Methodology for estimating the impact of the Sustainability Bond 2022

The extent of the impact generated by CDP's Sustainability Bond 2022 was analysed from an economic-social and environmental perspective, using established assessment methods[1].

Three types of estimates were made:

- environment, in terms of reduction of Carbon dioxide equivalent (CO_2-equivalent) and specific result indicators, for projects in the green categories;
- social, in terms of specific physical result indicators, for projects in the social categories;
- socio-economic, in terms of employment and value added, for the entire portfolio, net of investments made abroad.

Estimating the impact of green projects

The first assessment at aggregate level of the green impact of the resources disbursed through the Sustainability Bond was carried out for the Framework's Eligible Categories: the resources disbursed for green projects were broken down into categories, and the economic sectors where the investments are realised were assigned to each category, analysing their environmental profile.

Area	Framework Category	Sector	Disbursed (€ M)	Total framework category
Green	Energy Efficiency	Manufacturing	174.7	214.2
		Construction	24.1	
		Energy	15.0	
		Other sectors	0.3	
	Renewable Energy	Construction	150.4	180.2
		Energy	25.9	
		Water, sewage networks and waste management	4.0	
	Sustainable Water and Wastewater Management	Water, sewage networks and waste management	129.8	129.8
	Pollution Prevention and Control	Manufacturing	23.5	38.5
		Energy	15.0	
	Clean Transportation	Manufacturing	27.6	35.2
		Construction	7.6	
	Green Buildings	Construction	30.0	30
	Circular Economy	Manufacturing	8.0	11.9
		Water, sewage networks and waste management	3.9	

[1] Assessment and estimate carried out by CDP's "Sectoral Strategies and Impact" Department ("Monitoring and Impact Analysis" Team).

cdp

The analysis at aggregate level was carried out using data on atmospheric GreenHouse Gas (GHG) emissions, measured in CO_2-equivalent, consisting of CO_2 and other climate-altering gases, at national level. In particular, the Environmental accounts/NAMEA air emissions (NACE Rev.2), published by the Italian National Institute of Statistics (ISTAT) in November 2022, were used in accordance with Regulation (EU) 691/2011, as amended by Delegated Regulation (EU) 2022/125. These Accounts contain data on atmospheric emissions by economic activity, referring to the Italian economy, considering the production activities the allocated resources are assigned to. The emissions considered concern 24 climate-altering substances, acidifiers, tropospheric ozone precursors, particulate matter, and heavy metals.

The environmental impact was also estimated for the green initiatives financed by the Bond, through calculations **based on physical environmental data produced by the beneficiaries, linked to the performance of the production processes, the performance of the power generation plants and the infrastructures financed**, both in Italy and abroad.

Specifically, the GHG reduction as a result of the projects financed in the green categories of the Framework – Renewable Energy, Energy Efficiency and Clean Transportation – was calculated. This enabled a precise quantification of the CO_2-eq reduction for 23 of the 29 green operations, corresponding to 429.6 million euro of loans (around two thirds of the total disbursement for the green categories).

In line with the Global GHG Accounting and Reporting Standard for the Financial Industry, developed by the PCAF Global Core Team, the avoided GHG emissions are:

- reported in CO2-equivalent (CO_2-eq), which is the standard unit of measurement used internationally to express the climate impact of the various greenhouse gases and hydrofluorocarbons with global warming potential over 100 years[2], as identified in the IPCC Assessment Reports. The most important greenhouse gases, apart from carbon dioxide (CO_2), are methane (CH_4) and nitrous oxide (N_2O);
- calculated using a counterfactual approach, i.e. assessing the reduction in emissions that the financed investment generates compared to what would have been emitted in the absence of the project (baseline situation). For example, for the project financing in the Renewable Energy category, the emissions avoided through the substitution by clean energy were measured assuming that, in the absence of the project, the same amount of energy would have been produced using natural gas[3];
- estimated considering the useful life of the plants, including their residual life, and taking into account their degradation, namely their progressive decline in performance, as well as the progressive reduction in emissions associated with domestic electricity generation[4];

