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Green Finance and Green Project Evaluation

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Chapter IV: Green Project Evaluation

CAPITOLO V: Analysis of practical cases

Introduction

At the basis of this study there is the analysis of green projects, a fundamental tool used within the field of green finance that supports the transition to a green, low-carbon and climate-resilient economy.
In recent years, this issue has led to growing interest not only from investors but also from the general public. This field, which is still being explored and constantly evolving, has aroused in me the curiosity to explore not only issues related to sustainability and climate change, but also how the financial sector reacts to this type of challenge.

The need and urgency to take concrete measures in this context, led me to consider the study of green projects: the aim is to understand what defines these types of projects, how they are evaluated in relation to other projects and how they can contribute to environmental objectives.

The thesis is structured in five chapters: the first deals with scientific evidence and international agreements adopted to form a united front in the fight against climate change. The second focuses on the sustainable finance segment and in particular on the description of this concept, the key principles, the instruments used and the actors involved. The third chapter goes into detail about green projects, through the analysis of the instruments used for their financing, the eligibility criteria and the different certifications. The fourth chapter offers a special focus on the different methodologies that can be used in the evaluation of green projects. Finally, the last chapter provides an analysis of two distinct projects evaluated with different methodologies.

CHAPTER I

Overview about climate change

1.1 Introduction to climate change

One issue which has received particular attention in recent years is climate change. The growing interest in this topic is due to global warming, which has occurred not as a result of the geological evolution of our planet but as a result of human intervention.

Although the phenomenon of climate change is still being denied by various subjects, it is evident that it has a strong impact on the ecosystem of our planet.

In fact, in addition to the increase in temperatures there has also been a consequent increase in extreme weather events (such as floods, storms, extreme heat, drought and hurricanes), as well as the rise of the oceans.

Climate change is caused by the emission of greenhouse gases (GHGs) into the atmosphere, which cause temperatures to rise. These emissions are called climate-altering, precisely because they have the capacity to alter the climate.

The need and urgency to take concrete measures to fight the negative effects of climate change, with the aim of developing a more sustainable economy that supports the transition to a green, low-carbon and climate-resilient economy, has led international organizations to the drafting of the Paris Agreement and the definition of various objectives.

1.2 Scientific evidence of climate change

For several decades, the issue of climate change has led to several conflicts over the scientific evidence of climate change. However, despite many denialist approaches, it's now clear that science agrees that global warming exists.

In 1988 in Geneva the UN founded the IPCC (Intergovernmental Panel on Climate Change), a scientific committee to study this phenomenon. The IPCC highlights, through its reports, the climate changes to which our planet is mainly subject due to human actions. There is, in fact, a strong correlation between extreme weather events and

climate change, mainly due to greenhouse gases emitted by humans, now considered one of the major factors responsible for rising temperatures.

This phenomenon, now undeniable, has had disastrous consequences for our planet, particularly in the climate system there are changes with regard to:

- Cryosphere
- Sea level
- Oceans
- Atmosphere
- Carbon and other Biogeochemical Cycles.

Cryosphere

The cryosphere is a term referred to those portions of Earth's surface where water is in solid form, including sea ice, lake ice, river ice, snow cover, glaciers, ice caps, ice sheets, and frozen ground[1].

Over the last two decades, there has been a reduction in glaciers worldwide, the Greenland and Antarctic ice caps have lost mass and snow cover in the northern hemisphere continues to decrease (see figure 1).

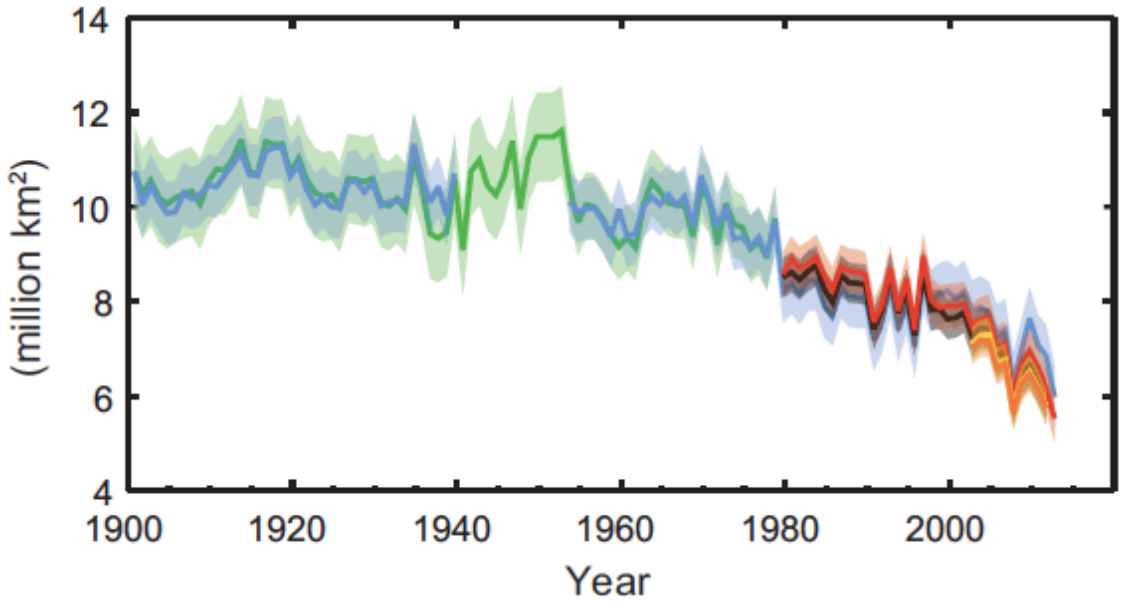

Figure 1: Arctic summer sea ice extent (Source: IPCC (2013), *Climate Change 2013: The Physical Science Basis*, Summary for Policymakers)

[1] https://en.wikipedia.org/wiki/Cryosphere

Sea level

As a consequence, the sea level rose by 0.19 mm yr globally, in particular between 1910 and 2010 (see figure 2). There are several factors contributing to this, such as changes in glaciers and in land water storage and the absorption of heat from the ocean.

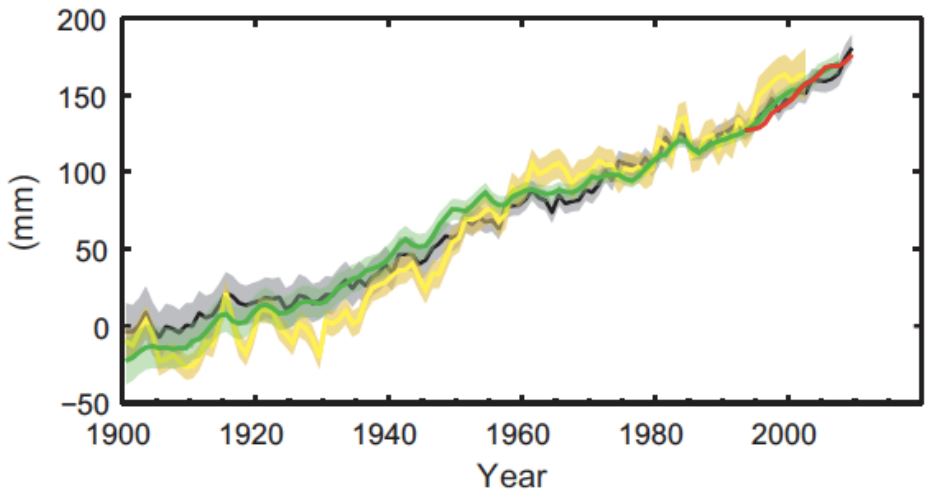

Figure 2: Global average sea level change (Source: IPCC (2013), *Climate Change 2013: The Physical Science Basis*, Summary for Policymakers)

Oceans

Ocean warming is related to the increase in energy stored in the climate system and represents more than 90% of the energy stored between 1971 and 2010 (see figure 3). More than 60% of the energy that the ocean has accumulated is between 0 and 700 meters, while the remaining 30% is below 700 meters.

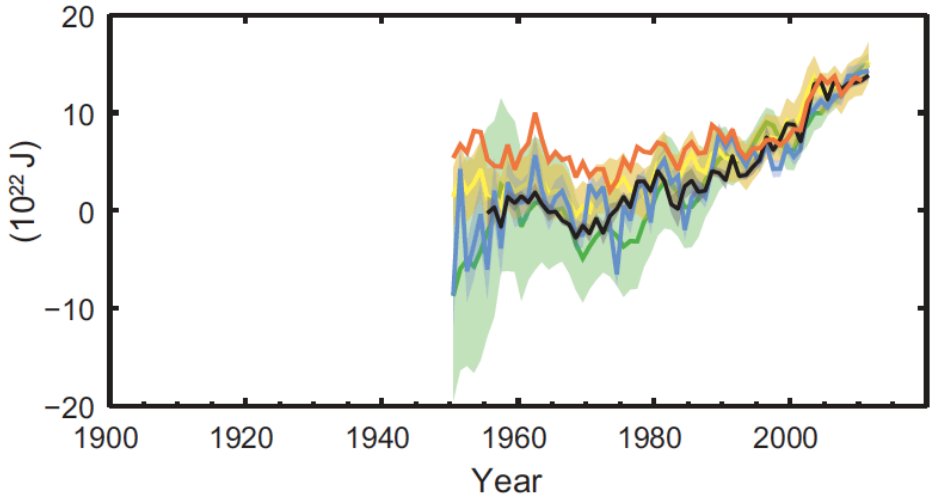

Figure 3: Change in global average upper ocean heat content (Source: IPCC (2013), *Climate Change 2013: The Physical Science Basis*, Summary for Policymakers)

Atmosphere

The atmospheric temperature of the last three decades has been, in sequence, warmer than any previous decade since 1850, particularly in the Northern Hemisphere, the period 1983-2012 was likely the warmest of the last 1400 years (see figure 4).

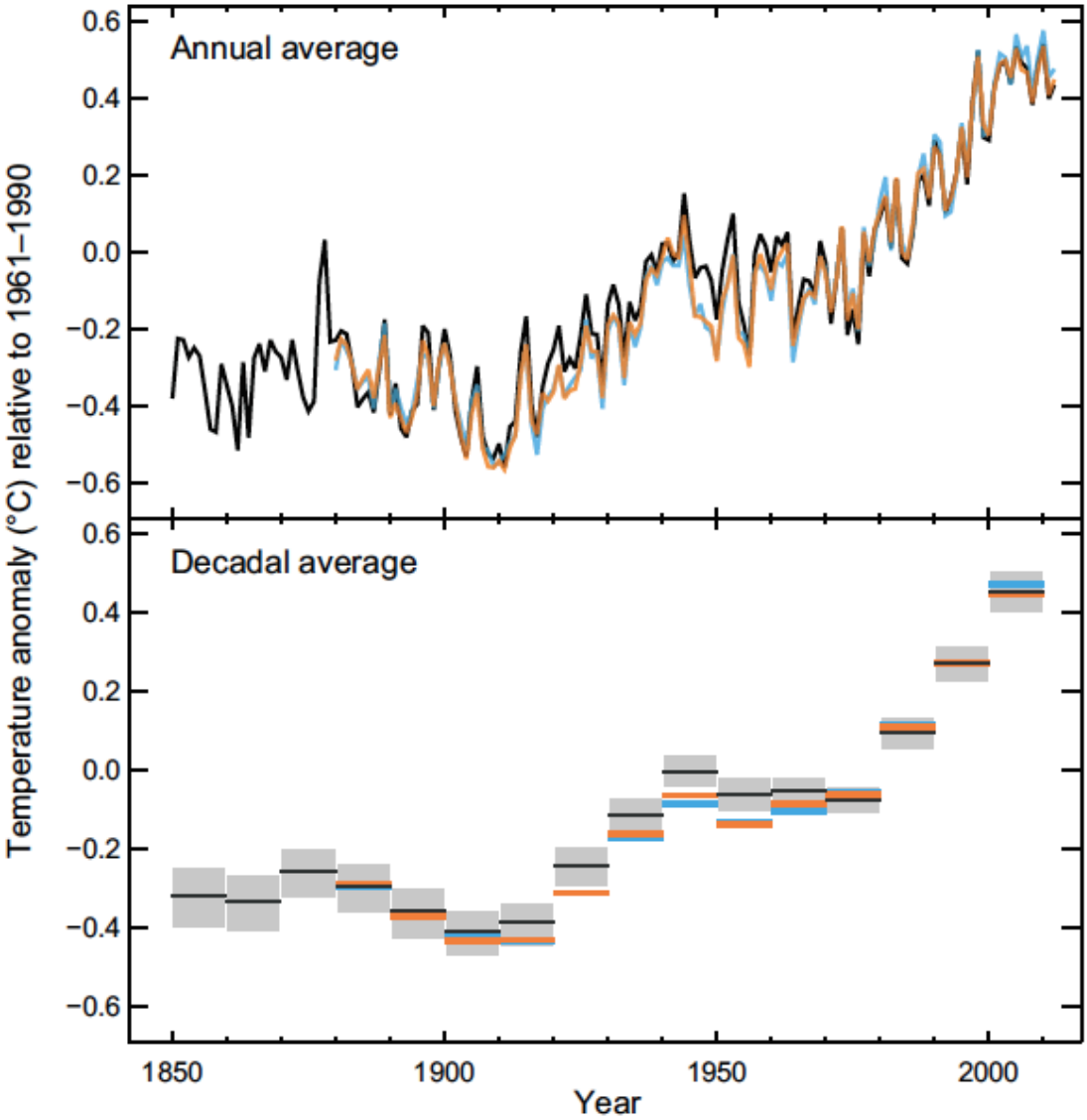

Figure 4: Observed globally averaged combined land and ocean surface temperature anomaly 1850-2012 (Source: IPCC (2013), *Climate Change 2013: The Physical Science Basis*, Summary for Policymakers)

Carbon and other Biogeochemical Cycles

The use of fossil energy sources, deforestation, waste decomposition, intensive animal breeding cause emissions of carbon dioxide and methane into the atmosphere. These emissions have increased to unprecedented levels over at least the last 800.000 years

(carbon dioxide concentrations have increased by 40% since pre-industrial times). This explains the greenhouse effect that causes temperatures to rise (see figure 5 and 6).

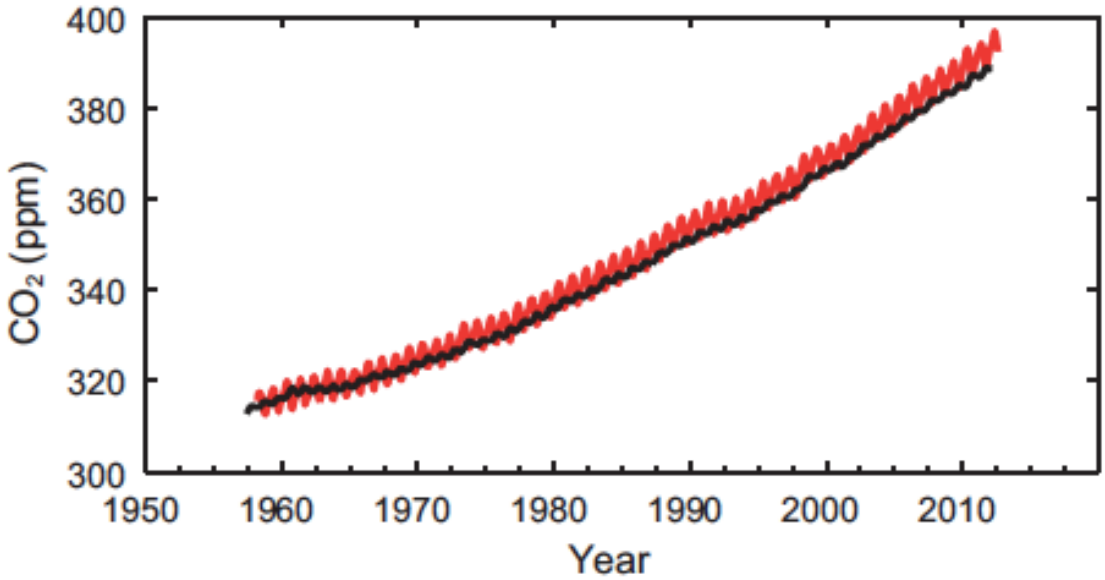

Figure 5: Atmospheric CO_2 concentrations from Mauna Loa (Hawaii, with red line) and South Pole (black line) (Source: IPCC (2013), *Climate Change 2013: The Physical Science Basis*, Summary for Policymakers)

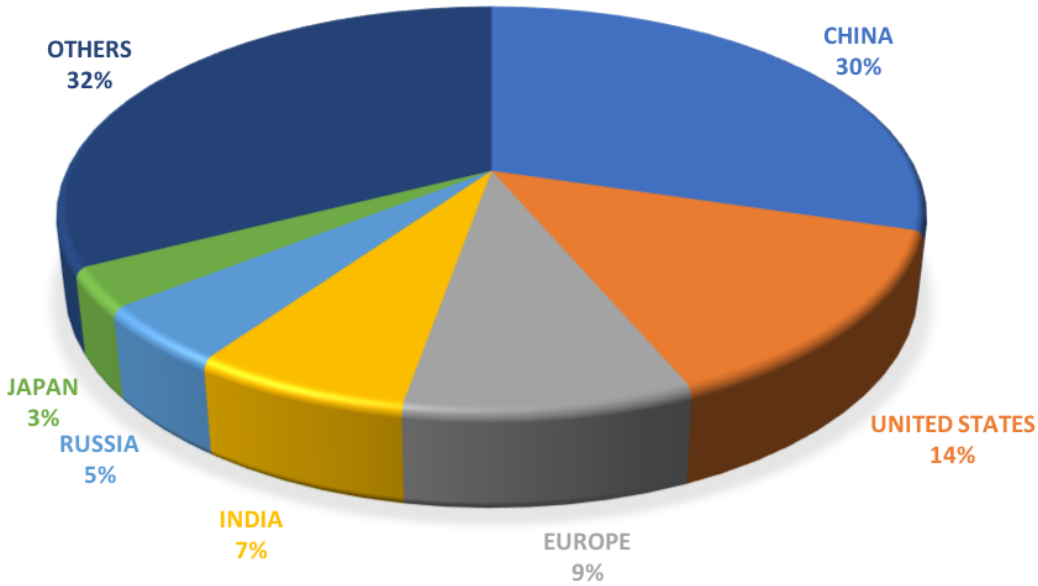

Figure 6: Share of CO_2 emissions worldwide (Source: *Personal elaboration, using 2018 data of the Emission Database for Global Atmospheric Research (EDGAR)*)

What to do for future? It's a question of timing: human influence on the climate system is obvious, but we have to fix it, because if emissions continue, temperatures are going to rise and with them the unpredictability of extreme climate events.

1.3 Paris Climate Agreement

On 12 December 2015, at the Paris Climate Conference (COP21), the first universal agreement signed by 195 countries to address global warming was adopted: the Paris Agreement. This agreement is a starting point for the fight against climate change. It allows the countries involved to adopt policies aimed to reduce emissions and to plan more aggressive, targeted and detailed strategies for the future.

The main objective of this agreement is to keep the global average temperature below 2°C, with the intention of limiting it to 1.5°C in order to avoid the risks and impacts of climate change. However, it's commonly agreed that this is a symbolic objective, as 1.5°C would be unachievable for many.

Governments are expected to meet every five years to assess progress and to report to each other on subsequent actions planned. This gives the agreement a clear transparency and reciprocal accountability.

Developed (i.e. the most polluting) countries will be required to make greater efforts than emerging and developing countries to prevent them from slowing down their economic growth in the name of decarbonization.

