT calculator[63] or the one proposed by the UK Living Wage Foundation[64] are used as a reference. In this case, the total economic value (more than 9 million euros for the creation of 220 jobs at market prices/wages) is adjusted downwards, discounting the sum of all salaries below the living wage level that has been defined. Conceptually, this penalty is established by the

[62] As an economic ratio, the PMC is between 0 and 1.
[63] Living Wage Calculator MIT (2022).
[64] Living Wage Foundation (2022).

Table 3. Methodological development of the calculation of wage quality impact from the wind farm construction according to the Harvard Business School's Impact-Weighted Account Initiative (IWAI) methodology.

Employment impact (wage quality)			
Concepts	**Data**	**Formulation/rational**	**Impact (€)**
(1) Total Unadjusted Salary		(1.1) + (1.2) + (1.3)	9.561.204,00 €
1.1. Management team		(1.1.1) * (1.1.2)	475.444,00 €
1.1.1. Number of employees	4 employees		
1.1.2. Average salary	118.861 €		
1.2. Middle management		(1.2.1) * (1.2.2)	4.906.176,00 €
Number of employees	88 employees		
1.2.2. Average salary	55.752 €		
1.3. Professionals in the trade		(1.3.1) * (1.3.2)	4.179.584,00 €
Number of employees	128 employees		
1.3.2. Average salary	30.653 €		
(2) Annualized Living Wage	20.632 €	Reference MIT Calculator (https://livingwage.mit.edu/)	
(3) "Living Wage" Penalty		Sum of wages "below the living wage".	382.448,16 €
(4) Adjusted (Living) Wages		(1) - (3)	9.178.755,84 €
(5) Annualized Minimum Wage		Minimum Wage according to local regulations (OECD Statistics, Real Minimum Wages)	13.510,00 €
(6) "Minimum Wage" Compensation		Sum of wages "between living wage and SMI".	+294.983,61 €
(7) Adjusted Salary (Minimum)		(4) + (6)	9.473.739,45 €
(8) Total impact			9.473.739,45 €

IWAI methodology with the objective of encouraging companies to pay better wages offering a higher quality of life to their workers. In this case, the penalty amounts to around 380,000 euros, representing a reduction of approximately 4% of the total initial value.

- Adjusted Wage (Minimum): finally, and with the aim, in this case, of promoting the effort made by organizations to raise the lowest wages, the value of the total wages that are between the minimum wage in the region in which the organization operates and the defined living wage, is added. This is an upward adjustment, which, in this case, is valued at around 295,000 euros.

Based on the above, and after analyzing the economic value of the social impact generated by the creation of 220 jobs measured in terms of wage quality under the IWAI methodology, it can be concluded that this company is generating a positive impact valued at 9.47 million euros throughout the year[65].

In some cases, the destruction of jobs dedicated to those lines of business replaced by the wind farm may need to be considered as a negative social impact, in the event it were to occur. Or even, if the company itself decided to go for a training strategy to recycle its workers, the economic value that this decision could entail could be analyzed by measuring the added value of the economic return of an investment in training, measured as the social value of such learning.

3. Product´s social impact

As indicated by Harvard's own methodology (Impact Weighted Accounts), it is essential to measure the social impact generated by products. This can be done by

[65]The calculation is made for a period of 1 fiscal year, taking into account that the economic value of the salary quality is determined by the total value of the payrolls paid in a year.

evaluating different variables. One of them could be the impact generated in terms of the scope of the service. What is the market share and how many customers are being offered a service that satisfies an essential need, such as, in this case, energy supply. Another option is to measure the value generated from supplying a product to an underserved customer segment living, for example, in rural areas or in developing countries, by measuring the impact it can have in terms of improving their quality of life (e.g. increase of income savings per capita, coverage of losses resulting from power outages, etc.). On the other hand, it is worth noting how the introduction of renewable energy sources leads to a final reduction in the price of energy. If this price reduction is passed on to individual and industrial consumers, it can improve their purchasing power. This effect is especially relevant in a context such as the current one, with wholesale market price levels at historical highs. This particular project will supply energy at prices ranging between 28 and 34 euros/MWh, compared to average wholesale market prices[66].

According to data from the Spanish Wind Energy Association[67], wind power generation in 2020 represented a significant benefit for Spanish consumers, especially industrial consumers. At the national level, and according to AEE estimates, in 2020 wind power generated total savings for consumers of 1,292 million euros for 27,446 MW of installed capacity. Therefore, the estimated contribution of this 39 MW installation project would represent an additional impact in terms of reduced energy prices and hence savings of over 1.7 million euros.

In addition, and although not discussed in detail in this example, other social impact variables should be evaluated, such as the value of health and safety at work measured in terms of the impact on insurance coverage savings for prevented losses due to injury and illness, the value of training measured in terms of the return for society, or the social value of corporate volunteering in which employees participate.

4. Direct negative environmental impact from the transport of wind turbines from the factory to the wind farm.

The construction phase is responsible for the largest volume of negative environmental impacts compared to the rest of the project phases.

In this case, the value of the impact generated by the GHG emissions associated with the manufacturing of wind turbines, which according to the GHG Protocol, fall under scope 3 emissions, will be analyzed. For its calculation, the IWAI (Impact Weighted Account Initiative) methodology developed by Harvard University[68] will be applied.

The manufacturer of the wind turbines at the wind farm indicates in its "Report on greenhouse gas emissions" that for each MW of installed capacity, 3.17 tons of CO2 equivalent[69] are emitted into the atmosphere. With this primary data, the calculated emissions associated with the manufacturing of all the wind turbines were approximately 123.63 tons of CO2 e

The total tons emitted as a result of wind turbine manufacturing must be evaluated in terms of impact. To do this, the value of the overall impact of externalities, both social and environmental, linked to the emission of one ton of CO2 is used. According to the Environmental Protection Agency (EPA), this social cost is €34.23 per ton of CO2 emitted.