[2] In other words, it is the amount of CO_2 that, over a given time period, would cause the same integrated radiative forcing (a measure of the strength of the drivers of climate change) as an emitted amount of another greenhouse gas or mixture of greenhouse gases. In this respect, the PCAF recommends using 100-year global warming potentials.
[3] The choice of using natural gas instead of the fossil mix to assess the reduction of emissions linked to the installation of renewable energy production plants is linked to the progressive increase of this source in the national electricity mix, and the accompanying phasing out of coal. On the basis of the industry sector literature and the electricity mix scenarios to be implemented to achieve the climate objectives set at EU level, as envisaged in the Italian Energy and Climate Plan (PNIEC) and the New Green Deal, natural gas is the transitional fossil fuel to be used in the path towards the total decarbonisation of the Italian electricity system.
[4] For the analysis, life-time discount and degradation factors are used to include the gradual reduction of emission factors as a result of climate change mitigation policies implemented at EU and national level. For the "Renewable Energy" category, literature-based degradation factors related to the progressive reduction in the performance of renewable energy generation plants over their lifetime are considered. For the "Energy

Cassa Depositi e Prestiti
Società per Azioni
Via Goito, 4 - 00185 Roma
T +39 06 4221 1
F +39 06 4221 4026

Capitale Sociale
€ 4.051.143.264,00 i.v.
Iscritta presso
CCIAA di Roma al
n.REA 1053767

Codice Fiscale
e iscrizione al Registro
delle Imprese di Roma
80199230584
Partita IVA 07756511007

- measured without taking into account emissions from implementation of the projects in the short term (e.g. during the construction of a plant or the manufacture of an electric vehicle), in other words using “gross data”;
- calculated considering the technical specifications of each plan/project, where available, or estimated based on data on expected production levels and national emission factors provided by Italian Institute for Environmental Protection and Research (ISPRA) or the available literature[5].
    - For the Renewable Energy category, the calculation of the CO_2-eq reduction was made by taking into account the expected production levels of the plants in kWh, based on location, and the national CO_2 emission factor related to electricity generation by natural gas.
    - For the Energy Efficiency category, the CO_2-eq reduction was calculated on the basis of the expected average annual energy savings in electricity or heat/fuel consumption in MWh, using the ISPRA national emission factor for national gross thermoelectric production [6].
    - For the Clean Transportation category, the CO_2-eq reduction was calculated taking into account the type of vehicles replaced with electric vehicles and the average distance travelled by each vehicle in the fleet, using the ISPRA database of average emission factors values for each vehicle type and Euro emission standard at consistent average speeds of road and area types [7];
- assessed for a statistically relevant sample of projects, grouped by type of investment, such as photovoltaic plants, cogeneration plants, highly energy-efficient presses and smelters, and new-technology food industry production lines, to arrive at a parameter of avoided financed greenhouse gas emissions per million euro invested (tCO_2eq/€ M);
- proportionally allocated according to an environmental impact attribution factor to CDP’s Sustainability Bond, based on the ratio between the disbursed amount of the loan and the total value of the investment according to the Company’s Investment Plan;
- computes adopting a conservative approach. In the absence of physical data on the green projects financed and given that only data of a financial nature or derivable from sustainability reporting was available, it was decided not to report any contribution to decarbonisation. The measure provided in terms of reduction of climate-altering emissions is therefore provided only for the Framework categories Energy Efficiency, Renewable Energy and Clean Transportation (67% of the total green

---

Efficiency” category, a discount factor of the polluting capacity of energy generation is considered, based on a reference scenario with a progressive adjustment of the mix of energy sources for electricity generation in favour of natural gas and renewables with lower GHG emissions. This estimate is consistent with the trend of reduction in greenhouse gases per kWh of electricity over the last 20 years (source: ISPRA - Italian Institute for Environmental Protection and Research). It is also consistent with the projections to 2050 produced by the Italian government within the framework of the Paris Agreement, negotiated at COP 21 in 2015, and with the Italian long-term strategy on the reduction of greenhouse gas emissions.

[5] Italian Institute for Environmental Protection and Research (ISPRA), Indicators of efficiency and decarbonisation of the national energy system and the electricity sector, Report 363/2022; ISPRA, Database of average emission factors of road transport in Italy; D. C. Jordan, S. R. Kurtz (2011),
“Photovoltaic Degradation Rates-an Analytical Review”, John Wiley & Sons, Ltd; Saddler L., Glover E, Tynan C. (2023), “How Long Do Solar Panels Last?”, Forbes Media LLC; I Staffell (2014), “How does wind farm performance decline with age?”, Renewable Energy, vol. 66, issue C, 775-786; Gestore dei Servizi Energetici S.p.A. (GSE) “Statistical Report 2021 Energy from Renewable Sources in Italy”, March 2023; GSE “Solar Photovoltaic Statistical Report 2022”, April 2023; GSE, “Activity Report 2021: GSE activities in 2021 in the context of the energy transition”, European Commission, Photovoltaic Geographical Information System (PVGIS), and EU Science Hub.