With regard to funding, it has been established that to help developing countries to combat the effects of climate change and to deal with losses and damages caused by extreme climate events, "developed countries intend to mobilise USD 100 billion per year by 2020 and extend this until 2025. A new and higher goal will be set for after this period"[2].

However, no sanctions will be applied to those who fail to comply with the agreement; the only constraint is the four-year wait for those who wish to abandon the initiative.

In this regard, three years after the signature of the previous President Barack Obama, the United States has formalized the start of the process for the withdrawal from the Paris Agreement on 4 November 2019. The current President Donald Trump has never made any secret of his desire to withdraw from the agreement because, in his opinion, this agreement undermines the competitiveness of US companies. However, the withdrawal

[2] https://ec.europa.eu/clima/policies/international/negotiations/paris_en

of the second largest country responsible for CO_2 emissions leaves many doubts for the international community as to its ability to meet its climate change targets.

1.4 The 2030 Agenda for Sustainable Development

In 2015, the United Nations Organization decided to contribute to global development, promote human well-being and protect environment by adopting the Agenda 2030 for Sustainable Development with 17 Sustainable Development Goals (SDGs) and 169 sub-targets characterized by three dimensions: economic, social and environmental (see Table 1). The concept of sustainability linked only to the environmental issue is therefore overtaken and is integrated into various dimensions.

This Agenda has been accepted and is applicable to all countries, this means that all countries must make a contribution to achieving the goals according to their capacities because the SDGs have universal validity. It covers five areas (called five "P"): People, Planet, Prosperity, Peace and Partnership; where the first four have a domestic dimension and the last one an international one.

The objectives to be pursued by 2030 represent common objectives on a set of important development issues: the fight against poverty, the end of hunger, the protection of human rights and the building of peaceful societies, to name a few.

Table 1: The 17 Sustainable Development Goals

	End poverty in all its forms everywhere
	End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Ensure healthy lives and promote well-being for all at all ages

Ensure inclusive and equitable quality education and promote lifelong learning opportunities

Achieve gender equality and empower all women and girls

Ensure availability and sustainable management of water and sanitation for all

Ensure access to affordable, reliable, sustainable and modern energy for all

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Reduce inequality within and among countries

Make cities and human settlements inclusive, safe, resilient and sustainable

Ensure sustainable consumption and production patterns

Take urgent action to combat climate change and its impacts

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Source: *https://sustainabledevelopment.un.org*

1.5 Actions to fight climate change: mitigation and adaptation

In order to reach the targets set in the Paris Agreement for a sustainable low-carbon future, we have to consider two types of measures that can be used by humans to prevent and limit the impacts of climate change: mitigation and adaptation.

Mitigation and adaptation work together to achieve the objective set by the United Nations Framework Convention on Climate Change (UNFCCC), which in Article 2 aims to limit GHG emissions in the atmosphere and enable sustainable economic development.

The concept of mitigation (also called preventive measures) refers to the actions that are intended to reduce or prevent GHG emissions and diminish the concentration of carbon dioxide (CO_2) by strengthening sinks. Indeed, if the amount of carbon dioxide in the atmosphere does not decrease, there is a risk of changing the climate in unpredictable ways that will make any attempt at adaptation impossible.

This is therefore a combined action, with mitigation actions on one hand and adaptation actions on the other, that means, in other words, reacting to climate impacts that are now inevitable.

The concept of adaptation refers to the ability of humans and natural systems to adapt in response to actual or expected climate change and its effects.

In particular, the UNFCCC focuses on three key notions, which are climate change impacts, resilience and vulnerability. The concept of resilience refers to the ability to absorb disturbances while vulnerability relates to the inability to cope with the negative effects of climate change. Furthermore, the IPCC makes a distinction between incremental adaptation, whose aim is to maintain system integrity, and transformational adaptation, whose purpose is to make changes in the system in response to climate effects.

There are different measures used to mitigate and adapt to climate change, including programs and policies covering different sectors. In the table below some examples (see (Table 2).

Table 2: Examples of mitigation and adaptation measures in different sectors

SECTORS	MITIGATION MEASURES	ADAPTATION MEASURES
ENERGY	Improve energy distribution and make greater use of renewable energy	Reduce power outages by promoting the distribution through renewable energies, reduce the risk of network overload
TRANSPORT	Incentives in the production of hybrid vehicles or vehicles using cleaner fuel (e.g. diesel), introduce the use of public transport and traffic calming solutions	Promote programs to check the state of maintenance in the most vulnerable civil infrastructures (river bridges, tunnel)
BUILDINGS	Encourage the use of efficient heating and lighting systems and better house insulation	Promotion of building rules that could include increased resistance to strong wind, flooding, …
INDUSTRY	More efficient use of electrical systems, recycling and better use of materials	Introduction of requirements for managers of dangerous infrastructures located in vulnerable areas to review their safety and environmental management systems
AGRICOLTURE	Better crop management, improving in energy efficiency, fertilizer management	Promotion of local agricultural products
FORESTRY	Management of forests and wood products and reduction of deforestation	Reduce urban heat by planting trees to provide shade and cooling, monitoring systems against forest fires
WASTE	Use of waste incineration with energy recovery, organic waste composting	Public initiatives to involve the population, such as recycling at home
WATER	Adapt water structures, use of water-saving tools in different sectors such as agriculture	Construction of rainwater collection cisterns, conserve water so it's available during the most severe drought periods

Source: *Personal elaboration*

1.6 The European Green Deal

On 14 January 2020, the European Green Deal was approved, an investment plan that aims to make the European Union the first climate neutral continent by 2050.

Executive Vice-President for the European Green Deal, Frans Timmermans, said that "the necessary transition towards climate-neutrality is going to improve people's well-being and make Europe more competitive. But it will require more efforts from citizens, sectors and regions that rely more on fossil fuels than others. [...]"[3].

The Green Deal represents a commitment not only on the part of the European Union but also on the part of individual Member States to reconvert their economies to achieve the carbon neutrality objective.

This Investment Plan will mobilise European funds and create an environment that will stimulate the public and private investment needed to reach the agreed amount, that is € 1 trillion of investment over the next 10 years to support the fight against climate change and the need to reduce CO_2 emissions. But let's figure out how the predetermined amount set by the European Commission will be reached:

- 503 billion of liquid resources from the European budget
- 114 billion co-financing from Member States
- 25 billion from the proceeds of ETS securities
- 280 billion of investments expected from public and private operators that will be guaranteed by InvestEU and the European Investment Bank (EIB).

The remaining part will be provided by the Just Transition Mechanism, the instrument with which the Commission intends to support the social and economic costs of the transition for those regions that will be most affected by the conversion of their economies. It's a system dedicated to those regions whose economy depends heavily on the burning of fossil fuels.
The access to this fund, which provides a sum of € 7.5 billion over 7 years, will be subject to the presentation by the states of the Just Transition Plan, where the territories eligible to receive these funds will be indicated; with a limit of € 2 billion resources for each Member State.

[3] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_17

CHAPTER II

Green Finance

2.1 Definition of "green"

From the Paris Agreement to the SDGs, a path has been initiated in the past years towards a sustainable development based on decarbonization.

The concept of sustainable development has been defined in the Brundtland Report as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[4].

Sustainable finance is therefore aimed at creating value in the long term, by adopting investment strategies that integrate the analysis of financial data with environmental, social or governance (ESG) criteria (see figure 7).

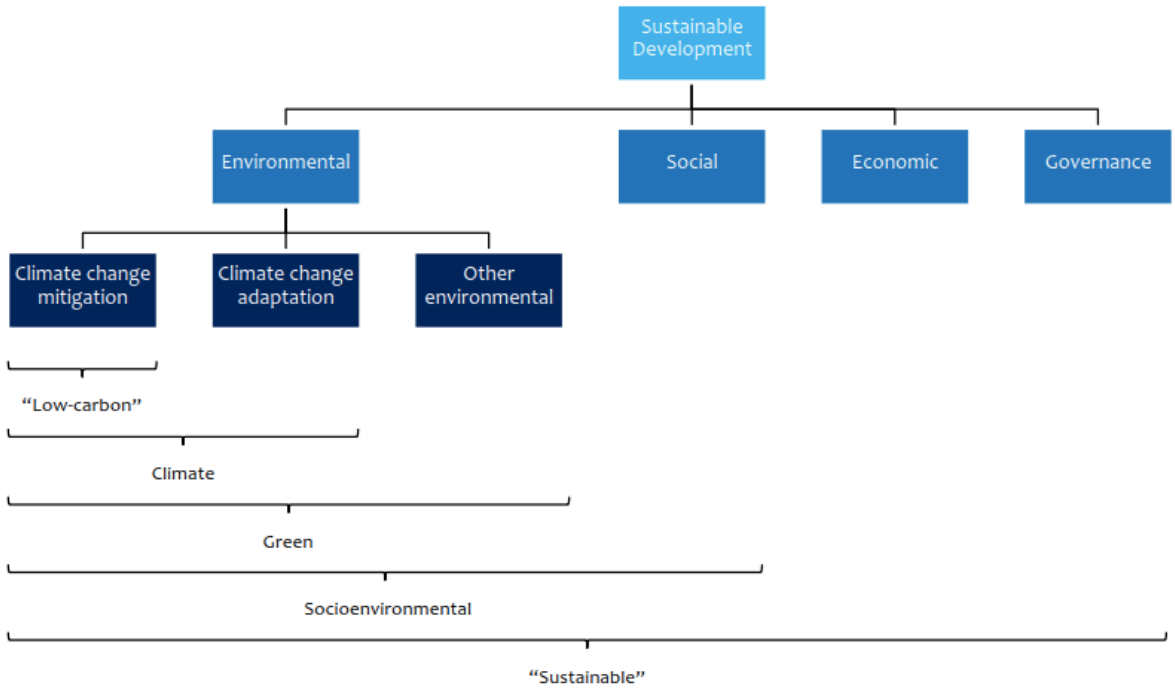

Figure 7: Linkages between climate, green and sustainable finance (Source: European Commission (2017), *Defining "green" in the context of green finance*, Final Report)

[4] https://www.iisd.org/topic/sustainable-development

Until now, we do not have a precise definition of green finance, but it can be said that this term is used to define the area of finance that aims to safeguard the environment. This raises a number of questions about what is meant by green investment. Therefore, there needs to be a high degree of clarity and transparency in order to avoid mistakes linked to incorrect or insufficient information. The actors involved must have reliable and transparent information on the environmental impact, risks and the degree of sustainability of economic activities in order to better identify sustainable investment opportunities.

In addition to the normal valuation criteria used by traditional finance, green finance believes that green-oriented business strategies would reduce information asymmetries and can significantly reduce business risk while creating value.
Some of the main definitions of green or sustainable finance mention that:

- People's Bank of China: "Green finance policy refers to a series of policy and institutional arrangements to attract private capital investments into green industries such as environmental protection, energy conservation and clean energy through financial services including lending, private equity funds, bonds, shares and insurance."
- Government of Germany: "Green finance is a strategic approach to incorporate the financial sector in the transformation process towards low-carbon and resource-efficient economies, and in the context of adaptation to climate change."
- Organisation for Economic Co-operation and Development (OECD): Green finance is finance for "achieving economic growth while reducing pollution and greenhouse gas emissions, minimising waste and improving efficiency in the use of natural resources."
- Indonesian Financial Services Authority (OJK): Sustainable finance in Indonesia is defined as "comprehensive support from the financial service industry to achieve sustainable development resulted from a harmonious relationship between economic, social and environmental interests"[5].

The field of green finance, which includes the different financing methods of the green economy, differs from the concept of climate finance, which finances climate-related activities.

[5] UNEP (2016), *Definitions and concepts: Background Note*, UNEP Inquiry, available at http://unepinquiry.org/wp-content/uploads/2016/09/1_Definitions_and_Concepts.pdf

The UNFCCC defines climate finance as "local, national or transnational financing – drawn from public, private and alternative sources of financing – that seeks to support mitigation and adaptation actions that will address climate change"[6].

2.2 ESG criteria

The growing awareness about climate change has led to an increased interest in sustainable investments and, also in the private sector, investors have started to mobilize their savings towards this type of investment.

A sustainable investment is considered as such because, in the selection process, more specific criteria such as environmental, social and governance factors, have been integrated into the traditional financial analysis to identify potential risks and opportunities.

This is because the financial analysis is no longer able to capture the value and risk of a security in which we are going to invest. The main objective of ESG assessment remains, therefore, the financial performance. But what is meant by ESG?

- The "E" concerns the environmental impact, that is the impact that the company and its business have with respect to environmental protection and sustainability; such as CO_2 emissions, deforestation or climate change.
- The "S" concerns the behavior of the company with respect to its employees, suppliers, customers, ... It includes gender policies, human rights, the company's initiatives towards health and well-being of its employees and respect for company values in the relationship with suppliers.
- The "G" relates to the behaviour of business executives and corporate governance practices; in particular the company's risk control activity, policy in terms of majority and minority shareholders, managers' remuneration policies, the composition of the board of directors.

[6] https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance

The following Table 3 summarizes the three main factors used by socially responsible investors in their decision-making process:

Table 3: Examples of ESG criteria

ENVIRONMENTAL	SOCIAL	GOVERNANCE
Waste	Human rights	Board diversity
GHG emissions	Health and safety	Lobbying activities
Climate change	Working conditions	Political contributions
Deforestation	Gender and diversity	Tax strategy
Resource depletion	Labor standards	Ethics and transparency
Energy efficiency	Employee relations	Manager remuneration
Air and water pollution	Customer satisfaction	Bribery and corruption

Source: *Personal elaboration*

ESG factors play a fundamental role in determining the risk and return of an investment. The main reason why companies adopt a sustainable strategy is to reduce risks. In fact, companies that are interested in environmental issues, which are based on strong social policies and have good governance can contribute to minimizing risks in the best way.

Their success is due primarily to the growing number of investors (especially women and millennials) and secondly to the positive image, in terms of reputation, that the actors involved acquire.

2.2.1 ESG rating

The ESG rating is a synthetic rating that is used to certify the soundness of an issuer, security or fund. This type of assessment, which is based on environmental, social and governance criteria, is combined with the traditional rating based on economic and financial variables. The combination of these two rating activities, provides a more comprehensive analysis aimed at improving the choice of an investment.

Companies interested in certifying their quality through independent analysis sign contracts with rating agencies, which are responsible for assessing the companies' performance in terms of sustainability (such as Morningstar, MSCI, Sustainalytics).

There is currently no single standard for ESG assessment; since information can be attributed a different weight, measurement methods may vary and qualitative variables may be more difficult to quantify than quantitative variables (e.g. quantification of harmful emissions).

ESG ratings are processed on the basis of public information, documents produced by the companies themselves, questionnaires or interviews and information provided by external bodies; for this reason, transparency and collaboration are necessary to ensure a correct evaluation.

2.3 SRI and related strategies

As a normal investment, a Sustainable and Responsible Investment (SRI) aims to create value for the investor in the long term. However, when evaluating and selecting a security to invest in, environmental, social and governance criteria are also taken into account.
These two terms are often used interchangeably, but it is good to make a distinction. The main difference between ESG and SRI methodology is that the principles they promote are applied differently to an investment portfolio.

The ESG analysis shows how these three factors influence the performance of a particular investment, highlighting the intrinsic qualities of the asset. SRI is an investment approach that is activated by the client and reflects the ethics of the investor using various types of criteria, such as negative or positive filters. Usually it's the client himself who imposes certain standards to form a morally acceptable portfolio.
SRI uses ESG factors to apply negative filters to avoid using money in controversial companies or industries and positive screening to reward those companies that turn their attention to morality.
Below are listed the different SRI strategies most commonly used, which provide a more complete analysis and allow to identify risks that financial analysis alone would not be able to highlight.

Negative/Exclusionary screening: it provides the exclusion of issuers, sectors or countries from investments on the basis of certain criteria (e.g. gambling, arms trade, tobacco).

Positive/Best-in-class screening: it consists in the selection, within all possible sectors, of the companies that have the best positive performance in terms of the ESG criteria.

Norms-based screening: the selection of investments is based on compliance with international norms and standards, such as those issued by the OECD, the United Nations or other agencies (including the ILO, UNEP, UNICEF).

ESG integration: ESG variables are integrated into the financial analysis to improve investment decisions and expected financial returns.

Sustainability themed investing: the selection of issuers is based on investments in sustainability issues (e.g. clean energy, green technology, sustainable agriculture).

Impact investing: this strategy involves investing in companies that aim to generate a positive social and environmental impact in addition to financial returns (e.g. renewable energy or sustainable building).

Corporate engagement and shareholder action: this activity concerns the dialogue with the company on sustainability issues and the exercise of voting rights related to capital participation. It's a process aimed at positively influencing the company's behaviour and increasing the degree of transparency[7].

The study conducted by the European Sustainable Investment Forum (Eurosif) on European SRI strategies shows a wide use of exclusion criteria (which are very easy to apply) and the growth of ESG integration. There is also a positive growth for Engagement, Best in Class and Impact Investing strategies (see figure 8).

[7] https://investiresponsabilmente.it/cose/

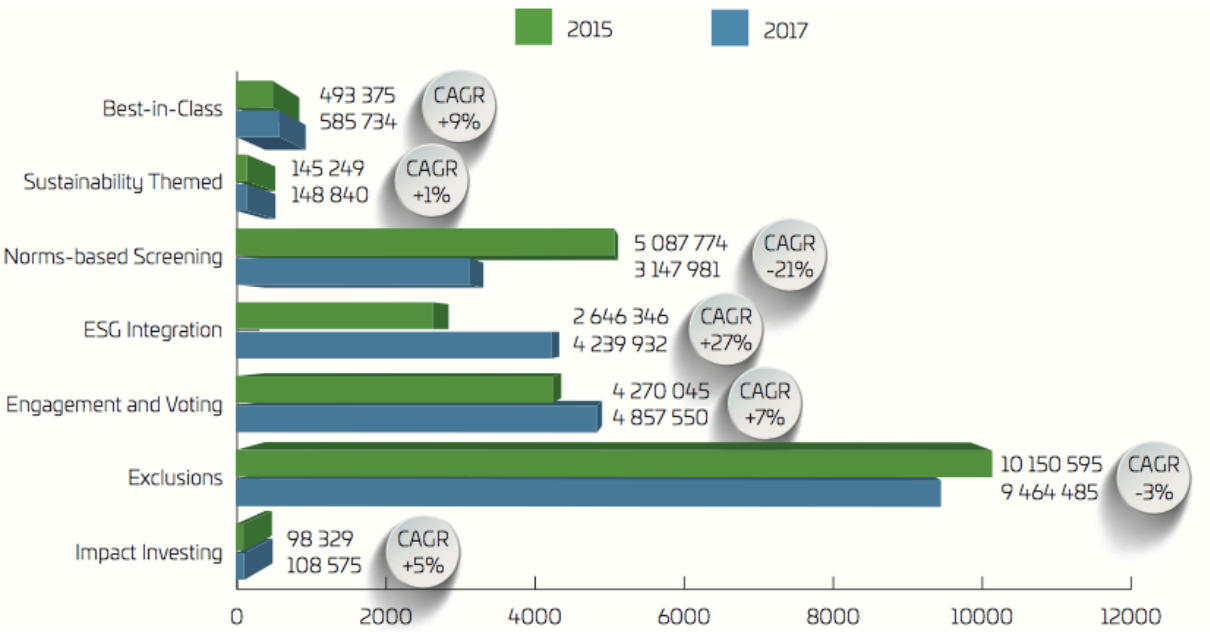

Figure 8: Overview of SRI strategies in Europe (Source: Eurosif (2018), *European SRI Study 2018*)

2.4 What Green Finance is about?

Green finance is the main instrument to support green growth: it refers to "any financial instruments whose proceeds are used for sustainable development projects and initiatives, environmental products and policies under the single goal of promoting a green economic transformation toward low-carbon, sustainable and inclusive pathways"[8].