This means that the manufacture of these wind turbines has a negative impact valued at -4,231.85 €.

5. Positive and indirect environmental impact from the reduction of CO2

In this case, the commissioning of this wind farm will allow the production of 100% renewable energy generated from inexhaustible sources, which will avoid an annual emission of around 55,000 tons of CO2 according to the technical studies that have been carried out.

The total GHG emissions avoided due to the decarbonization of the energy production process must be evaluated as an impact, so the value of the global impact of externalities of €34.23 per ton of CO2 emitted is used as in the previous point.

Therefore, it can be concluded that the development of this project has a positive impact valued at 1,882,650 €, generated from the total emissions avoided under the IWAI methodology.

From an environmental point of view, the company must also evaluate the rest of the direct and indirect environmental impacts related to the construction of the plant, its operation and maintenance, and finally, its dismantling. To this end, estimates must be made of the tons emitted by these activities weighted by the aforementioned social cost.

In addition, and although they are not being analyzed in detail in this illustrative example, other environmental variables can also be considered, such as the total impact of water recycling by assessing the cost of production and delivery, or the impact related to the cost of wastewater treatment, the net impact generated from the cost of waste generation, and the value of the waste generation and the value of recycling this waste, the impact on the local biodiversity due to the destruction or disturbance of habitats, etc.

Reporting

Finally, all previously quantified impacts are aggregated into their corresponding categories according to the structure defined in the first phase:

[66] Prices for the last few months have not been considered in order to avoid the bias that would result from factoring in the very high prices in the current market.
[67] AEE (2021).
[68] Impact-Weighted Accounts Harvard Business School (2022).
[69] Siemens-Gamesa (2020).

- Direct, indirect and induced impact on GDP economic variable (+30.000.000 €) is included in the category associated with economic impact.
- Salary quality variable (+9,473,739 €), aggregated in the social impact category.
- Social impact through affordable product variable (+1,696,000 euros) for increased consumer per capita income from savings as of year 2, once the plant is operational and offering services considered in the social impact category.
- CO_2 emissions variable (scope 1, 2 and 3) which includes the -4,231.85 € of emissions associated with the manufacture of wind turbines along with the rest of the direct and indirect emissions of the project corresponding to year 1. This is included under the environmental impact category.
- Avoided emissions from the value chain variable (+1,882,650 € en el año 2, y 2.862.000 euros en el año 26) aggregated in the environmental impact category.

Table 4 shows the result for years 1 and 2 of the project, as well as a projection over the years of useful life of the wind power plant to show the increased cumulative environmental impact resulting from the increase in avoided social costs of CO2 due to clean energy production.

Year 1 shows the result associated with the activities related to the construction of the wind farm, so the value associated with avoided emissions is zero.

On the other hand, year 2 shows the exercise associated with the wind farm operation and maintenance stage. This is the reason why the value associated with negative environmental impacts is much higher in year 1, whilst year 2 shows a positive value in thsi respect. Likewise, 220 people are hired during the wind farm construction stage, and 10 people are hired during the operation and maintenance stage, implying a lower value of the social impact from sustainable salaries, among other variables. As for the economic impact generated in year 2, it is reduced due to the decreased number of direct hires, although this is certainly offset by the benefits generated once the plant is operational.

The total aggregate economic value of the impacts generated by the company's activity makes up the so-called ESG-P&L – an indicator of the extra-financial value generated that complements the financial P&L for the year.

In addition, a governance model must be defined that allows for monitoring and updating this indicator within the established deadlines.

Table 4. ESG-P&L

(In thousands of euros)	Year 1	Year 2 ... 26[1]
Extra-financial result for the period (ESG-P&L)	**40,314 €**	**30.940 €...31.919 €**
1. Economic Impact	**30,783 €**	**26,869 €**
Direct impact on GDP1[2]	10,942 €	17,650 €
Indirect impact on GDP	15,064 €	8,980 €
Induced impact on GDP	4,776 €	239 €
2. Social Impact	**9,598 €**	**2,190 €**
Occupational health and safety	-75 €	-4 €
Sustainable remuneration	9,474 €	431 €
Return on training (external and internal)	108 €	16 €
Sustainable product	- €	1,696 €
Corporate volunteering	91 €	52 €
3. Environmental Impact	**-67 €**	**1,881 €(year 2)...2,860 € (year 26)**
CO2 Emissions (Scope 1, 2 and 3)	-4 €	-1 €
Avoided Emissions[3]	-	1,883 € (year 2)...2,862 € (year 26)
Water Consumption	-4 €	-0 €
Waste generations	-7 €	-0 €
Biodiversity	-52 €	-1 €

[1] As can be seen in the avoided emissions item, the purpose of this year 2 to year 26 projection is to show the increased positive cumulative environmental impact value resulting from the increased avoided social cost of CO2 emissions over the useful life of a wind power plant of this nature.
[2] As mentioned above, "double-counting" is avoided by subtracting from the direct impact on GDP the wage value of direct employment generated, which is already accounted for by the "sustainable remuneration" variable.
[3] The social cost of carbon will increase by 152% according to EPA projections for the next 25 years. This will lead to a cumulative increase in the environmental impact from avoided emissions, considering the useful life of a wind power plant of these characteristics (25 years). Therefore, the environmental impact value for the first year in which the plant is operational is 1,882,650.00 euros, and the accumulated value considering the projection of the avoided social cost of carbon (2023-2047) is 59,525,462.60 euros.