[6] Using the average for the last five years.

[7] Reference was made to the average emission factors for road transport, derived from the Copert model and provided by ISPRA on the basis of the “EMEP/EEA air pollutant emission inventory guidebook 2019” in line with the 2006 IPCC Guidelines and taking into account the characteristics of the replaced vehicle fleet.

portfolio). Hence, it does not take into account the additional avoided emissions that may result from energy savings linked to the modernisation and expansion of the water infrastructure network and the upgrading of sewage treatment plants (structurally an energy-intensive activity, which consumes up to 3% of the world's total energy generation and contributes to more than 1.5% of global emissions) or to buildings energy efficiency investment in the Green Buildings category (a sector responsible for around 39% of CO_2 emissions globally, where energy efficiency measures can result in around a 90% reduction in CO_2 emissions when upgrading from F to A4, corresponding to around 9.7 kg per square metre per year[8]).

For the Clean Transportation category, in addition to the impact in terms of reduction of GHG emissions, the number of diesel vehicles replaced with electric vehicles and the number of trains purchased to upgrade the local metro service, under the investment projects financed, has been reported, indicating the portion attributable to CDP with respect to the total investment.

For the Sustainable Water and Wastewater Management category, the extension in km of the water network subject to modernisation and efficiency measures, under the investment projects financed, has been reported, indicating the portion attributable to CDP with respect to the total investment.

For the Circular Economy category, the increase in waste treatment capacity for biomethane in terms of tonnes per year treated, under the financed investment projects, has been reported, indicating the portion attributable to CDP with respect to the total investment.

For the Pollution Prevention and Control category, the reduction in the amount of hazardous waste generated, as part of the financed investment projects, has been reported, indicating the proportion attributable to CDP with respect to the total investment.

For the Green Buildings category, information has been provided on the quality of the building stock concerned from an energy and environmental perspective.

Estimating the impact of social projects

The impact assessment of projects with a social purpose, coming under the Healthcare and Socioeconomic Advancement and Empowerment categories, was based on CDP's internal database of counterparties and the results of surveys of several beneficiaries.

For the Healthcare category, the number of new beds created at hospital facilities has been reported; while for the Socioeconomic Advancement and Empowerment category, the employment impact in foreign countries receiving financed investments, in terms of jobs created or maintained, has been estimated.

Also, for these categories, the social impact has been proportionally allocated based on the amount of the loan granted by CDP with respect to the total value of the investment.

[8] Politecnico di Milano, How much does the construction sector impact on CO_2 emissions, ReFocus: Decarbonisation Objective, 2023.

Cassa Depositi e Prestiti
Società per Azioni
Via Goito, 4 - 00185 Roma
T +39 06 4221 1
F +39 06 4221 4026

cdp

Estimating the socio-economic impact of the portfolio

With regard to the assessment of socio-economic impact, several variables have been considered, namely i) production, ii) value added, iii) jobs and iv) private income and consumption. With regard to these variables, the ***total impact*** generated by the Sustainability Bond includes:

- the *direct impacts,* relating solely to the sector affected by the issuance;
- the *indirect impacts*, related to the increased demand of intermediate goods and services provided by other sectors not directly affected by the issuance (Leontief multiplier);
- the *induced impacts,* deriving from the increase in income stimulated by the Sustainability bond (Keynesian multiplier).

The passage from the allocated 750 million euro to the approximately 590 million euro of resources used as input for the estimate of the socio-economic impact was made by excluding the activities from the scope of the analysis that, despite having deployed resources, do not have the characteristics to generate a direct impact on the national aggregate demand. Therefore, investments made outside Italy were excluded, both in the context of international cooperation projects (around 105 million euro) and in relation to green projects for production facilities located in other countries (around 55 million euro). The vector of resources obtained at purchase prices was converted into basic prices, considering only the effects produced by the deployed resources allocated, with no carryover effects on the economic system. For construction, the estimate brings forward to 2022 the demand impacts generated by the resources deployed during the year, even if these impacts may occur over a longer time frame.

The assessments were carried out using a Multi-Regional Input-Output (MRIO) modeling, through which the study of the economic interdependencies between regions enable to estimate how the total impacts are distributed across the local area which has been invested in. The model[9] presents a disaggregation into four macro-regions (Northeast, Northwest, Centre and South) and 54 production sectors. The interdependencies between the different areas represent the peculiarity of the MRIO models, as they make it possible to determine the ability of the local area to internalise (retain) the multiplier effect of both domestic final demand and that coming from the other macro areas.