The use of green products and services has become very popular not only among traditional banks but also among insurance companies, asset management companies and diversified financial services providers.

But what makes a financial product green? In most cases this refers to the sustainable aspect of the product (such as an investment in a renewable energy project), in other cases the product is designed to encourage environmentally friendly activities (such as green mortgages), other products labelled as green may not be universally accepted (such as credit cards or environmental catastrophes insurance). It's clear that the soul of the

[8] https://greenfinanceplatform.org/page/explore-green-finance

product should be green with the aim of protecting or improving natural systems and the environment.

In the field of sustainable finance, different sectors can be distinguished.
In the retail banking sector, the range of products and services offered to customers is supplemented with incentives to encourage those who want to support more sustainable choices. These include:

- Green mortgages, which provide customers with better interest rates for those who buy energy-efficient homes or appliances.
- Green home equity loans, also called second mortgages, that are reduced rate equity loans to help households to install residential renewable energy technologies.
- Green commercial building loans, which are loans for building projects characterized by lower energy consumption, reduced waste and lower pollution.
- Green car loans, which are loans to encourage the purchase of more sustainable vehicles at interest rates lower than market rates.
- Green cards, which include debit and credit cards linked to environmental activities.

In the corporate and investment banking sector, the need to contribute to the financing of green projects has led to the creation of new instruments. In particular, in response to climate change, new products and services have been developed.

- Green project finance, banks have created service divisions, or teams, dedicated to the project finance of large-scale renewable energy projects.
- Green venture capital and private equity, with regard to environmental issues, is increasingly being considered the financing of companies through the capital market (IPOs and bond issues).
- "Carbon finance is a general term applied to resources provided to projects that are generating or are expected to generate GHG emission reductions in the form of the purchase of such emission reductions, which are tradable on the carbon market"[9].
  A carbon market is a market created to buy and sell carbon credits. If a company wants to emit more than it is allowed to, then it can buy credits from someone who has reduced its emissions below the target level, or even from a project in a developing

[9] https://energypedia.info/wiki/Carbon_Finance

country that has Certified Emission Reduction credit (CER) to sell. The CER or carbon credits are the currency used in carbon markets.

This instrument has advantages as it can be used to obtain advance funding guaranteed by carbon revenues and can also be used to refinance projects, thus unlocking resources for new projects. However, there are only a few potential buyers of CER and a significant risk is transferred to public funding agencies if purchases are made before the project is registered (under the Clean Development Mechanism) or if carbon revenues are uncertain. Finally, the process for generating carbon revenues can be complex and costly.

- Green securitization, where a securitization refers to the process of transforming a pool of illiquid assets into tradable financial instruments (securities). The vast majority of securitization is used to refinance loans to existing assets, and banks are the main issuers of asset-backed securities (ABS)[10].

  A securitization can be defined as "green" when it is directed to low-carbon activities or when the proceeds raised are used to finance green infrastructure loans. One example is Toyota ABS, which securitizes the loans for electric and hybrid vehicles. There was an increase in the issuance of green ABS (see figure 9). Europe saw its first emission of green ABS in 2016. It's estimated that annual green ABS will reach at least $280-380 billion by 2035.

  Green securitization improves access to capital, for example by allowing small-scale projects to be grouped together and then securitized to an appropriate size for bond markets. It also allows the cost of capital to be lowered, since ABS issued in bond markets can offer a lower cost of capital than bank financing and this is important for low-carbon projects that typically have a high capital expenditure.

[10] Climate Bonds Initiative (2017), *Green Securitisation: unlocking finance for small-scale low carbon projects*, Briefing paper, available at https://www.climatebonds.net/files/files/March17_CBI_Briefing_Green_Securisation.pdf

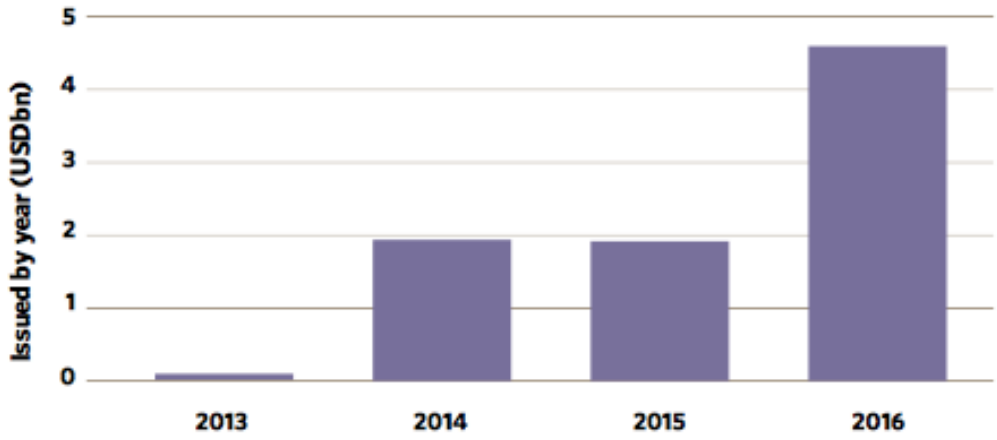

Figure 9: Growth of green labelled ABS issuance (Source: Climate Bonds Initiative (2017), *Green Securitisation: unlocking finance for small-scale low carbon projects*, Briefing paper)

In the asset management sector, risk management practices such as operational, compliance, market and credit risk are expanding.

- Green fund, which is a mutual fund or another investment vehicle that will only invest in companies that are deemed socially conscious in their business dealings or directly promote environmental responsibility. A green fund can represent a form of an investment vehicle for companies which are committed to environmentally friendly activities, as for example alternative forms of sustainable energy, eco-friendly transportation, reduction of waste, and eco-friendly ways of living[11].
  - A green investment fund is a sustainable fund that has evolved through three generations; first generation funds use only exclusion criteria (businesses such as guns, alcohol, gambling, pornography, animal testing, etc.); second generation funds use positive criteria (environmental programs, energy conservation, fair trade) and third generation funds apply both criteria to assess and select potential investments.
  - A green fiscal fund is a fund that offers fiscal advantages. In order to make investment in green funds attractive to private investors, the Dutch ministries, in cooperation with the Dutch banking sector, launched a green fiscal policy in 1995. Banks and specialized green funds provide loans at lower interest rates to entrepreneurs who engage in activities such as organic agriculture or natural development. While the return on investment is generally lower with green funds, the government has provided a fiscal advantage to those who invest in these green

[11] https://www.investopedia.com/terms/g/green_fund.asp

funds to make it financially attractive. By buying shares in a green fund, or investing money in a green bank, investors can accept a lower interest rate on their investment, while banks can offer green loans at a lower cost to finance environmental projects.

- Carbon funds, whose primary function is to encourage the development of a global carbon market and to support carbon pricing and other instruments to reduce global carbon emissions. A carbon fund receives money from investors to buy CO_2 reduction credits from existing emission reduction projects or to invest in new projects.

  The first carbon fund was created by the World Bank in 1999, with the establishment of the Prototype Carbon Fund.

  The Bank facilitates Emission Reduction Purchase Agreements (ERPAs) using funds provided by governments and companies in OECD countries to purchase project based on GHG reductions emission in developing countries and countries with transition economies. However, these funds fail to reduce emissions significantly, mainly because there are difficulties in pricing and free allocation of carbon permits.

The insurance sector is the one that is likely to grow most significantly in the coming years. Products currently available include:

- Green insurance, this type of insurance includes two kinds of products; insurance products, that differentiate insurance premiums based on environmental characteristics, and those specifically designed for clean technologies and emissions-reducing activities. These products include green car insurance and green home insurance.
- Carbon insurance, whose policy is designed to cover the main risks associated with transactions to reduce emissions and low-carbon project assessment and development activities. These risks relate to weather conditions, environmental damage or environmental disasters. Several insurance products have been designated to manage the volatility of carbon credit prices. For instance, coverage for price volatility and Kyoto project risks or insurance products for renewable energy projects.

2.4.1 The actors of Green Finance

The shift towards a more sustainable economy must be ensured through the financing of green investments and through policies that support green initiatives. However, sources of public funding are insufficient and private investment is therefore also needed.

The main actors involved include banks, institutional investors, international financial institutions, climate funds, national governments and many others.

- Corporations: are the largest source of climate related funding through investments in sustainable sectors (such as transport and renewable energy).
- Banks: play an important role because they represent a significant share of the global financial resources that can be mobilised for green investments.
- International financial institutions: include green investment banks and development banks, which provide funding for sustainable projects. They can support the green transition by testing new financing methods and by providing innovative tools (such as green bonds).
- International organization (such as the United Nations and the OECD): their funding is limited, but they are tasked with helping to coordinate funding sources and to manage sustainability issues at international level.
- Climate funds (such as the Green Climate Fund and Adaptation Fund): are funds financed through contributions from individual countries for mitigation and adaptation projects.
- National governments: decide the share of public funding that is allocated to green investments.
- Stock exchanges: are often specialize in green and sustainable investments.
- Central banks and regulatory authorities: have the task of establishing appropriate policies, laws and regulations. One of the most pressing problems to be solved is that, to date, the financial system is mainly driven by short-term returns and little attention is paid to investment in long-term projects. In this regard, bank stress tests and due diligence standards for banks and financial institutions could influence the investment decision making process by focusing on climate risks.
- Institutional investors (such as pension funds, sovereign wealth funds and insurers): are another important group of private sector financiers, but they are subject to certain restrictions. Green investments are generally not included in the relevant benchmarks

of rating agencies because there are not enough data to assign a rating; moreover, although institutional investors would be willing to invest in long-term and sustainable projects, current legislation often prevents them from doing so or allows them to do so in a very limited way.

2.4.2 The risk of greenwashing

Since the 1990s, the term greenwashing has been coined, incorporating the words green (in reference to the sustainable/ecological aspect) and washing which recalls the verb whitewash (in the sense of hiding).

This is a communication strategy adopted by companies which aims to capture consumers' favour by leveraging on environmental impact. The aim is therefore to give a positive, even if misleading, image of the company.

Consumers are increasingly interested in sustainability issues, which is why they expect companies to operate in the same way. However, in order to meet this growing need, it may happen that companies give a false image of themselves through the practice of greenwashing to encourage the purchase of their products or to attract investors.

The greenwashing phenomenon can be used to communicate untrue information about the environmental performance of one product or about the company. A greenwashing practice may involve, for example, the launch of sustainable marketing campaigns by polluting industries or changing the name of a product to make consumers believe that it comes from a natural environment.

This practice has also taken marketing connotations, as it is used to hide the defects of its own products by making the customer focus on issues of universal interest. These include pinkwashing (symbol of the fight against breast cancer), rainbow washing (symbol commonly used by LGBT communities) or genderwashing (symbol of gender equality).

2.5 The instruments of Green Finance

The choice of an investment instrument depends on various factors, such as the type of financing chosen, the development phase of the product/company, the need for partnership and the need for further support.

The two main financial instruments of green finance are debt and equity.
Equity financing is often used in the early stages of developing a project or company. This type of investment involves the investor receiving, in exchange for the invested capital, an ownership interest (stock or shares).
Equity can be divided into preferred stock and common stock (also called junior equity). Dividends of preferred stock are generally higher than those of common stock, and holders of preferred stock are paid first in case of liquidation, therefore are exposed to lower risk.

In the later stages of development, debt financing is predominantly used and often in combination with equity. In this case, investors lend money, which will be repaid with interest. Debt financing can be divided into bonds and loans.

A bond is a financial instrument that allows, to the one who buys at a predetermined price, to obtain periodic interest and repayment of principal at maturity.
A loan is a transfer of money from an individual, organization, or other entity to another.

Within sustainable finance we can distinguish between different types of bonds and loans:

- Green bonds: used to finance sustainable projects (such as renewable energy projects).
- Social bonds: used to finance projects that have a positive social impact (like investing in low-cost housing for people with limited access to the housing market).
- Blue bonds: whose funds are allocated to marine or water projects (such as investing for a more sustainable fish stock).
- Sustainable bonds: whose funds are earmarked for projects in line with the objectives set by the SDGs (provide energy-efficient and low-cost housing for people with limited access to the housing market).
- Green loans: whose funds are used for climate or environmental projects (such as recycling of plastic).

- Social loans: also in this case, it refers to projects that have a social impact (such as encouraging the employability of people with disabilities through better training).
- Sustainability loans: designed for green and social impact projects (such as providing a job opportunity for people with disabilities at a plastics recycling factory).

However, the way of raising funds is different, as the funds come from the investor market for bonds and from banks for loans.

Another investment vehicle used in environmental finance is represented by debt and equity funds. This instrument groups together several projects that may have different themes, such as forestry and agriculture; moreover, these funds allow for risk diversification between projects/investments.

Furthermore, investors use the instrument of guarantees for risk management. This tool protects the investor in case of default; in fact, part or all of the risk is transferred from the investor to the public institution, which is the guarantor of the loan; in this way, the investor can benefit from a lower rate and increase his profitability.

Private sector investments can help to close financing gaps due to scarce public funding. Investors interested in environmental and social impacts use credit enhancement instruments, some of which are first-loss capital catalysts, i.e. an instrument that absorbs a part of the investors' risk. These include grants, equity, guarantees and subordinated debt, for example a grant covering a certain amount of first loss or a guarantee covering a certain amount of capital for first losses.

Another tool that has become particularly popular in recent years is crowdfunding. This is an initiative born in Australia and the United States, which can be of a social, economic, cultural or charitable nature.
The promoter of the initiative asks the public (crowd) for sums of money of any amount (even small) to support the project (funding) through the use of a website.

The role of the crowdfunding platforms is to present the projects of the startups, which aim to raise certain amounts of money within a certain deadline: this allows them an easier way to raise capital.

At the end of the operation, portal managers may retain a percentage of the capital raised by the investment project, or it may offer the service for free, and finance themselves through the donations that the promoters of the different projects will want to offer.

There are different types of crowdfunding:

- The donation-based model concerns the collection of funds for non-profit initiatives.
- The reward-based model provides in exchange for a donation, a non-monetary reward, such as a prize or recognition (such as a public thanks on the company website).
- The lending-based model concerns microloans to individuals or companies.
- The equity-based model involves participation in the company's share capital.

CHAPTER III
Green Projects

3.1 What is a Green Project?

The growing threat of climate change has pushed different states to seek solutions to limit the effects of global warming on our planet. States have initially acted through the drafting and approval of international agreements and then have defined actions to moderate these changes.

In order to achieve these objectives, it's necessary to redirect capital towards more sustainable investment opportunities, such as investments in projects and policies that provide environmental and climate benefits through the use of different financial instruments. These environmental benefits may include improvements in energy efficiency, pollution reduction, use of cleaner technologies (cleantech), climate change mitigation and adaptation.

Although there is no universal definition of what is considered green within a project, we can say, in a general way, that a green project is a long-term project aimed at the preservation, protection and conservation of the environment, in areas such as energy, infrastructure, transport, agriculture, forestry and many others.
The lack of a precise definition makes investors reluctant to invest in these projects, which is why guidelines and standards have been drawn up to allow easier and more clear identification of what should be considered as green investment.

The fundamental requirement to define a project as green is the objective pursued, which must cover environmental issues. In order to better identify these goals, we tend to distinguish into sectors which in turn include several sub-categories (see figure 10).

Common Green Project Categories			
Energy	**Buildings**	**Industry**	**Transport**
Solar	Efficient Buildings	Resource Production	Rail
Wind	Low Carbon Materials	Fuel Production	Charging Infrastructure
Transmission	Urban Development	Carbon Capture	Sustainable Shopping
Information Technology	**Waste and Pollution**	**Land Use/Marine Resources**	**Water**
Power Management	Waste to Energy	Agriculture Production	Monitoring
Connectivity	Material Recovery	Sustainable Fisheries	Flood Defense
Broadband	Recycling	Commercial Forestry	Storage and Treatment

Figure 10: Common Green Project Categories (Source: *Climate Bond Initiative*)

These types of projects can be developed either publicly by national or supranational institutions, such as a European renewable energy project; or by private individuals, such as a project to make a company's machinery more efficient.

Here are some examples of existing European green projects (see figure 11):

Investing in new environmentally friendly technology

Substituting harmful refrigerants in commercial refrigerators with carbon dioxide, to:

- reduce greenhouse gas emissions;
- make the appliance at least 10% more energy efficient;
- reduce installation and maintenance prices.

Where: Italy, Spain and Romania

Supported by: the EU's LIFE programme

Helping citizens and businesses cut CO_2 emissions and lower energy bills

- installation of solar panels on private homes;
- renovation of multi-apartment buildings;
- energy efficiency investments in industrial companies.

Where: Lithuania

Supported by: the European Investment Bank guaranteed by the European Fund for Strategic Investments.

Creating new economic opportunities in former mining towns

- transforming a former coal mine in Katowice into a cultural area which now consists of a museum, a congress centre and a new concert hall;
- creating opportunities in the construction, tourism, cultural and food services sectors.

Where: Poland **Supported by:** Cohesion policy funding

Lowering car emissions

Reducing the weight of vehicles on the road by replacing heavier car manufacturing materials with lighter, renewable components.

- 30,000 new cars to be equipped with these new components;
- 8% less carbon dioxide to be emitted by new cars.

Where: Poland and Italy

Supported by: the EU's LIFE programme

Figure 11: Examples of European Green Projects (Source: European Commission (2020), *EU Funded Projects to Green the Economy*)

The slow development of green projects is due to:

- Project duration, green projects are long-term projects and therefore need long-term funding. Public financial institutions, or even pension funds and insurance companies, can be used to fill this gap.
- Associated risks, within a green project, new technologies are used and often result to be expensive and risky. The production of these technologies may also depend on the supply chain and trade with foreign countries, so the exchange rate risk is added. Finally, there may be more general risks related to the project or, for example, to natural disasters.
- Low rate of return, the lack of access to conventional sources of financing increases the cost of debt (borrowing interest rate) and this leads to a reduction in the rate of return of green projects compared to fossil fuel projects. Moreover, the lack of green data and

green databases hinders the development of these projects, as it limits the banks' ability to assess the environmental risks associated with the project.

The first step in choosing a project includes identifying the right project, developing a plan that involve both public and private sector to raise the necessary funds, and structuring the financing.

3.2 How to finance a Green Project?

There are several tools, among those analyzed in the previous chapter, that can be used to fund a green project. Given the long-term nature of these kind of projects, the bond market is a valuable source of financing and the most widely used instrument is the green bond.

Green Bonds

This is not a new instrument, but is simply a bond which, at the end of a given period, repays an interest rate in addition to the amount invested. Green bonds are similar in structure, risk, and return compared to a traditional bond; the only difference concerns the investment objective.

In essence, the necessary condition to consider this type of bond as green is that the proceeds must be explicitly earmarked for environmental purposes. Green bonds allow the financing of various types of projects with a positive environmental effect, such as energy, transport, waste and water management, pollution control, land use and building construction.

In 2007, the European Investment Bank issued the first green bond called Climate Awareness Bond (CAB). Initially, the new bonds came mainly from supranational financial institutions, such as the World Bank or the European Investment Bank. Today, in the market, there are also companies, local, state and national governments.

Since 2007, the green bond market has expanded significantly worldwide, partly due to subsequent climate agreements, such as the Paris Climate Agreement. The rapid growth is also due to the growing attention of supranational institutions to sustainability issues

and the entry into the green bond market by large companies from emerging countries such as China and India.

The green bond market is the fastest growing segment of the global debt securities market. The turning point was reached in 2013, when the first corporate green bond was issued. Between 2012 and 2017, the annual average growth of the green bond market was 120% (see figure 12). Green bonds are used in several sectors for projects that aim to solve global warming problems, in particular in the energy, building and transport sector (see figure 13).

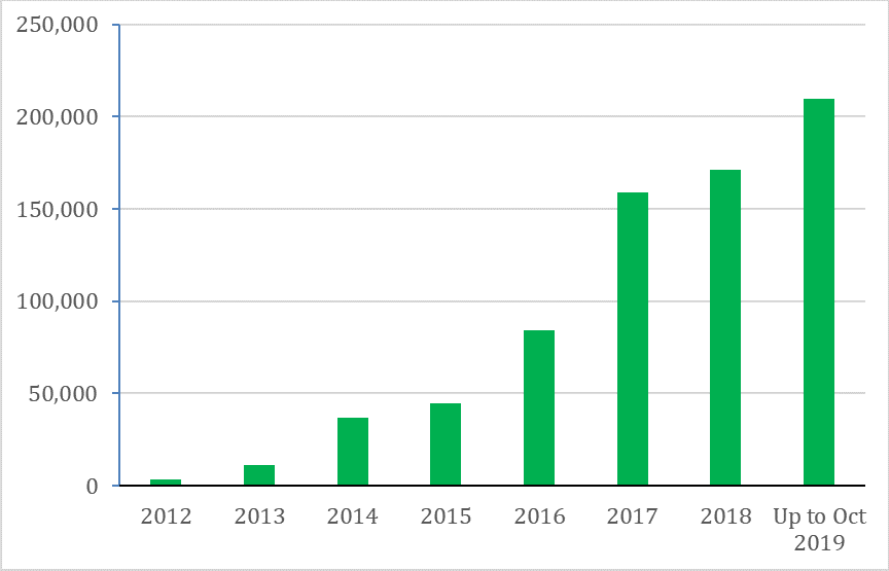

Figure 12: Annual Green Bond issuance (USD million) (Source: *Climate Bond Initiative*)

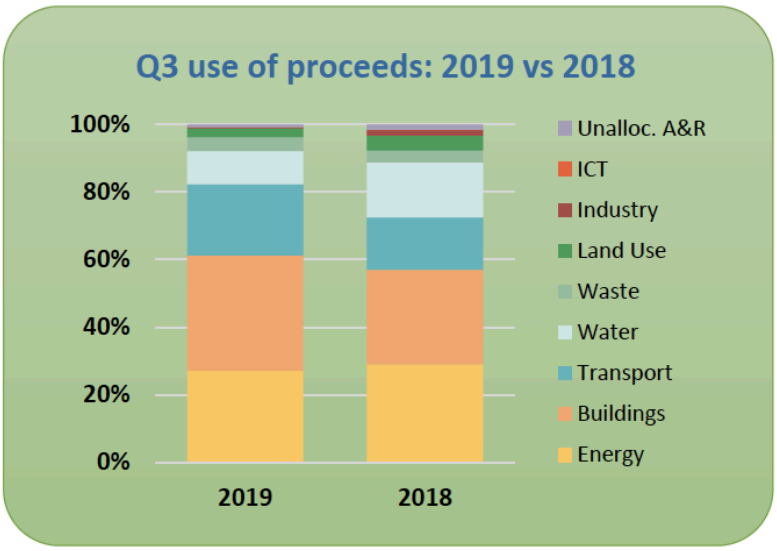

Figure 13: 2018 VS 2019 Green Bond issuance per sectors (Source: Climate Bonds Initiative (2019), *Green bond market summary*, Q3 2019)

In addition to green bonds, other instruments used for financing green projects are the social bonds and the sustainability bonds.

Social Bonds

A social impact bond (also known as social bond) is a type of financial security that provides capital to the public sector to fund projects that will create better social outcomes and lead to savings[12].

The social bond, introduced in 2010, is basically a financial instrument used by governments to finance social projects. These projects aim to address or mitigate a specific social issue and/or seek to achieve positive social outcomes, especially, but not exclusively, for one or more target populations. Social projects include basic infrastructure at affordable prices (clean drinking water, energy), access to essential services (health, education), food safety, … ; while target populations include those that are living below the poverty line, excluded or marginalized populations, migrants and/or displaced persons, unemployed and many others.

The process begins when the government identifies a social challenge or problem in the public sector (public safety, health and family support services, ...) it wants to address. Consequently, a contract is concluded with an organization that acts as an intermediary.
The intermediary raises capital from investors, who provide the necessary funds to support the execution of the project (for the entire duration of the project, the investors do not receive any interest payments).
At the end of the established period, an independent evaluator completes the evaluation of the success of the project on the basis of predetermined benchmarks.
If the project is successful, the investors are reimbursed by the government for their investment; if the project fails, the investors will lose money and get nothing. The high risk to which the investor is exposed with these bonds is therefore evident.

The following figures (see figures 14 and 15) highlight the countries and sectors where social bonds are most widely used.

[12] https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/social-impact-bond/

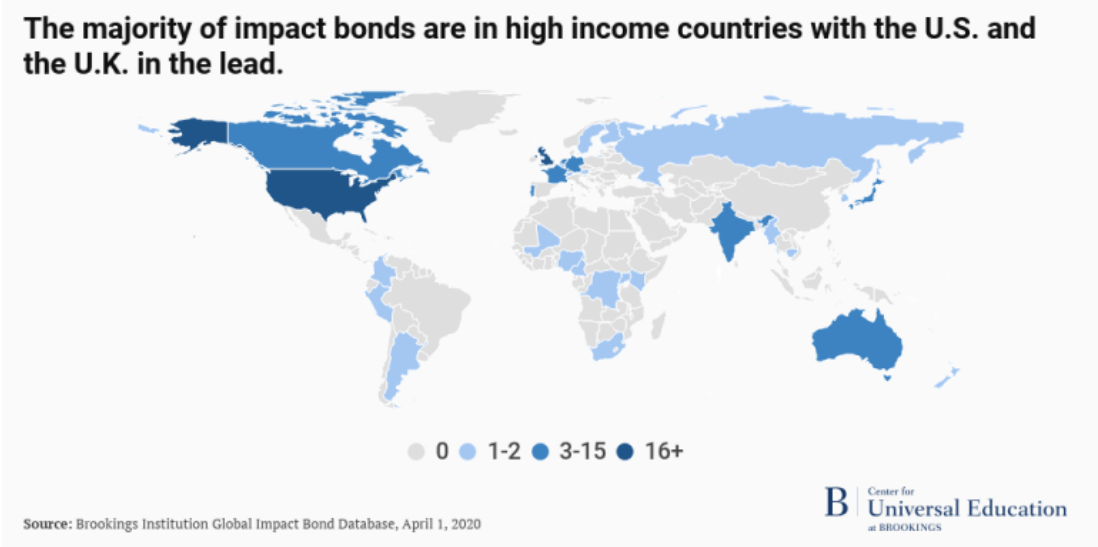

Figure 14: Use of social bonds by country (Source: *https://www.brookings.edu*)

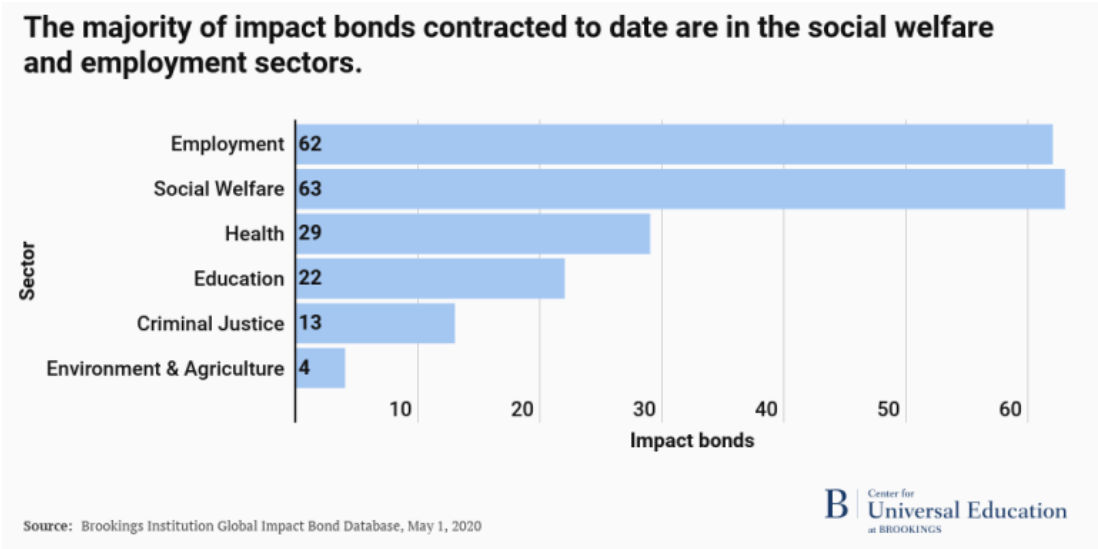

Figure 15: Use of social bonds by sector (Source: *https://www.brookings.edu*)

Sustainability bonds

Bonds that intentionally mix green and social projects are referred to as sustainability or sustainable bonds, created to meet the investment needs of the Sustainable Development Goals.

The sustainable bonds are debt securities issued by private or public entities to finance activities or projects linked to sustainable development. The sustainable bond must

specify the interest rate (coupon) that will be paid and the time at which the principal of the bond must be returned (maturity date)[13].

Sustainable bonds can be distinguished by the nature of their returns or by their sector of reference. As for social bonds, in some cases the return is linked to the success of the project (riskier), in other cases the return is fixed.

2020 marks the beginning of a decade of urgent climate and sustainability actions. Although the sustainable bond market has grown over the past year, it is still unable to meet global sustainability challenges. In this respect, the European Taxonomy represents an important step forward in redirecting economic activity towards sustainable activities.

Green Loans

Finally, one of the most widely used financial instruments which fall under green finance umbrella is green loan, which is mainly used for the financing of green and sustainable projects.

Green loans, which have become more popular since the guidelines were established in 2018, are the same as a conventional loan in terms of financial and commercial return, but there is a commitment to actions that lead to environmental benefits.

Currently, the green loans market in Europe has slowed down (33%) but has grown significantly in Asia-Pacific (46%). To date, the proceeds from green loans are mainly allocated to the energy and building sectors (see figure 16 and 17).

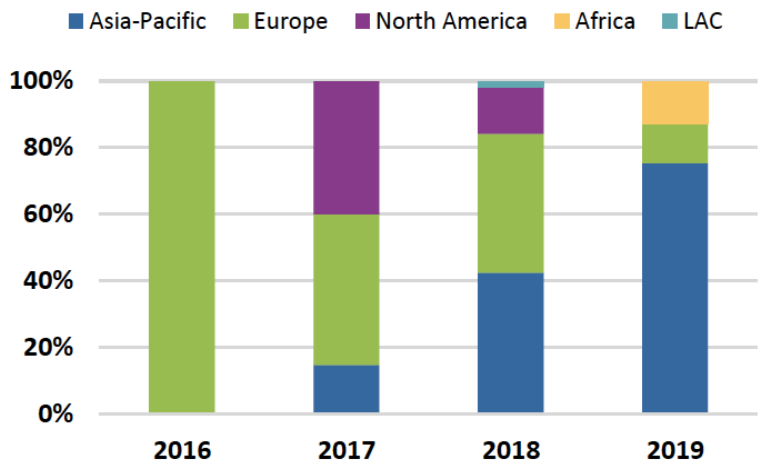

Figure 16: 2019 Green Loan issuance per country (Source: Climate Bonds Initiative (2019), *Green bond market summary*, Q3 2019)

[13] European Impact Investing Luxembourg (2016), *Sustainable Development Bonds*, available at http://www.impact-investing.eu/blog-publications/article/2016/07/sustainable-development-bonds

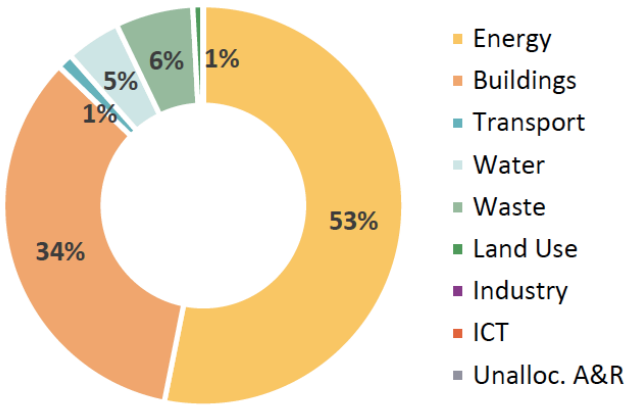

Figure 17: 2019 Green Loan issuance per sectors (Source: Climate Bonds Initiative (2019), *Green bond market summary*, Q3 2019)

Finally, a distinction can be made between a green loan and a sustainability linked loan, another form of loan that has been successful in recent times.

Unlike green loans, sustainability linked loans do not have to allocate their proceeds to a particular project, but borrowers are required to improve their performance in relation to ESG criteria; this means that the loan is linked to sustainability performance. If certain sustainability targets are met, the recipient may benefit from interest rate reductions on the loan or receive other financial incentives.

The global volume of green and sustainability linked loans grew exponentially in 2018, exceeding USD 99 billion, of which USD 43.2 billion was in sustainability linked loans (see figure 18).

Figure 18: Aggregate volumes of green and sustainability linked loans from 2014 to 2019 (Source: *Bloomberg data 2019*)

Those listed are the most popular types of funding for green projects, but they are not the only ones. Among them we can find some tools already described in the previous chapter, such as crowdfunding, green securitization and green funds, just to name a few.

3.3 How to say if a project is eligible?

There is currently no common classification system either at European or global level defining which economic activity can be considered as sustainable.

In 2018, the European Commission has created the Technical Expert Group on Sustainable Finance (TEG), a group of 35 experts and over 100 consultants to advise on different topics, one of which concerns a European classification system called EU Taxonomy, or in other words a "green list", which provides a common language for identifying economic activities that can be defined as sustainable.

The main purpose is to reduce greenwashing practices and reduce fragmentation resulting from market-based initiatives and national practices. This document is a key step towards achieving the decarbonization targets set for 2050, but above all, it allows to help investors and financial institutions efficiently allocate capital and make well-informed decisions.

The final report on Taxonomy published by the TEG on 9 March 2020 defines the technical screening criteria according to which an economic activity can be defined as sustainable. In particular, it must have a positive impact on at least one of the six environmental objectives, without harming the others and it must meet minimum safeguards (e.g., OECD Guidelines on Multinational Enterprises and the UN Guiding Principles on Business and Human Rights):

1. Climate change mitigation
2. Climate change adaptation
3. Sustainable and protection of water and marine resources
4. Transition to a circular economy
5. Pollution prevention and control
6. Protection and restoration of biodiversity and ecosystems.

The activities considered are more than 70 and their sectors produce about 93% of European polluting emissions, such as agriculture, energy, transport, construction, information and communication technology and many others.
Among them, the TEG report identifies three categories of activities considered sustainable: those that are already environmentally sustainable (low carbon), those that pollute but cannot be avoided (transition) and those that are useful to the other two categories (enabling).

Activities that damage the environmental objectives fall under the criteria defined as brown and, currently, this type of criteria is excluded from the Taxonomy report. An example is nuclear, widely demanded by a group of Member States led by France. However, it's not excluded that these so-called brown criteria could be included in future revisions.
The final report explains that "by establishing brown criteria, the Taxonomy would effectively create three performance levels within the Taxonomy structure: substantial contribution (green), significant harm (brown, or perhaps red) and a middle category of neither substantial contribution nor significant harm"[14].

To make the Taxonomy operative, the European Commission will provide a platform for the drafting of delegated acts: the platform on sustainable finance (Article 15 of Regulation (EU) No 346/2013).

- By the end of 2020, the delegated acts relating to the first two of the six criteria will have to be published.
- By the end of 2021, the first set of criteria will become effective and the delegated acts of the other four criteria will also have to be published.
- By the end of 2022, the last 4 criteria will become effective (see figure 19).

[14] Technical Expert Group (2020), *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*, available at https://ec.europa.eu/knowledge4policy/publication/sustainable-finance-teg-final-report-eu-taxonomy_en

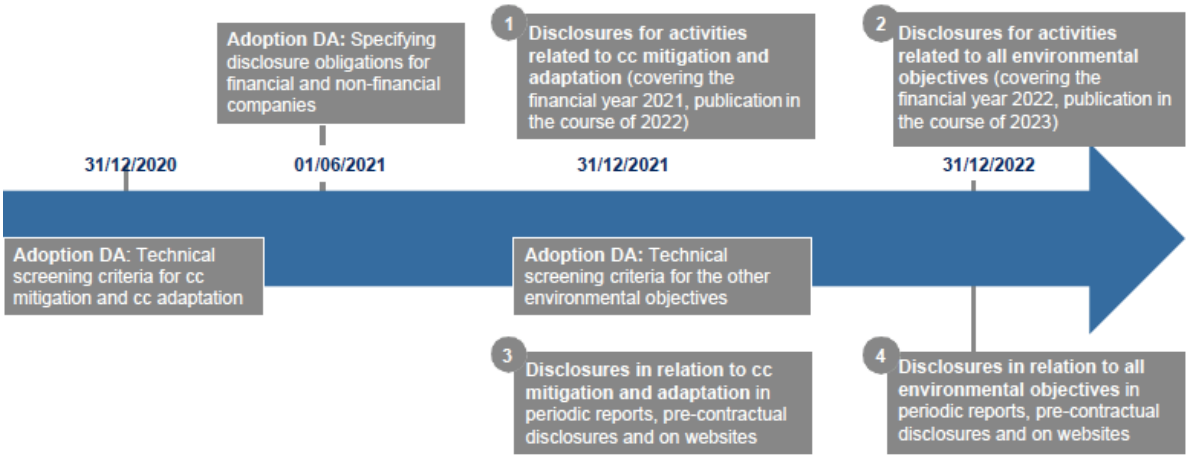

Figure 19: Taxonomy's timeline (Source: Technical Expert Group (2020), *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*)

Similarly to the Taxonomy provided for by the European Commission, the Climate Bond Initiative has established a certification system for green bonds with the aim of encouraging issuers, investors, governments and financial markets to priorities investments that contribute to address climate change. It has developed its own Taxonomy to classify all activities that can be defined as green and areas of interest to which issuers may refer when issuing a green bond (see figure 20).

A traffic light system has been adopted to identify whether assets and projects are considered suitable for the decarbonization process. The green light indicates compatibility, the orange light indicates potential compatibility (depending on whether more specific criteria are met or not) and the red light indicates incompatibility. The grey circle indicates that a color still needs to be identified for that specific asset.
Within these areas, projects are selected according to inclusion and exclusion criteria. For example, in the energy sector, activities that generate energy from renewable sources are included, while energy production from fossil fuels is excluded.