With regard to the estimation of the characteristics of the labour force, the assumption adopted is that the distribution by gender and age of the workers supported by the CDP's resources, in the various branches of economic activity, is substantially similar to the distribution by gender and age observed in the respective branches, as reported by ISTAT, using 2021 as the base year.

The model's ability to correctly assess the effect on the national economic system and employment of the investments made with the funds raised through the Bond clearly depends on the ability to correctly attribute the expenditure flows to the various product items in the input-output matrix classification and to the geographic areas of destination of the investments.

[9] Developed by the Regional Institute for Economic Planning of Tuscany (IRPET).

Input-Output tables and multiregional matrices

The IO tables or tables of interdependencies by sector are a schematic-accounting representation of the different value flows in a given economic system and over a given time frame (normally one year, known as the base year). The reference unit consists of economic sectors grouped together in branches (production units characterised by similar cost structure, production processes and products), each of which carry out two types of transactions: i) purchases from other sectors of goods and services that they use for their own production activities (use branches); ii) sales of goods and services they produce to other sectors and end consumers (supply branches).

The accounting structure of the tables underlying the MRIO model consists of two sets of accounts: the single region supplies and use table[10] (SUT) and a multi-regional trade matrix.

Starting from the standard IO models formulation and the basic assumptions of perfect competition and an economic equilibrium between supply and demand, total production (domestic and imported) in sector *m* is equivalent to what is consumed locally (intermediate goods or final goods) and to what is exported. Formally[11], the following relationship holds:

$$X^m + J^m = nK^{mn} + Y^m \qquad (1)$$

Where X^m corresponds to total production of sector *m*; J^m are the imports of sector *m*; $\sum_n K^{mn}$ represents the intermediate demand of the production in sector *m* necessary to satisfy the production in sector *n* in the area considered and Y^m corresponds to the final demand of the sector.

The assumptions underlying the IO model can be summarised as: i) the economic system is initially in equilibrium and the increase in demand is met by an increase in production (and not in stocks); ii) linear production technology, that is, the input quantity used for each production activity is proportional to the volume of output X^m; ii) assumption of fixed economies of scale in all production sectors, i.e. the unit input need is assumed to be constant regardless of changes in production volumes; iii) no external effects, i.e. the effect deriving from economic activity outside the market transactions is not considered and hourly wages, hours worked, relative intensity of domestic production and imports are kept fixed (i.e. exogenous); and iv) the Leontief production function is used, which assumes no substitutability between production factors (capital and labour).

The key element of the IO models is the matrix of technical coefficients, whose single elements a^{mn} define the relationship between production levels and intermediate demand:

$$a^{mn} = K^{mn} X^n \quad \Longrightarrow \quad K^{mn} = a^{mn} \cdot X^n \qquad (2)$$

Where a^{mn} are the technical coefficients and represent the monetary value of the product in sector *m* (input) necessary to produce a unit of value in sector *n* (output), K^{mn} is the intermediate demand in sector *m* necessary to satisfy production in sector *n* and X^n represents the production value in sector *n*. It should be

---

[10] For a detailed description of the IRPET building and balancing procedure for SUTs, see Paniccià R. & Rosignoli S., "A Methodology for Building Multiregional Supply and Use Tables for Italy", IRPET, 2018

[11] Adapted from Cherubini L., Ghezzi L., Paniccià R. and Rosignoli S, Economic integration between the South and the Centre North, Bank of Italy, 2011.

noted that the value assumed by the technical coefficients depends on the production technology of the area considered (under assumptions of linear production and, therefore, without considering economies of scale or learning). The matrix of technical coefficients, in addition to being calculated for production, is also calculated for imported inputs and primary inputs (wages and salaries, value added, etc.).

Once equation (2) has been defined, (1) can be rewritten as:

$$X^m + J^m = \sum_n a^{mn} \cdot X^n + Y^m \quad (3)$$

And, the basic IO model can be represented as follows in matrix form:

$$X=(I-A)-1\cdot(Y-J) \quad (4)$$

Where $(I - A)^{-1}$ is well-known in literature as the Leontief inverse matrix or multiplier matrix. The sum of the matrix columns value represents the increase in production due to a unitary variation in final demand in the sector considered and enables to estimate the impact of an exogenous change in the final demand on production, intermediate imported inputs and primary inputs. Finally, from Leontief's inverse matrix it is possible to compute the multipliers used to estimate the impact of the investments made on production, intermediate import inputs and primary inputs. From this matrix, it is also possible to derive demand multipliers that are used to estimate the impact in terms of jobs created or maintained.