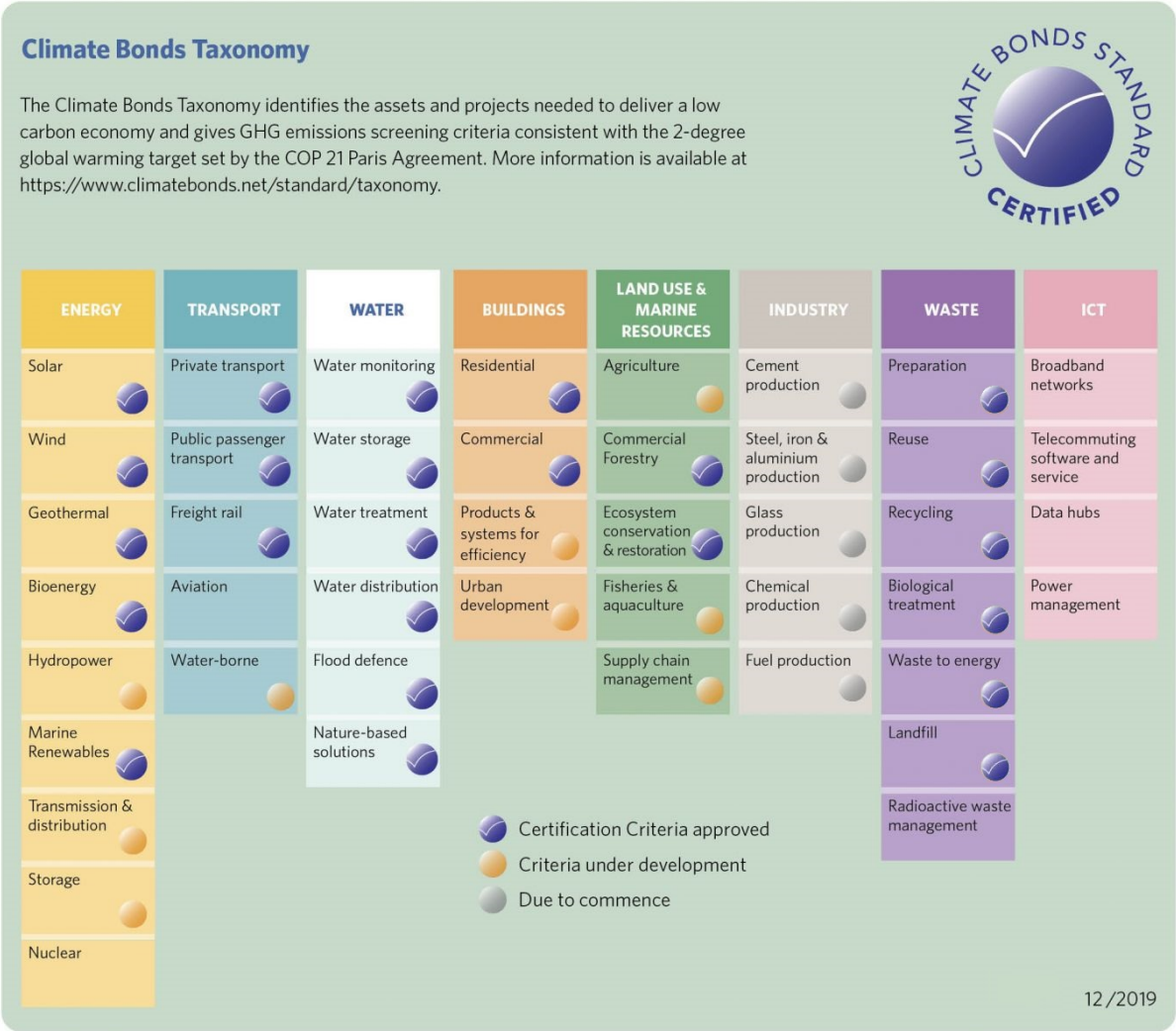

Figure 20: Climate Bond Initiative Taxonomy (Source: *https://www.climatebonds.net/standard/taxonomy*)

3.4 Green Certification

At the international level, there is a regulatory fragmentation, as the two regulatory frameworks for the green bond market are the Green Bond Principles and the Climate Bond Standard; however, there are regulations on a national basis adopted by specific countries such as China and India that follow different, although similar, guidelines.

This creates high costs for investors as they are forced to compare different standards in order to verify the necessary green requirements.

There is currently no global standard to certify a particular bond as "green" but there are guidelines developed by the International Capital Market Association (ICMA).

Depending on the type of instrument used, ICMA has identified the necessary requirements for a bond to be considered green, social or sustainable. There are different types of certification such as the Green Bond Principles, the Social Bond Principles and the Sustainability Bond Guidelines. Similarly, the Loan Market Association (LMA) has developed the Green Loan Principles, a set of standards and guidelines used in the green loan market.

3.4.1 Green Bond Principles

In 2014, ICMA established the Green Bond Principles (GBP) that are voluntary process guidelines (and, as such, do not provide for any penalties in the event of default) that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach for issuance of a green bond[15].

The GBP have four main components:

1. Use of proceeds, that is the utilisation of the proceeds of the bond for green projects which, by definition, bring environmental benefits. If a portion of the proceeds is used to refinance a project, the portion assigned to financing and the portion allocated to refinancing must be specified.

   The Green Bond Principles explicitly recognize several categories of eligibility for green projects (see Table 4), which contribute to environmental objectives such as climate change mitigation, climate change adaptation, natural resource conservation, biodiversity conservation, and pollution prevention and control.

[15] ICMA (2018), *Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds*, available at https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/

Table 4: Categories of eligibility for green projects

CATEGORIES	GREEN PROJECTS
Renewable Energy	Production and transmission of renewable energy (solar, wind, water…)
Energy Efficiency	Energy storage, district heating, smart grids
Pollution Prevention and Control	Reduction of air emissions, GHG control, soil remediation, waste reduction
Management of Living Natural Resources and Land Use	Environmentally sustainable agriculture, animal husbandry, fishery and aquaculture, forestry, including afforestation or reforestation and preservation of natural landscapes
Terrestrial and Aquatic Biodiversity Conservation	Protection of coastal, marine and watershed environments
Clean Transportation	Electric, hybrid, public transportation and reduction of harmful emissions
Water and Wastewater Management	Sustainable infrastructure for clean water, wastewater treatment, sustainable urban drainage systems
Climate Change Adaptation	Information support systems, such as climate observation
Eco-Efficient and Circular Economy	Promotion of eco-sustainable products, resource-efficient packaging and distribution
Green Buildings	Construction of buildings according to regional, national or international standards.

Source: Personal elaboration based on ICMA (2018), Green Bond Principles, *Voluntary Process Guidelines for Issuing Green Bonds*

2. Process for project evaluation and selection, where the issuer of a green bond should communicate to investors:
   - the environmental sustainability objectives
   - the process to determine if the project is eligible for green bonds and falls within the established categories
   - the selection criteria used (eligibility and, if applicable, exclusion criteria) to identify suitable projects.

It's recommended that the issuer's process for project evaluation and selection is completed by an external review.

3. Management of proceeds, which means that net proceeds of the green bond, or an equivalent amount, should be deposited in a dedicated account, transferred to a specific portfolio or in any case tracked by the issuer.
4. Reporting requires that issuers must update annually their data relative to the use of the proceeds, including a list of the projects where the proceeds were used, a brief description of the projects, details of the amounts allocated, the expected impacts on the environment and their performance.

Issuers are recommended to appoint one or more external auditors to verify the alignment of the green bond with the four principles listed above. There are a variety of ways for issuers to obtain such information and there are several levels and types of review that can be provided to the market.

Second Party Opinion

The second party opinion is an opinion released by an institution that is independent from the issuer and has environmental competences. Generally, it involves an assessment of compliance with the GBP. It may involve an evaluation of the issuer's general objectives, strategies, policies and/or procedures in relation to environmental sustainability, as well as an analysis of the environmental characteristics of the project.

The Centre for International Climate and Environmental Research (CICERO) is one of the most famous external reviewers dealing with the second party opinion. In 2015, CICERO introduced a methodology that provides external opinion on the quality of the green product, evaluating the degree of environmental benefits generated by the project through the assignment of a certain shade of green. This methodology provides transparent information on how a green bond aligns with a low-carbon climate resilient future (see figure 21).

SHADES OF GREEN	DESCRIPTION
	Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future.
	Medium green is allocated to projects and solutions that represent step toward the long-term vision but are not quite there yet.
	Light green is allocated to projects and solutions that are environmentally friendly but do not by themselves represent or contribute to the long-term vision.
	Brown for projects that are in opposition to the long-term vision of a low carbon and climate resilient future.

Figure 21: Cicero Shades of Green methodology (Source: *https://www.cicero.oslo.no*)

Verification

The issuer may obtain independent verification in relation to a specific set of criteria, generally related to business processes and environmental criteria. It may focus on the alignment of the project with internal or external standards, the procedure used in the allocation of funds, the environmental impact statement or the alignment of reporting with the principles.

Certification

It takes place when the issuer requests that qualified and accredited third parties certify the alignment of its instrument with the GBP. The most famous organisation that provides for this type of certification is the Climate Bond Initiative.

Scoring/Rating of Green Bonds

The issuer may request to qualified third parties to evaluate its green bond according to a pre-defined scoring/rating method. In doing so, the risk of the bond, the yield and the impact on the environment can be established.

All companies providing external reviews should be driven by the following five ethical and professional principles:

- Integrity
- Objectivity

- Professional competence and diligence
- Confidentiality
- Professional behaviour.

An external review may be partial, covering only some aspects or complete; where alignment with all four key components is assessed. To conclude, it can be said that the external review, or a summary of it, must be made available to the public.

3.4.2 Climate Bonds Standard

Another relevant certification scheme comes from the Climate Bond Initiative which has established a clear and transparent certification system to be applied to green bonds and other debt instruments: Climate Bonds Standard (CBS).

It was launched in 2011, with periodic updates, with the aim to provide a guidance to issuers, investors, governments and regulators to prioritize investments aimed at dealing with climate change and; in order to make the international framework as homogeneous as possible, CBS are aligned with GBP.

The CBS requirements are divided into a pre-issuance and a post-issuance phase.

The first phase concerns issuers seeking certification before the issuance. At this stage, CBI uses a body called Climate Bonds Standard Board to ensure that all the documents that the issuer delivers are correct. The verification is carried out by an independent body that ensures that Climate Bonds Standard requirements are met. Once the requirements have been verified, the obligation is certified as "Climate Bond Certified" (see figure 22).

Figure 22: Certified Climate Bond mark (Source: *https://www.climatebonds.net*)

The certification, in this case, refers exclusively to the climatic attributes of the bond and does not cover other aspects such as compliance with national or international law.

The second phase concerns issuers seeking to continue certification after the issuance of the bond and those seeking certification of bonds already issued. At this stage, within 12 months after issuance, the verifier's post-issuance report must be submitted to confirm that what was verified prior to certification has remained unchanged. Finally, it is necessary to provide an annual report to bond holders and CBI.

The success of this certification system lies in the link between the standards and the Taxonomy system developed by the CBI. This, in fact, has allowed a more detailed and specific identification of the relevant sectors; which has led the European Commission to outline its own classification system (EU Taxonomy) and its own certification scheme (EU Green Bond Standards).

3.4.3 EU Green Bond Standards

The need for a global green bond standard, has driven the European Commission to develop the EU Green Bond Standards (EU-GBS), a standard to be followed on a voluntary basis, in line with the same Taxonomy, accessible and applicable everywhere, such as the GBP.

The TEG describes an EU Green Bond as any type of bond instrument that meets the following three requirements:

- The proceeds are used exclusively to finance or re-finance green projects
- The issuer's Green Bond Framework needs to explicitly be aligned with the EU-GBS
- The alignment of the EU-GBS is verified by an accredited external verifier.

Analogously to the GBP, the EU-GBS have four main components:

1. Green Projects: are defined as such when the capital raised through the issuance of the green bond is used to finance or refinance a project that has certain environmental objectives. Green projects must be compulsorily aligned with the EU Taxonomy. Such green projects must be present within the Green Bond Framework and in the legal documentation accompanying the issuance of such bonds.
2. Green Bond Framework: this is the document through which the issuer communicates to investors the projects that will be financed by the green bond; providing information regarding the environmental objectives, the process by which the issuer determines

the alignment of green projects with the EU Taxonomy, a description of the green projects to be financed or refinanced.

3. Reporting: issuers are required to do reporting, at least annually until full allocation and such reporting is also required at a future date, if there have been changes in the allocation of such proceeds. The report must include a statement of EU-GBS compliance, the amount allocated, the nature and environmental impact of each green project, the geographical distribution of the revenue allocation and the Green Bond Ratio[16].
4. Verification: it becomes mandatory and must be assigned to an external verifier appointed by the issuer, who must be formally accredited. This verification includes an initial pre-issuance and post-issuance. The results of the verification must be made public on the issuer's website in order to make investors aware of their investment choices.

The main differences between GBP and EU-GBS are listed in Table 5:

Table 5: Difference between GBP and EU-GBS

	TECHNICAL ASPECTS	GBP ICMA	EU-GBS
Use of Proceeds	Sectors financed by the green project	List of general categories	European Taxonomy
Use of Proceeds	Indication of the proportion of proceeds for refinancing/financing	Recommended	Required
Process for Project Evaluation and Selection	Confirmation of GBP/EU-GBS alignment in a legal document	Recommended	Required
Management of Proceeds	Traceability of capital raised	Recommended	Required
Reporting	Monitoring and reporting environmental impact	Recommended	Required
Third party auditor	External reviews	Recommended	Required
Third party auditor	Publication of the external reviews	Recommended	Required

Source: *Personal elaboration*

[16] The Green Bond Ratio is the ratio of the total amount of outstanding green bonds to the total amount of outstanding debt at the end of the reporting period.

3.4.4 Social Bond Principles, Sustainability Bond Guidelines, Green Loan Principles

In addition to the green bond market, the social bond market, the sustainability bond market and the green loan market are also regulated by their own guidelines inspired to GBP. Once again, these are voluntary guidelines that promote the development of the market through transparency, disclosure and reporting.

Social bonds are defined as any type of bond instrument in which the proceeds will be used exclusively to finance or refinance new and/or existing social projects. The Social Bond Principles are aligned with the four main components of GBP.

The sustainability bonds are defined as any type of bond instrument in which the proceeds will be used exclusively to finance or refinance a combination of green and social projects. The sustainability bonds are aligned with the four main components of both the Green Bond Principles and the Social Bond Principles.

The classification of an obligation as green bond, social bond or sustainability bond should be determined by the issuer, based on the objectives pursued in its project.

Green loans are defined as any type of loan instrument used exclusively to finance or refinance, in whole or in part, new and/or existing green projects. The Green Loans Principles are aligned with the four main components of the GBP.

The four components are:

1. Use of Proceeds
2. Process for Project Evaluation and Selection
3. Management of Proceeds
4. Reporting

The Social Bond Principles provide the utilisation of the proceeds of the bond for social projects that should provide clear social benefits. If a portion of the proceeds is used to refinance a project, the portion assigned to financing and the portion allocated to refinancing must be specified. Points 2,3, and 4 remain unchanged compared to GBP.

The Green Loan Principles provide the utilisation of the loan proceeds for green projects which should provide clear environmental benefits. If a portion of the proceeds is used to refinance a project, the portion assigned to financing and the portion allocated to refinancing must be specified.

A green loan may take the form of one or more tranches of a loan. In this case, the green tranche must be indicated, and the proceeds of the tranche must be deposited into a separate account or traced by the borrower in an appropriate way.

The Green Loan Principles explicitly recognize several general categories of eligibility for green projects; in line with those listed within the GBP. Points 2,3, and 4 remain unchanged compared to GBP.

The external review process, consisting of the four components second party opinion, verification, certification and rating, remains unchanged from the GBP.

3.4.5 Other Green Bond Guidelines

In addition to the above guidelines, which take on an international dimension, some states have decided to regulate the issuance of green bonds through national guidelines. Examples include the guidelines of China and India.

China Guidelines

In December 2015, the Public Bank of China (PBoC), which is the regulatory authority overseeing the interbank bond market, published the first official Chinese Green Bond guidelines. These guidelines establish the requirements to qualify projects as green, management of proceeds and reporting.

One year later, the National Development & Reform Commission (NDRC) published a different set of guidelines for green bonds aimed exclusively at bonds issued by companies. Unlike the PBoC guidelines, the NDRC guidelines are less comprehensive as only the definition of green bond is taken into account.

In the same year, the Shanghai Stock Exchange (SSE) published its own set of green bond guidelines for corporate issuers, inspired to PBoC guidelines.

The official list of green project categories considered eligible for green bond funding are listed in a document called The Catalogue, approved by PBoC. The NDRC guidelines also

define their own list of eligible projects which are largely in line with those approved by PBoC; except for nuclear energy, not approved by PBoC.

In general, the categories considered are mostly aligned with the categories of green projects provided by international guidelines and standards, such as the GBP and the CBI Taxonomy and Standard. However, there are some categories of green projects considered unacceptable by international investors but allowed by Chinese issuers and investors; such as fossil fuel projects (see figure 23).

Sectors Aligned	Sectors aligned that can be further developed by China	Sectors not aligned
Industry and energy-intensive commercials **Energy distribution and management** **Green buildings** different technical criteria applied **Renewable energy** solar, bioenergy, wind, hydro, geothermal and marine **Waste, pollution control and sequestration** recycling, circular economy **Transport** new energy vehicles, biofuels, private transport, ICT **Adaptation** different examples	**Renewable energy** supply chain **ICT** broadband, teleconferencing and telecommuting software and services **Adaptation** energy, industry and waste, transport, food supply chain, and financial sevices **Transport** pubic bike, multi-modal logistic hubs, and public transport (the Cimate Bonds Standard require additional emission threshold) **Agriculture and Forestry** The Climate Bonds Standard requires mitigation or adaptation benefits from agriculture and forestry	**Fossil fuels** coal-powered generation, "clean" coal, and fuel production

Figure 23: Comparisons between PBoC guidelines and Climate Bonds Standard (Source: Climate Bond Initiative (2016), *Roadmap for China: green bond guidelines for the next stage of market growth*)

With regard to the management of the proceeds, there are restrictive rules that provide the creation of a special account by the issuer to deposit the proceeds of the green bonds and use them to finance a green project. Unallocated proceeds should be temporarily invested in green bonds of other issuers to ensure that unallocated proceeds are not invested in non-green projects.

The Chinese guidelines require issuers to report to the market every three months the types of projects that the bond is financing. The guidelines also require issuers to report on the environmental impact of these projects, even though it's not mandatory.

To conclude, the (recommended) revision includes a pre and post-issuance phase. The first phase is used to provide information, in particular on the types of green projects financed and the procedure to demonstrate the effective use of the proceeds is also provided. The second phase is designed to ensure investors that the funds have been allocated as planned and to provide more information on the environmental impact of the bonds. External reviews may take the form of second-party review or third-party certification. There is not yet a standardized procedure for providing external review on green bonds in China.

India Guidelines

Green bonds in India are regulated by the Securities and Exchange Board of India (SEBI), whose guidelines, issued in January 2016, comply with the same principles issued by ICMA. The key points concern:

- The issue and listing of green bonds will be governed by the SEBI Regulations of 2008
- There is no real definition of a green bond, from time to time, SEBI will assess the bond and define it as green
- Independent third-party review of the pre-issuance and post-issuance process, including project evaluation and selection criteria are optional
- The issuer must provide in the annual report made to the Stock Exchanges details regarding the use of the proceeds, their traceability, the list of projects to which they have been allocated.

CHAPTER IV

Green Project Evaluation

4.1 Project Evaluation

Evaluation is the tool through which a project is analyzed: progress, performance, consistency with the stated objectives, compliance with deadlines and achievement of goals.

Evaluation takes place before, during and after a project and generally, there are several steps to follow to provide a complete assessment (see figure 24).

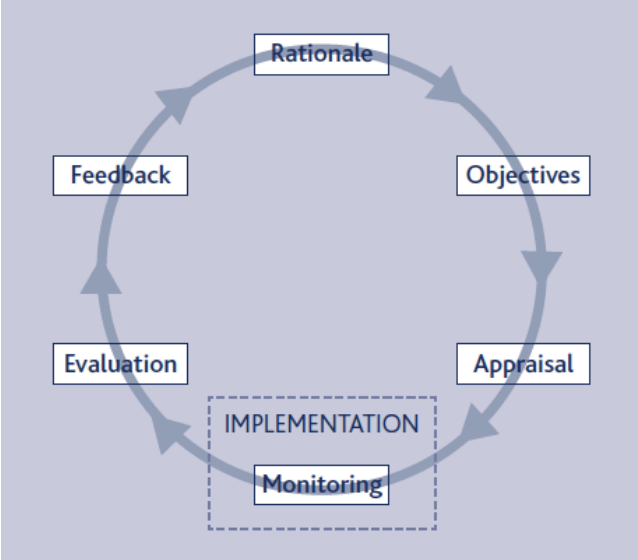

Figure 24: The evaluation cycle (Source: Arts & Humanities Research Council, *Understanding Your Project: A Guide to Self-Evaluation*)

Once the rationale of the project has been agreed, it's necessary to define the objectives, which must be concrete and achievable. The objectives should be SMART (Specific, Measurable, Achievable, Relevant, Time-bound).

Appraisals provide an assessment of the utility of the proposed project, usually carried out as a cost-benefit analysis. As the options for implementing the project are defined, it's important to examine the impact of risks and uncertainties to ensure that the selected option is the best one, even under changing conditions.

Once the options have been assessed, the project can be implemented and the monitoring phase, which collects information about the progress made towards achieving the objectives, such as results, outcomes and impacts; is considered particularly important.

Evaluation is similar to appraisal, except that it uses historic rather than forecast data. The evaluation is a continuous process that accompanies the project from start to finish and can be divided into several phases. From the definition of sub-objectives, to mid-term evaluations to analyze what has been done so far and, if necessary, make changes and lastly the final evaluation, which verifies the success or failure of the project and the achievement of the objectives.

In addition to the activities, performance and results generated by the project, are also evaluated the changes induced by the project, its progress (it should be assessed whether the selected procedure is appropriate or could be improved for future projects). Finally, the evaluation should not only be retrospective, but should also look to the future, so recommendations should be made both for the continuation of the work and for other people interested in the project.

To plan a project, a model can be useful to evaluate the planned work and the intended results and also to consider the resources/inputs needed to carry it out (see figure 25).

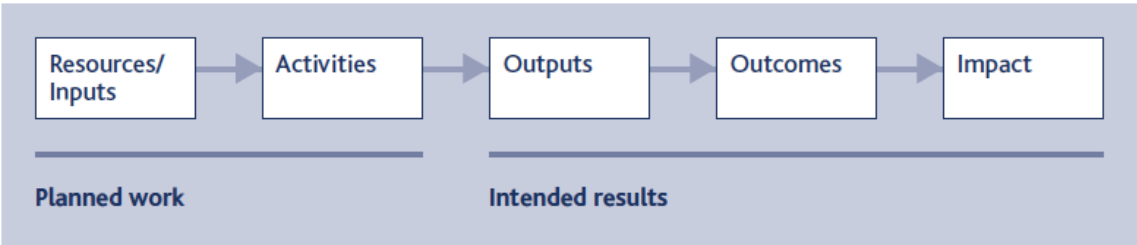

Figure 25: Planning a project (Source: Arts & Humanities Research Council, *Understanding Your Project: A Guide to Self-Evaluation*)

The planned work describes which resources (such as human, financial and organizational resources) and activities (i.e. the processes, tools, technologies and actions) are needed to implement the project. The expected results are the desired outcomes of the project that take into account the impacts that occur as a consequence of the project activities.

Depending on the costs and the result to be achieved, information can be collected in different ways, for example through descriptions, statistics or questionnaires.
Among the different types of data we can distinguish between:

- Quantitative data, i.e. data that can be measured in numbers (e.g. measuring behaviour or impacts). Quantitative data are based on defined questions on a large sample and the four basic techniques for quantitative data collection are: face-to-face interviews, telephone interviews, self-completion on paper and self-completion electronically. For small events, the most used method is self-completion on paper, where questionnaires are distributed and participants must complete and return them at the end of the event. For large events, face-to-face interviews are most used, as they provide immediate feedback.
- Qualitative data, i.e. data that cannot be measured in numbers (used to find new ideas, test a programme or activity). Qualitative data are collected on a small targeted sample through interviews, open question surveys, discussion groups and allow to address deeper questions.
- Mixed method, i.e. mixed data incorporating both quantitative and qualitative data.

The next step is the analysis, that is the elaboration and interpretation of data collected through the reading of questionnaires, the transcription of interviews and the elaboration of statistics or graphs using quantitative data.

The evaluation can be carried out internally or by external specialists.
The external evaluation offers two advantages: distance and independence; in fact, external evaluators are able to observe aspects that people involved in the project would not notice. Generally, it's recommended to engage external specialists for large projects.
Project managers will therefore have to cooperate with the external evaluators and provide them with any information concerning the project, the initial plan and subsequent versions and make the data collected available.
The internal evaluation is carried out by the project participants and this allows them several advantages, such as an extensive knowledge of the project and the institutions involved, no additional costs and greater flexibility. Self-evaluation is often used for small and medium-sized projects although, in some cases, the advice of external specialists may be useful.

The results of the evaluation must be presented in a final report which is addressed to the promoters of the project, who will use it as a guide and to the funders, who will use it to verify the results of their investments. The data should be presented in a clear, objective and comprehensible manner, avoiding personal opinions which should be presented separately together with the relevant recommendations.

The last aspect to be taken into consideration concerns costs, which are often underestimated and are difficult to assess as they vary according to the size and the complexity of the project.

4.2 Cost-Benefit Analysis for Green Project Evaluation

The assessment of green projects does not follow a uniform assessment criterion, but the majority of them are assessed through a cost-benefit analysis (CBA).

The cost-benefit analysis is the evaluation scheme used in public projects (although there are cases of application in the private sector) which aims to verify the financial and economic–social sustainability of the investment financed with public resources.

The aim is therefore to verify whether the benefits deriving from the implementation of the project exceed the costs necessary for its realization, through the measurement in monetary terms.

In general terms, anything that satisfies a wish is called a benefit and, by contrast, anything that is taken away from a wish is a cost. In this specific case, it can be said that anything that increases well-being is a benefit (referring to any resource produced or saved under the project), while anything that reduces it is a cost (value of resources consumed under the project).

Cost-benefit analysis is explicitly required, along with other elements, as a key requirement for decision-making on the co-financing of major projects included in the operational programmes of the European Regional Development Fund (ERDF) and the Cohesion Fund.

A major project is an investment operation that include a "series of works, activities or services intended to accomplish an indivisible task of a precise economic and technical nature which has clearly identified goals and for which the total eligible cost exceeds € 50

million" [17], where this cost is the part of the investment eligible for EU co-financing. For thematic objectives, the financial threshold can be increased up to € 75 million.

The main difference between the European Regional Development Fund and the Cohesion Fund is that ERDF focuses on investments related to the context in which firms operate (such as infrastructure and innovation) and in providing services to citizens (such as energy, health, education); while the Cohesion Fund promotes transport and environment interventions. In the environmental area, it supports investments in climate change adaptation, water and waste management and energy efficiency; in the transport area, it focuses on investments in the Trans-European Transport Network and low-carbon and sustainable transport.

In order to obtain co-financing, various information must be made available, such as the description of the investment and its location, the total cost and an environmental impact analysis. Among these, the most important is the cost-benefit analysis, which includes an economic and financial analysis and a risk assessment; moreover, it ensures absolute transparency in the project selection process.

4.2.1 Guide for Cost-Benefit Analysis

The CBA consists of seven phases, which will be analysed below: the context description, the definition of objectives, the identification of the project, the technical feasibility and environmental sustainability, the financial analysis, the economic analysis and the risk assessment.

Phase 1: Context Description

In this first phase, the aim is to define the social, economic, political and institutional context within which the project will take place. The analysis of macroeconomic conditions is crucial to obtain reliable future forecasts about the users, the costs and the benefits of the project. This exercise should also allow to verify that the project is

[17] European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*, available at https://op.europa.eu/it/publication-detail/-/publication/120c6fcc-3841-4596-9256-4fd709c49ae4

consistent with its context both in the early stages of design and in the evaluation, in order to introduce changes and innovation, if necessary.

Phase 2: Definition of Objectives

The second phase is aimed at defining the objectives of the project. On the basis of the analysis of the context, we proceed with the needs analysis, necessary for a correct definition of the objectives. A clear definition is necessary to measure the effects and impacts of the project; to verify the problems, the strategies and in general the motivations behind the project. Finally it's important to define in which measure the project contributes to the achievement of the objectives, which may relate to increase of existing capacity, improvement of the quality of outputs of a given production process or a better accessibility to a service.

Phase 3: Identification of the Project

A project is defined when 3 requirements are met:

- The physical elements and the activities to be carried out for the realization of a given product or service and to achieve the identified objectives, consist of a self-sufficient analysis unit.

  To identify the activities of the project, it's necessary to provide a description of the type of infrastructure (railway line, power plants), the type of intervention (new construction, renovation), the service provided (freight traffic, cultural activities) and the location. In order to provide a correct assessment, it's essential to focus on the whole project which must be considered as self-sufficient, in other words it should allow to produce a functionally complete infrastructure and to make a service active, without depending on other new investments. It's therefore important to consider all essential components and avoid non-essential ones.
- The body responsible for implementation (defined as the project promoter or beneficiary) is identified, as well as its technical, financial and institutional capacities.

  Technical capacity refers to the skills and experience of the staff within the organisation. Financial capacity refers to the financial situation of the organisation, which must demonstrate the availability of financial resources for the implementation and management of the project. Institutional capacity refers to the institutional agreements and arrangements necessary to implement and operate the project.

External technical assistance may be provided when the owner of the infrastructure is different from the operator who will manage it. In this case, it will be necessary to provide a description of the managing entity, its legal status, the criteria used for its selection and the contractual framework.

- The project area, beneficiaries and all stakeholders are identified.

  The project area affected by the effects of the project is defined as an impact area and may be of local, regional, national or European interest, depending on the size of the investment and the production of its effects. In any case, all projects must take a broader view when dealing with environmental issues related to CO_2 and other greenhouse gas emissions with consequent impacts on climate change.

  Furthermore, it's necessary to identify the final beneficiaries of the project, i.e. the population that will benefit directly from the project and it's recommended to always clarify what kind of benefits are derived from the project. All the public and private actors, directly and indirectly involved in the project (e.g. partners, suppliers, competitors, public administrations) must also be described.

Phase 4: Technical Feasibility and Environmental Sustainability

All the information described above must be reported in the CBA to allow:

- The analysis of demand, which identifies the needs for an investment by assessing the current demand (based on statistics provided by national and regional offices) and the future demand (based on forecasting models).

  Various techniques such as multiple regression models and expert interviews are used to perform the demand analysis, where the methodology adopted depends on the nature of the goods and services of the project, the characteristics of the reference market and the reliability of the available data. These informations must be communicated and documented in a clear and transparent way to allow easy understanding and forecasting. Finally, information on the mathematical models used, software and supporting programs must also be disclosed.

- The analysis of options, which allows to choose a project solution by comparing all the available options. In the option selection phase, we can follow different approaches, such as the definition of a list of alternative strategies to achieve the desired objectives, or we can compare the different strategies on the basis of qualitative criteria (e.g. through a multi-criteria analysis based on scoring).

If different alternatives have the same objective, the selection can be based on the solution with lower costs per unit of output. If, however, with the same objectives, the results are different for the different options, a simplified CBA is recommended to choose the best alternative.

- Environment and climate change implications. The promoter of the project will have to demonstrate to which extent the project respects the resource efficiency targets, the provisions on the prevention and repair of environmental damage, the "polluter pays" principle, according to which it's necessary to repair the environmental damage caused and if he complies with the Environmental Impact Assessment (EIA) Directive.
  Although the EIA is an independent procedure from the CBA, it's essential to evaluate the direct and indirect effects of the project on humans and the environment. The EIA includes also the impacts of the project on the climate, in terms of GHGs reduction and the impacts that the same climate change has on the project, in terms of adaptation (such as drought, extreme rainfall, landslides, rising of sea levels).
- Technical design, cost estimation and time schedule. The proposed design solution must contain the summary relating to location (description of the location of the project), technical design (description of works components, technology adopted, design standards), production plan (description of the infrastructure capacity and the expected utilisation rate), costs estimates (estimation of the financial needs for the implementation of the project) and the implementation timing (a timetable used for project implementation and works planned).

Phase 5: Financial Analysis

The financial analysis allows to evaluate the profitability of the project as a whole and the profitability of the project for the promoter and for the stakeholders. This analysis uses the income statement and the balance sheet to assess whether the expected profit is sufficient to justify the investment and to outline cash flows.

The first element that determines the feasibility of a project is its sustainability from a financial point of view: incoming cash flows, properly discounted, must be able to fully cover all investment costs. If this does not happen, the project may be technically feasible but financially unsustainable. With the discounted cash flow method, only incoming and outgoing cash flows are taken into account, excluding provisions, depreciation and other accounting items that do not correspond to actual cash flows.

The present value of future cash flows is calculated through an appropriate Financial Discount Rate (FDR), which reflects the opportunity cost of capital (the European Union recommends it at 4% for the period 2014 – 2020). Financial analysis should generally be carried out using constant (real) prices, i.e. with prices fixed at a base-year. In this case the FDR is expressed in real terms; instead, in case of current prices, a nominal FDR will be used.

The analysis must be performed net of VAT, both for purchases and sales, VAT can be included only when it's not recoverable by the project promoter. Furthermore, direct taxes are considered only for the verification of financial sustainability and not for the calculation of financial profitability.
Finally, estimates of cash flows should be referred to an appropriate time horizon based on the useful life of the project and its long-term impacts. The choice of the time horizon influences the results of the evaluation and differs in the various sectors (see Table 6):

Table 6: European Commission's reference periods by sector

SECTOR	REFERENCE PERIOD (YEARS)
Railways	30
Roads / urban transport	25-30
Ports and airports	25
Broadband	15-20
Water supply/sanitation	30
Waste management	25-30
Energy / research and innovation	15-25
Business infrastructure and other sectors	10-15

Source: European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*

How to determine financial profitability?
The first step is to determine the total cost of the investment and its distribution over the years.

TOTAL COST OF THE INVESTMENT =

Initial Investment + Replacement Costs – Residual Value

where the initial investment includes the costs of fixed assets such as land, buildings and machinery (excluding start-up costs, design); the replacement costs are the costs incurred during the replacement of machinery or equipment with useful life less than the reference period (such as filters, vehicles, furniture) and the residual value of fixed investments is the service potential of fixed assets whose economic life is not yet fully exhausted. This value equals zero if the economic life of the fixed asset equals the time horizon. It has a minus sign because it's an incoming flow.

The second step of the analysis involves the calculation of total revenues and operating costs.

Operating costs include all operating and maintenance costs related to the operation of the infrastructures/services created by the project. Among these costs, generally divided into fixed and variable, we can find raw materials, energy, intermediate services, materials related to the maintenance and repair of plants and machinery. Financial charges are excluded.

Revenues are the incoming cash flows paid directly by the users for the goods or services provided, such as the fees charged to users for using the infrastructure or payments for services. Transfers, grants, subsidies and other financial revenues are excluded if not directly attributable to the use of the goods and services provided by the project.

NET REVENUES =

Total Revenues – Total Operating Costs

The third step is to identify the various sources of funding to cover the investment costs (such as a European contribution, national government grants, financial promoter contributions in the form of equity or loans).

The total cost of the investment, the operating costs, the revenues and the sources of financing allow the assessment of the financial profitability of the project, measured by the following indicators:

1. Financial Net Present Value *FNPV(C)* and the Financial Rate of Return *FRR(C)* on investment. They measure the ability of the net revenues generated by the project to pay back the initial investment, regardless of funding sources/methods.

The FNPV on investment is expressed in monetary terms (EUR), depends on the size of the project and is defined as "the sum that results when the expected investment and operating costs of the project (discounted) are deducted from the discounted value of the expected revenues"[18]:

$$\mathrm{FNPV(C)} = \sum_{t=0}^{n} a_t S_t = \frac{S_0}{(1+i)^0} + \frac{S_1}{(1+i)^1} + \cdots + \frac{S_n}{(1+i)^n},$$

where S_t is the balance of cash flow at time t, a_t is the financial discount factor chosen for discounting at time t and i is the financial discount rate.

The project is accepted when the NPV is positive (> 0), that is when the benefits are higher than the costs. Graphically it's possible to represent the performance of the NPV as a function of the discount rate chosen, as in figure 26. As the discount rate used increases, the NPV of benefits decreases.

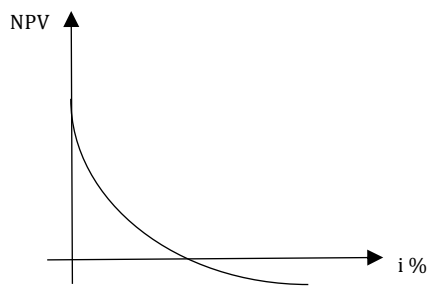

Figure 26: Relationship between the discount factor (i) and the NPV (Source: *Personal elaboration*)

The FRR on investment is a number expressed in relative terms (%), is invariant and is defined as the discount rate that produces a zero FNPV:

$$\mathrm{VAN} = \sum \frac{S_t}{(1+\mathrm{FRR})^t} = \frac{S_0}{(1+\mathrm{FRR})^0} + \frac{S_1}{(1+\mathrm{FRR})^1} + \cdots + \frac{S_n}{(1+\mathrm{FRR})^n} = 0$$

This indicator is also used to assess whether the project needs EU financial support. Graphically, it's possible to identify the FRR as the point where the curve representing the values of the discounted cash flows reaches zero (see figure 27).

[18] European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*, available at https://op.europa.eu/it/publication-detail/-/publication/120c6fcc-3841-4596-9256-4fd709c49ae4

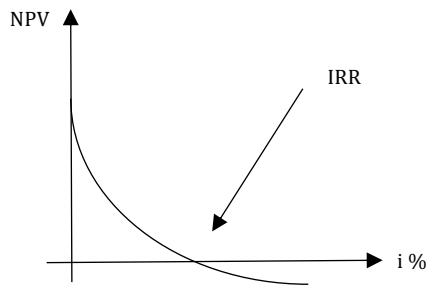

Figure 27: Internal Rate of Return (IRR) (Source: *Personal elaboration*)

The IRR is particularly useful for comparing projects between different periods, of different sizes and in different countries (choose the investment with the highest IRR).

2. Financial Net Present Value *FNPV(K)* and the Financial Rate of Return *FRR(K)* on national capital. All sources of funding are taken into account in this calculation, with the exception of EU contributions (considered as outgoing flows).
   The FNPV on capital is the sum of the net discounted cash flows accrued to the national beneficiaries (public and private together) due to the execution of the project, while the FRR on capital is the return expressed as a percentage value.

   While the FRR(C) is usually very low or negative for the public investments to be financed with EU funds, the FRR(K) is usually higher and, in some cases, even positive. NPV and IRR have an equivalent utility. They are complementary tools that together provide a better analysis of each of the two taken separately.

How to say if a project is financially sustainable?

"A project is financially sustainable when the risk of running out of cash in the future, both in the operational phases and during the investment, is expected to be zero"[19]. Project promoters must demonstrate the sources of funding available and the difference between incoming and outgoing flows will indicate the deficit or surplus that will be accumulated for each year. The inflows include sources of financing, operating revenues, transfer, subsidies and other financial gains. The outflows include initial investment, replacement costs, operating costs, reimbursement of loans and interest payments, taxes on capital/income and other direct taxes.