Starting from the basic IO model, the use of interregional matrices has allowed to extend the accounting structure of the model (MRIO) to estimate the impact of the Sustainability Bond in terms of trade flows between the macro regions, introducing an additional causal relationship (in addition to the Leontief-type technical relationship) of multiregional trade patterns, which distributes the total final demand among the various macro areas considered and determine the production levels of each macro region[12].

The MRIO model used, compared to the basic model, therefore allows consideration of the (more realistic) assumption that the region *j* of consumption of intermediate production K_j^{mn} and final consumption Y_j^m may differ from the region *i* of production X_i^m and import J_i^m. In other words, it is possible to model the monetary flows between different sectors of the economy and regions under analysis.

Formally, after the introduction of the *trade coefficient (T) matrix*, whose elements t_{ij}^{mn} (interregional trade coefficients[13]) represent the share of product in sector *m* coming from region *i* and used by sector *n* in region *j*, equation (4) can be rewritten as follows:

$$X=(I-\mathbf{T}\cdot A)-1\cdot(Y-J) \quad (5)$$

Finally, the vector of the investments attributable to the Sustainability Bond was included in the model using a bridge matrix to set them in accordance with the classification envisaged in the multiregional IO matrices. More specifically, the use of a bridge matrix makes it possible to assign the changes in final

[12] Cherubini L., Ghezzi L., Paniccià R. and Rosignoli S (2011), Economic integration between the South and the Centre North", Seminars and conventions, Bank of Italy.

[13] In particular, for the construction of the interregional trade coefficients, IRPET used the Chenery-Moses model (1970), where the underlying assumption is that the elements t_{ij}^{mn} are indifferent to the sector in which they are used.

demand due to the Sustainability Bond in a more precise and accurate manner, since they use specific[14] categories of expenditure[15], then converted into the classification used by the IO matrices (NACE rev.2). In this case, investments have been converted from sector of origin to sector of destination (user).

Estimated impact by framework category

Using the methodology described above, the impacts on the national economy in terms of value added and jobs have been calculated for each category of CDP's Framework, for all the investments made in Italy. To this end, a breakdown by category was performed, assigning the sectors that received the investments to each category, in the geographical macro-areas where they were made.

The impact generation capacity of each category of the Framework is linked to two factors: the volume of resources committed and their multiplicative potential which, in turn, depends on the branches of economic activity impacted by the investments made. Indeed, with the volume of resources being equal, each category of the Framework will be more likely to generate positive effects on the economy the more it involves key sectors in the network of intersectoral exchanges, for example by buying and selling goods and services from other economic sectors.

The analysis of the impact by category of the Framework has been carried out by multiplying the level of production activated, in the various sectors involved, by the resources allocated in Italy in each category of the Framework (Renewable Energy 172 million euro, Energy Efficiency 185 million euro, Clean Transportation 35 million euro, Green Buildings 30 million euro, Pollution Prevention and Control 21 million euro, Sustainable Water and Wastewater Management 130 million euro, Circular Economy 12 million euro, and Healthcare 6 million euro) for the sectoral coefficients, taken from the IO Tables, for the value added, and from the employment statistics, for the jobs. The Socioeconomic Advancement and Empowerment category (105 million euro) was entirely excluded from this analysis as it concerns investments all made outside Italy that, despite having positive social impacts in these geographies, are not able to generate impacts on the national aggregate demand.

[14] For example, if one considers spending intended for consumption in the form of government expenditure in infrastructure, the bridge matrix allows the amount of expenditure to be correctly allocated to the various economic sectors such as the construction, transport, machinery sectors, etc.

[15] In particular, the following international standards defined by the United Nations Statistics Division were used; i) COICOP (Classification of Individual Consumption by Purpose), for household consumption, ii) COFOG (Classification of the Functions of Government), for government expenditure; and iii) Gross fixed capital formation by asset for gross fixed investments.

Cassa Depositi e Prestiti
Società per Azioni
Via Goito, 4 - 00185 Roma
T +39 06 4221 1
F +39 06 4221 4026

Capitale Sociale
€ 4.051.143.264,00 i.v.
Iscritta presso
CCIAA di Roma al
n.REA 1053767

Codice Fiscale
e iscrizione al Registro
delle Imprese di Roma
80199230584
Partita IVA 07756511007