[19] European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*, available at https://op.europa.eu/it/publication-detail/-/publication/120c6fcc-3841-4596-9256-4fd709c49ae4

Phase 6: Economic analysis

The economic–social analysis is characterized by a change in the analyst's perspective, moving from that of the investor to that of the community and taking into account all the social costs and benefits arising from the implementation of the project.

The key concept on which the economic analysis of an investment is based is the shadow price, that is the price reflecting the opportunity cost of goods and services. However, due to a number of distortions, prices observed in the market may differ from the opportunity cost. Are therefore appropriate:

- Fiscal corrections; since we have changed point of view, what happens is that, while from the investor's perspective direct taxes are seen as an exit, for the community they are a simple transfer of money from one social group to another.

  Input and output prices must therefore be considered net of VAT, direct and indirect taxes, subsidies and other transfers granted by a public entity. There is an exception for indirect taxes or subsidies: these can be included in the project costs when they are used to correct environmental externalities (such as CO_2 emission taxes).
- Conversion of market prices into shadow prices; where we can distinguish between input and output.

  For a tradable good, the border price is used, while for non–tradable goods it's possible to apply the Standard Conversion Factor[20] (in case of minor items such as administrative costs), the Shadow Wage (for manpower), finally, ad hoc assumptions must be made to reflect the related long-term marginal cost (in case of main items such as machinery).

  To measure the direct benefit related to project outputs, it's possible to use the users' marginal Willingness-To-Pay (WTP), which measures the maximum amount that consumers are willing to pay for a unit of a given good or service (see figure 28).
- Assessment of non-market impacts and correction for externalities.

  Impacts generated on project users for which no market value is available, should be treated in the economic analysis as direct benefits of the project (e.g. savings in travel time, longer life or expected quality of life).

  When these impacts (costs or benefits) fall on third parties and not in the relationship between producer and consumer, they are defined as externalities (e.g. environmental

[20] It measures the average difference between world and domestic prices of a given economy.

effects). Due to their nature, their assessment must be carried out separately and can sometimes be difficult. However, there are some specific effects such as carbon dioxide emissions, noise and air pollution that provide a unit cost benchmark. When monetary quantification is not possible, environmental impacts must at least be identified in qualitative terms to allow informed choices.

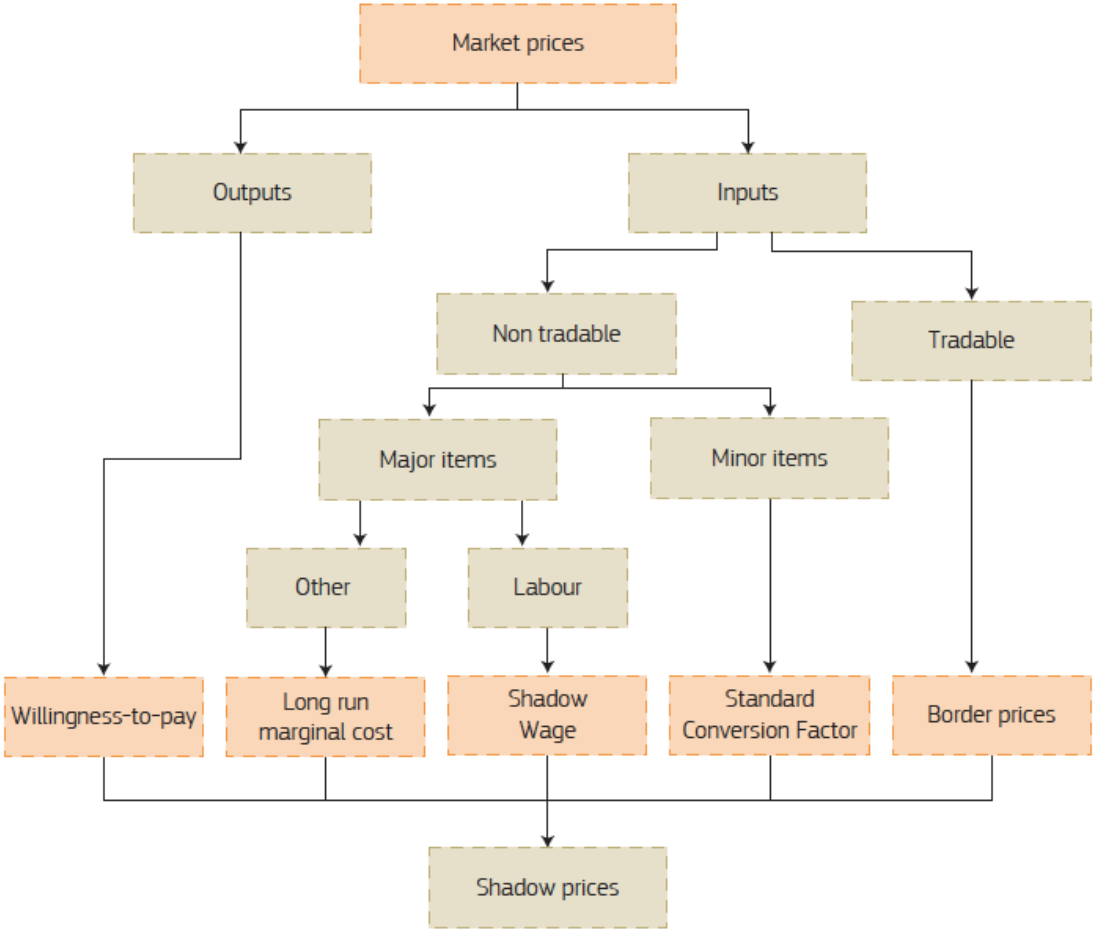

Figure 28: From market to shadow prices (Source: European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*)

Impacts on climate change play a special role in the assessment of externalities, because this is a problem of global interest that is finding increasingly solid scientific evidence, they are also difficult to predict and lead to catastrophic events; finally they have long-term effects because they persist for a long time into the atmosphere.

The methodology developed by the European Investment Bank (Carbon Footprint Methodology) allows to integrate a cost for environmental externalities into the economic evaluation (see Table 7).

Table 7: Value of carbon (EUR/t CO_2e)

	Value 2010 Emission	Annual adders 2011 to 2030
High	40	2
Central	25	1
Low	10	0.5

Source: *EIB*

The "value 2010 emission" correspond to a central damage estimate (related to an emission recorded in 2010), which was EUR 25 per tonne of carbon dioxide equivalent (EUR 25EUR/t CO2e).

This value (25 EUR) has been taken as the central value and includes the estimate of a higher value (40 EUR) and a lower value (10 EUR), all measured in 2006 constant euros.

The "annual adders" represent the absolute increase in value per year. Therefore, according to the central estimate, an emission in 2030 is equal to:

25 + (20*1) = 45 EUR (in 2006 euros).

After adjusting market prices and evaluating non-market impacts, it's possible to discount costs and benefits. The discount rate used in the economic analysis is the Social Discount Rate (SDR), which reflects the social view on how future benefits and costs should be valued against present ones. The European Commission recommends to use a SDR of 5% for large projects in Cohesion countries and 3% for the other Member States.

Moreover, in the economic analysis, the shadow price of the residual value of the project must be estimated, while indirect effects occurring on secondary markets must be excluded, since they are already incorporated in the shadow prices.

Once the appropriate SDR is used, the economic performance of the project can be calculated, measured by the following indicators:

- Economic Net Present Value (ENPV) is the difference between total discounted social benefits and costs.

$$ENVP = \sum B_t\,(1+i_t)^{-t} - \sum C_t\,(1+i_t)^{-t} - K$$

  where B_t are the financial benefits at time t and C_t are the financial costs at time t, K are the initial investment costs and i is the discount rate.

- Economic Rate of Return (ERR) is the rate that makes the value of the ENPV equal to zero.
- Benefit–Cost Ratio (B/C Ratio) is the ratio between discounted economic benefits and costs; when B/C >1 the project can be considered socially desirable.

$$\frac{B}{C} = \frac{\sum B_t\,(1+i_t)^{-t}}{K + \sum C_t\,(1+i_t)^{-t}}$$

  The ENPV is the most important and reliable social indicator for the economic evaluation of a project. Although the ERR and the B/C Ratio also play an important role, in particular cases, for example, the ERR may be multiple or undefined, while the B/C ratio may vary depending on whether a given flow is considered as cost or benefit.

  As a general rule, any project with an ERR below SDR or with a negative ENVP should be rejected, because the project uses too many socially useful resources to achieve modest benefits for the society as a whole.

Phase 7: Risk assessment

The final phase of the CBA is the risk assessment to evaluate the uncertainty inherent in investment projects, including possible risks arising from climate change. The risk assessment is carried out in the following stages:

- Sensitivity analysis, which allows to identify the critical variables of the project, that are those variables whose variations, positive or negative, have the greatest impact on the financial/economic performance of the project. The variables are considered critical when a change of ± 1% of the value, causes a change of more than 1% of the NPV. The variables to be verified must be independent and unrelated, otherwise they would produce distortions and double counting.

  Finally, the sensitivity analysis must be integrated with an optimistic and pessimistic scenario analysis; that studies the impact generated on the project by combinations of critical variables. If, for example, the ENPV remains positive even in the pessimistic scenario, the risk of project failure can be considered low.
- Qualitative risk analysis, that is the identification of adverse events (such as natural events, extreme weather events, failure to obtain permits, public opposition). Once the potential adverse events are identified, the corresponding risk matrix can be created.

For each adverse event, the effect produced, and its consequences must be described. To each adverse event is attributed a Probability (P) of occurrence, which can be classified as follows:

A. Very unlikely (0-10% probability)
B. Unlikely (10-33% probability)
C. About as unlikely as not (33-66% probability)
D. Likely (66-90% probability)
E. Very likely (90-100% probability).

To each effect is assigned a Severity impact (S) from I (zero effect) to V (catastrophic). These values allow a classification of the level of risk (P*S), associated with the relative probability of occurrence. There are four risk levels with associated color code (see figure 29). Once the level of risk has been established, it's important to identify mitigation and prevention measures. Depending on the level of risk, the intensity of the measure taken varies (see figure 30).

Risk level	Colour
Low	
Moderate	
High	
Unacceptable	

Severity / Probability	I	II	III	IV	V
A	Low	Low	Low	Low	Moderate
B	Low	Low	Moderate	Moderate	High
C	Low	Moderate	Moderate	High	High
D	Low	Moderate	High	Very High	Very High
E	Moderate	High	Very High	Very High	Very High

Figure 29: Risk levels (Source: European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*)

Severity / Probability	I	II	III	IV	V
A	Prevention or mitigation		Mitigation		
B					
C					
D	Prevention		Prevention and mitigation		
E					

Figure 30: Combination of measures (Source: European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*)

- Probabilistic risk analysis, it's a type of analysis that attributes a probability distribution to each of the critical variables identified in the sensitivity analysis. For this purpose, the Monte Carlo method can be used, which consists in the repeated

random extraction of a set of values, one for each of the critical variables, taken with the respective defined intervals, followed by the calculation of the project performance indices (NPV or FRR).

- Risk prevention and/or mitigation actions, which should be adapted to the specific project and its level of risk. It's essential to correlate adaptation/mitigation measures to the phases of the project in which adverse events can occur; in fact, the degree of risk does not remain constant throughout the period, but varies: the riskiest phase is the start-up phase of the project, while when the investment enters in the operational phase, the risk decreases.

In conclusion, the assessment of a green project compared to a traditional project through cost-benefit analysis is characterized by the identification and quantification of the risks and environmental impacts associated with the project and the choice of the corresponding mitigation and adaptation measures.
This feature, combined with the financial and economic–social analysis of the project, allows to provide a more complete evaluation that integrates the concept of sustainability, a fundamental characteristic for a green project.

4.2.2 Critical aspects of the Cost-Benefit Analysis

This type of analysis is characterized by a strong subjective content and a first problem to be addressed concerns the choice of the point of view to be adopted.
As regards public projects, these are financed by citizens through the payment of taxes; however, the benefits and disadvantages of the project do not affect the whole community in the same way. While in the private sector this is not a problem, in the public sector the difficulty is more pronounced precisely because all effects have to be taken into account, whoever receives them.

Another problem concerns the identification of costs and benefits and the discount rate; because there is no a standard procedure for their identification and because each project is different from the other, as well as the monetary quantification of the costs and benefits identified. However, where possible, it's preferred to use the indications given by different governments and ministries.

Due to the high volume of information required for this analysis and the criticism described above, other methodologies may be preferred.
The cost-effectiveness analysis is used where it's difficult to identify a monetary value and allows to compare a number of alternatives on the basis of their costs and a common measure of effectiveness that is quantified but not monetized.
We proceed through the construction of cost-effectiveness indices that allow the comparison between the different alternatives, in fact this analysis involves the comparison between costs expressed in monetary units and benefits expressed in another unit of measurement; therefore it's not possible to calculate the balance between costs and benefits.

Another type of analysis is the cost-utility analysis, used mainly for the evaluation of health policies in UK. In this analysis, the incremental cost of alternative interventions is compared with changes in community health status, which is calculated using the Quality Adjusted Life Years indicator, which considers both the length and the quality of life.

4.3 Green Climate Fund Evaluation

The Green Climate Fund (GCF) is the world's largest dedicated fund helping developing countries reduce their greenhouse gas emissions and enhance their ability to respond to climate change[21].
The GCF finances low-emission and climate-resilient projects and programmes to contribute to countries' climate change challenges.
The project promoter must demonstrate the impact that the project will have on climate change in terms of mitigation, adaptation or both and must identify the strategic impact areas to which the project contributes (see figure 31). In addition, the proposed project will fall into one of the four suggested size categories (see figure 32).

[21] https://www.greenclimate.fund/about

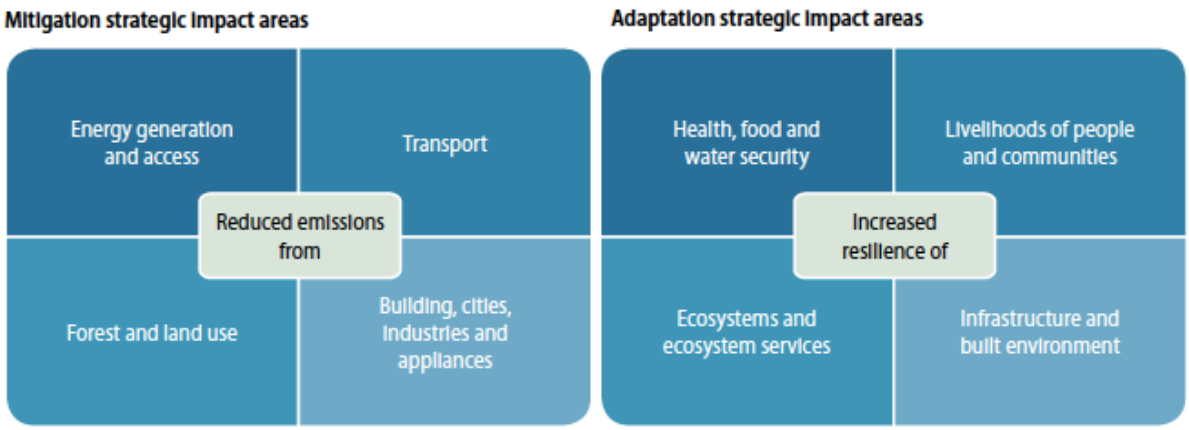

Figure 31: Strategic impact areas for adaptation and mitigation (Source: Fayolle, V. and Odianose, S. (2017), *Green Climate Fund Proposal toolkit 2017: Toolkit to develop a project proposal for the GCF*, Acclimatise and Climate and Development Knowledge Network)

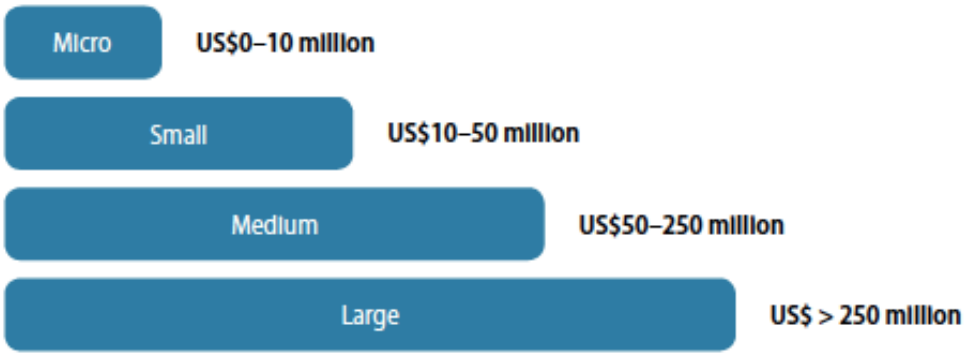

Figure 32: Total project costs (Source: Fayolle, V. and Odianose, S. (2017), *Green Climate Fund Proposal toolkit 2017: Toolkit to develop a project proposal for the GCF*, Acclimatise and Climate and Development Knowledge Network)

When preparing the financing proposal to be submitted to the GCF by the project promoters, there must be a number of different types of information, many of which are similar to those present in a cost-benefit analysis, while some are different.

It starts with defining the project's scope through a purpose analysis that will provide a better understanding of the strategic context in which the project will take place. Subsequently, the activities necessary to achieve the desired results and objectives are identified and clarified.

The next steps include the identification of social and environmental risks and the corresponding mitigation/adaptation measures to be taken, as well as the development of relevant indicators to monitor progress and performance. This is followed by the

preparation of the project budget and the identification of the GCF amount of funding to be requested.

A key point to integrate into the analysis concerns the inclusion of gender in a project. In this respect, project promoters should develop a gender assessment and a Gender Action Plan (GAP) which will provide an overview of how gender equality will be promoted within the project.

4.4 Organisation for Economic Cooperation and Development Evaluation

The Organisation for Economic Cooperation and Development (OECD)[22] has established evaluation criteria for the assessment of international development and humanitarian projects, programmes and policies. In 2018, the OECD decided to revise these criteria to provide for evaluations in line with the objectives of the 2030 Agenda.

The combined use of these criteria provides a complete picture of the intervention and their aim is to determine the merit, value or significance of the intervention subject to evaluation. All criteria can be used to estimate before, during or after an intervention.

The evaluation criteria refer to two principles:

- Principle one, which states that the criteria should be applied carefully to provide a useful and high-quality assessment.
- Principle two, which states that the use of criteria depends on the purpose of the evaluation. The criteria should not be applied automatically but should be used according to the needs and context of the evaluation.

The six criteria are explained below:

1. Relevance, i.e. the extent to which the objectives and design of the intervention meet the needs of the beneficiaries and the capacity to adapt as circumstances change. The intervention is therefore sensitive to the economic, environmental, equity, social and political conditions in which it takes place.
2. Coherence, i.e. the compatibility of the intervention with other interventions in a country, sector or institution. Internal coherence concerns the connection between the intervention and other interventions carried out by the same institution and

[22] It is an intergovernmental economic organisation with 37 member countries, whose aim is to stimulate economic progress and world trade.

consistency with international standards. External coherence concerns the coherence of the intervention with interventions of other actors in the same context.

3. Effectiveness, i.e. the extent to which the intervention has achieved, or is expected to achieve, its objectives and results.
4. Efficiency, i.e. the extent to which the intervention provides, or is likely to provide, results in an economic way (i.e. the conversion of inputs into outputs, impacts as cheaply as possible compared to alternatives) and in a timely way (within the time expected).
5. Impact, i.e. the extent to which the intervention has generated, or is expected to generate, positive or negative (social, environmental and economic) effects, intentional or unintentional.
6. Sustainability, i.e. the extent to which the net benefits of the intervention will continue or are likely to continue. It includes an examination of the financial, economic, social, environmental and institutional capacities of the systems needed to support these benefits over time. It also provides for an analysis of resilience, risks and potential trade-offs.

4.5 Standard & Poor's Evaluation

S&P Global Ratings' Green Evaluation is used to evaluate projects that have a positive environmental impact. Depending on the type of project, it's possible to distinguish between mitigation projects, which aim at environmental benefits and adaptation projects, which aim at managing the exposure and impact of natural disasters.
This type of assessment is based on the assignment of scores for three components, which are transparency, governance and mitigation or adaptation.

To arrive to the final Green Evaluation score (see figure 33), they combine the scores for transparency, governance and mitigation or adaptation, for a final value expressed on a scale from 0 to 100.

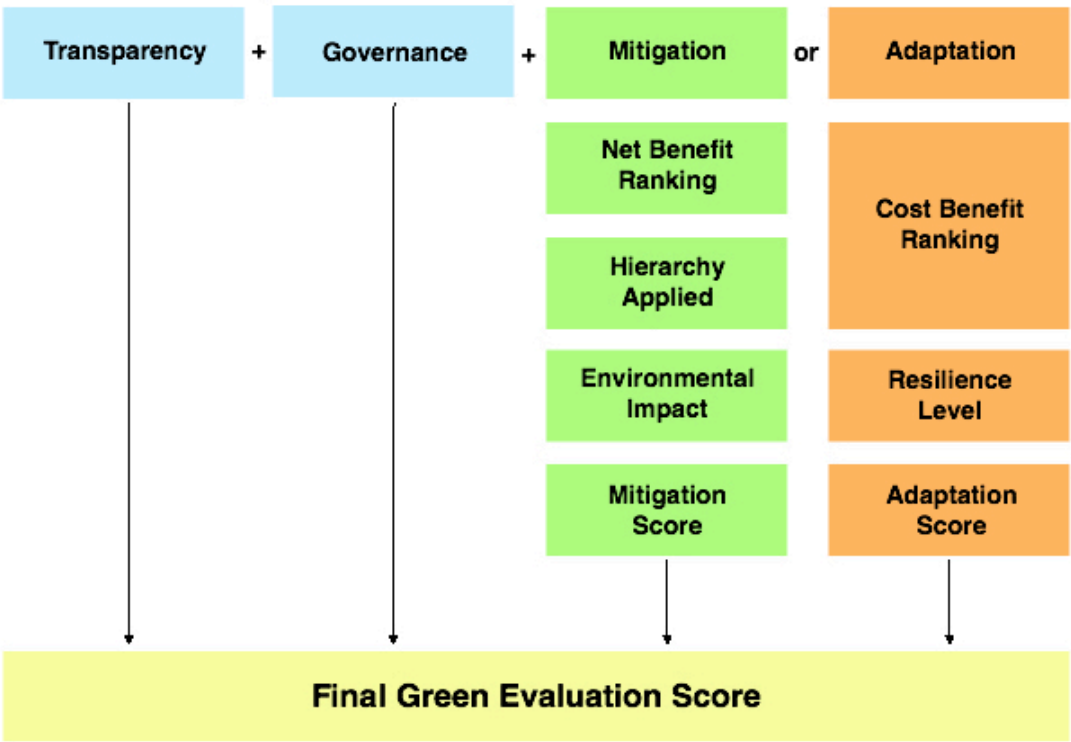

Figure 33: Green Evaluation Analytical Approach (Source: *Personal elaboration based on* https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963)

4.5.1 Transparency

In the evaluation of transparency, a qualitative analysis is carried out on the use of proceeds reporting, reporting and disclosure of environmental impact and external verification of impact data. To each factor is assigned an overall transparency score on a scale from 0 to 100.

A high-quality reporting allows investors and other stakeholders to assess governance and determine whether the environmental objectives and promised performance have been achieved.

In the use of proceeds reporting, the first step concerns the identification of the total amount of funding subscribed and proceeds allocated. The evaluation focuses only on the part of the proceeds (total or partial) allocated to the sustainable project. Naturally, a high frequency of reporting on the use of proceeds allows a high level of transparency. Finally, the criteria for the allocation of funds, selection and financing of the project must be clear and transparent.

In the reporting and disclosure on environmental impact, the first step is to measure and publish reports on the environmental impact of the project, as this allows investors to stay informed about environmental issues and increases transparency. It's very important to identify the indicators that measure the environmental impacts (basic, global and advanced indicators), as well as the methodology used in the calculation of the impacts and the time period within which these impacts will occur in the project (throughout the project life cycle or only partially).
In the external verification of impact data, it's necessary to ensure that the assessment, carried out by third parties, complies with an assurance standard in order to ensure maximum transparency.

4.5.2 Governance

In the evaluation of governance, the management of proceeds, the environmental impacts assessment and the compliance with the relevant regulations are examined. To each factor is assigned an overall governance score on a scale from 0 to 100.
In the management of proceeds, it's important to identify and disclose the rules for the selection of investments or funding, to ensure that the proceeds are allocated to the project that has environmental benefits. In addition, the percentage of proceeds allocated and their traceability must be reported in order to avoid that the proceeds are used for different purposes. Finally, a review by third parties is recommended to verify the current and future allocation of proceeds, to provide additional assurance for investors.

In the environmental impact assessment, it's necessary to measure, in qualitative or quantitative terms, the positive and negative environmental impacts of the projects financed. In order to achieve a higher governance score, it's desirable to demonstrate compliance with existing environmental standards.

4.5.3 Mitigation

The evaluation of mitigation estimates the environmental impact of the project over its lifetime (including construction, operations and decommissioning phases). It takes into account the net benefits based on various Environmental Key Performance Indicators

(eKPIs), such as carbon, water and waste. Then the hierarchy is identified, i.e. the sector within which the project is placed (e.g. solar energy within the green energy sector). Finally, the environmental impact of each sector is calculated to derive the mitigation score.

Combining the mitigation score with the transparency and governance score we obtain the Green Evaluation score, identified with E.

Net Benefit Ranking

The net benefit ranking estimates the positive and negative impact of a project compared to a baseline scenario to determine its overall net environmental impact compared to other technologies in the same sector.

The estimate is made for each of the eKPIs in its sector, taking into account all phases of the life cycle of a project; from construction, to operation, to deactivation.

The net benefit ranking takes into account the location, the technology and the sector of each asset. If the specific country is not known, regional or global factors are used. In the absence of disclosure, it's assumed that the technology used within the sector is the one with the lowest net benefit. Finally, if the type of subsector is known (e.g. green energy technologies), then the calculation can be further refined.

When assessing the net benefit of a project, a variety of eKPIs are considered, depending on the sector within which the project operates (see Table 8).

Table 8: eKPIs considered in net benefit

SECTOR	CARBON	WASTE	WATER USE
Renewable energy	X	X	X
Green building	X		X
Green transport	X		
Energy efficiency	X		
Water	X		X
Fossil fuel power plants	X	X	X
Nuclear	X	X	X

Source: *https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963*

Green energy: renewable energy allows a reduction in emissions through the supply of low-carbon electricity grid.

Green building: they allow a reduction of environmental impact during their useful life. Among the different types, we can distinguish between the construction of new buildings and the renovation of existing buildings. Energy saving initiatives include efficiency for heating, ventilation and air conditioning systems, double glazing to improve thermal insulation, ...

Green transport: the focus is on low-carbon transport, such as private electric transport or public transport, as they represent a key aspect to achieve significant environmental benefits.

Energy efficiency: these projects include the ability to provide the same service by reducing energy demand.

Water: they allow a more efficient use of water resources through better water use or distribution, higher levels of water recycling and better water treatment. These projects have become increasingly important because climate change, by warming the atmosphere, has altered the hydrological cycle and has changed the timing and intensity of precipitation. In mitigation projects we consider the purpose of reducing water consumption or improving quality; in adaptation projects we consider resilience to drought risk. Water projects include projects to reduce water demand (e.g. in residential buildings), water treatment to increase supply (e.g. wastewater recycling to provide non-drinking water for agricultural use) and wastewater treatment with or without energy recovery.

Fossil fuel power plants: they allow the reduction of GHG emissions through the reduction of carbon intensity in the conventional energy sector; including projects to convert "clean coal" and coal to gas. The current average overall efficiency of coal-fired power plants is around 33%, which is less than 45% possible.

Nuclear: they ensure low GHG emissions, fundamental for the decarbonization of the energy sector.

To each eKPI is assigned a percentile weight to define the environmental impact of a particular activity. If, for example, a weight of 60% is assigned to carbon, 10% to waste and 30% to water, the net benefit ranking is a weighted average of the individual eKPI percentile scores.

Sector Hierarchy and Environmental Impact

The last step to determine the mitigation score is to apply the carbon or water hierarchy. To the carbon and water hierarchy (shown in Table 9 and in Table 10) are assigned scores ranging from 0 to 100 and have a weight of 60-75%, differently from the weight assigned to net benefits which varies from 25 to 40%.

Table 9: Carbon Hierarchy

Carbon hierarchy	Carbon hierarchy score (0-100)	Weight of hierarchy score (%)	Weighting of net benefit ranking (%)
Systemic decarbonization	100	75	25
Significant decarbonization through low-carbon solutions	90	70	30
Decarbonization by alleviating emissions of carbon-intensive industries	80	65	35
Decarbonization technologies with significant environmental hazards	50	60	40
Improvement of fossil-fueled activities' environmental efficiency	0	60	40

Source: *https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963*

Table 10: Water Hierarchy

Tier	Water hierarchy	Water hierarchy score (0-100)	Weight of hierarchy score (%)	Weighting of net benefit ranking (%)
1	System enhancements	100	75	25
2	Marginal system enhancements	75	70	30
3	System enhancements with significant negative impacts	62.5	70	30
4	Demand-side improvements	50	65	35

Source: *https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963*

Finally, to determine the environmental impact score, we combine the weighted hierarchy score with the weighted net benefit score (see Table 11).

Table 11: Example to determine the environmental impact

Project	Hierarchy Score (0-100)	Weight (%)	Net Benefit Score (0-100)	Weight (%)	Environmental Impact (0-100)
Green Energy	100	75	0	25	75
Clean Coal	0	60	100	40	40

Source: https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963

In the figure above, the green energy project is included in the carbon hierarchy in the category "systemic decarbonization" with score 100; while the clean coal project is included in the carbon hierarchy in the category "improvement of fossil-fueled activities' environmental efficiency" with score 0.

4.5.4 Adaptation

The evaluation of adaptation estimates the increase in resilience that a project is able to provide. First of all, they quantify the benefit of the added resilience, i.e. the reduction in the cost of expected damages caused by extreme weather events. The evaluation of the environmental benefit, defined as the ratio between the benefit of the resilience and the financing deriving from the proceeds of the bond (resilience benefit ratio), assumes a value on a scale from 1 to 5 points (see Table 12); where higher level of resilience (level 1), assumes that the resilience benefits are greater than the amount of project funding.

Table 12: Resilience Scale

Resilience level	Range of resilience benefit ratio
1	≥ 4
2	≥ 3 & < 4
3	≥ 2 & < 3
4	≥ 1 & < 2
5	< 1

Source: https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963

How to determine the range of resilience benefit ratio?

To determine the resilience benefit, they refer to the expected benefits that derive from the investment (previously calculated to assess the feasibility of the project).

The evaluation of these benefits on a probabilistic basis (given the uncertain nature of extreme weather events) by an independent third party should not only take into account the financial characteristics, but it should also include the quantification of the humanitarian and ecological benefits (although difficult to assess).

Since these are assumptions and there is the possibility of over – or underestimating the benefit, adjustments are possible. Further modifications are also included for projects in developing countries which, in the absence of analysis, use the Notre Dame Global Adaptation Index to identify the countries most exposed to climate risk and vulnerability.

Finally, to each level of resilience, corresponds an adaptation score (see Table 13).

Combining the adaptation score with the transparency and governance score we obtain the Green Evaluation score, identified with R.

Table 13: Adaptation score

Resilience level*	Adaptation score
1	100
2	75
3	50
4	25
5	0
*Including any adjustments	

Source: *https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963*

4.5.5 Final Green Evaluation Score

For mitigation projects, the score is expressed on a scale from E1 to E4 (divided into quartiles), while for adaptation projects, the score is expressed on a scale from R1 to R4 (divided into quartiles) (see Table 14).

Table 14: E and R score

Green Evaluation	E score	R score
75 – 100	E1	R1
50 – 74	E2	R2
25 – 49	E3	R3
0 – 24	E4	R4

Source: *https://www.spglobal.com/ratings/en/research/articles/191204-environmental-social-and-governance-green-evaluation-analytical-approach-11266963*

The green evaluation score is expressed on a scale from 0 to 100, with 100 being the highest possible score. It consists of weighted scores of transparency (whose weight is 15%), governance (whose weight is 25%) and mitigation or adaptation (whose weight is 60%). To conclude, in case of projects involving a combination of mitigation and adaptation, two separate assessments will be carried out, both on a scale from 0 to 100.

CHAPTER V
Analysis of practical cases

In order to better understand the different types of assessment that can be used when evaluating a project, I thought it would be interesting to analyze different projects that use different types of assessment methodologies. By analyzing, step by step, the various components that have been taken into account during the evaluation phase, it will be easier to understand the objectives, results and risks that characterize each project.
Among the four different methodologies analysed in the previous chapter, only projects corresponding to the methodology followed by the European Union (cost-benefit analysis) and the Green Climate Fund were available.

5.1 Project Evaluated with Cost-Benefit Analysis: the case of Serbia

The first document analyzed [23] refers to the evaluation of a project implemented in Serbia, through the cost-benefit analysis methodology. The evaluation of the project, which aims to dispose of inadequately treated wastewater, is entrusted to the Serbian Government and more specifically to the Ministry of Agriculture, Forestry and Water Management, which is responsible for the planning, implementation, monitoring and evaluation of the intervention.
For wastewater, we refer to water that has been contaminated and is therefore dangerous for public health and for the environment. More specifically, urban wastewater includes a mixture of domestic, industrial and rainwater; whose quality is so compromised that it cannot be returned directly to the ground, as well as to the sea, rivers or lakes.

Although Serbia is not a member of the European Union, the Republic of Serbia considered as essential the harmonization of its legal framework with EU environmental legislation.
Moreover, in order to obtain project co-financing from the European Union, it's useful to apply the methodology proposed for the evaluation of large projects: cost-benefit

[23] Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

analysis. The aim is to contribute to a better environmental sustainability and the fight against climate change through better management of solid waste, water and wastewater in line with European requirements.

With regard to wastewater management, a specific reference is made to Directive 91/271/EEC (also called Urban Wastewater Directive) which contains rules about the collection, treatment and discharge of urban wastewater. Together with this Directive, a more recent Directive (2000/60/EC) was introduced, in order to improve water status, prevent water deterioration and ensure sustainable water use, through an analysis of water characteristics, impact of human activities and an economic analysis of water use.
For this reason, the methodology developed by the European Commission has been used to assess the economic feasibility of the proposed project by quantifying the costs and benefits and of the wastewater treatment process.

Phase 1 – 2 - 3

In these early stages, the context, the project objectives and the actions to be taken are identified.
The location chosen for the project is the municipality of Brus, located in the southern part of central Serbia, in the valley of the Rasina river and near the Celije Lake. This municipality, which is one of the major suppliers of potable water in the country, supplies approximately 250,000 consumers in central Serbia.
Given the high pollution levels of the lake, the project aims to provide an efficient system for the collection, transport and treatment of wastewater in the Brus area, through the construction of a wastewater treatment plant (WWTP), with the initial construction and collection network planned for 2015-2017, while WWTP operations should start in 2018. The WWTP is designed for 25 years of operations and the project reference period is 2015–2044.
The Rasina river (one of the biggest polluters of the lake) is classified as class II[24] surface water, however, after the analysis of several samples, it was found that the presence of

[24] According to the Serbia's Water Streams Classification (Official Gazette SRS, No. 5/68); under which swimming, recreation and water sports, fish farming and the use of water for drinking water supply and food industry are permitted.

some parameters (BOD[25], ammonia and phosphates) does not allow to reach the required standards for class II.

The main pollutants present in Lake Celije (nitrogen and phosphorus) cause environmental imbalances and affect water quality, which is why essential measures are required to ensure adequate sanitation, appropriate agricultural practices, water quality and hydrological sustainability.

Phase 4

Subsequently, they proceed with the analysis of current and future demand. This type of analysis is based on the correlation between the total volume of water consumed and the quantity of wastewater produced. The strategy adopted focuses on the stimulation of population growth through measures that will encourage economic development. It's expected, in fact, that water consumption will increase over the years, as well as wastewater flows, i.e. the sum of domestic, industrial/commercial and infiltration wastewater. Based on the growth recorded over the last 30 years, an annual population increase of 0.4% is estimated. The table below shows the total present and future consumption of drinking water (see Table 15). The projected increase in domestic consumption from 2012 (332,385) to 2044 (498,779) reflects the increase in domestic water consumption per capita per day from 135 l in 2012 to 166 l in 2044.

Table 15: Past and projected water demand

	2012	**2018**	**2027**	**2044**
Population	7495	7645	7844	8237
Domestic water consumption (liters/person/day)	135	145	155	166
Domestic consumption (m^3/years)	332,385	404,616	443,756	498,779
Commercial consumption (m^3/year)	130,587	140,000	150,000	155,000
Total consumption (m^3/ year)	**462,972**	**544,616**	**593,756**	**653,779**

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

[25] BOD measures the content of biodegradable organic material contained in a water sample and is one of the parameters used to estimate the pollutant load of wastewater.

From the following table, it can be seen that the volume of water consumed is not equal to the wastewater generated (see Table 16).

Table 16: Past and projected wastewater flow

	2012	2018	2027	2044
Domestic (m^3/years)	199,431	327,739	399,380	450,976
Industrial/commercial (m^3/years)	104,000	112,000	120,000	124,000
Infiltration (m^3/year)	57,625	42,539	50,631	57,488
Total wastewater flow (m^3/ year)	**361,056**	**482,278**	**570,011**	**632,463**

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

"To estimate future values, the ratios of wastewater flow to water demand of 0.9 for the domestic consumers and 0.8 for the industrial/commercial consumers are adopted. In addition to that, there is a portion of infiltration water present in the wastewater collection network estimated at the rate of 0.1 l/s per km of network length"[26].
In order to choose the best option for the construction of the Brus WWTP, a careful assessment of investment costs, operating and maintenance costs, process complexity and sludge management was made.

To protect the water quality of the Rasina river and Celije lake and to comply with the effluent standards of the Urban Wastewater Directive, "the Sequencing Bach Reactor (SBR) with chemical phosphorus removal and additional sludge stabilization was selected. This process has lowest investment and operation and maintenance costs. The treatment includes pre-treatment facilities, biological treatment in the SBR (carbon and nutrients removal), chemical precipitation (phosphorus removal) and additional sludge stabilization with mechanical dewatering"[27]. This is a highly efficient technology that can

[26] Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425
[27] Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

reduce ammonium by up to 96% and phosphates by 88%, together with nutrient removal. In addition, excess sludge from biological treatment will be stabilized and dewatered before disposal.

To conclude this phase, the total cost of the investment is estimated at € 8.16 million, split as follows:

- € 4.60 million for the wastewater collection network.
- € 3.56 million for the WWTP (this includes the investment needed to restore the existing wastewater collection network and to extend the primary collector to the selected location chosen for the WWTP).

Phase 5-6

The final stages are reached, where the financial analysis of the project to determine its profitability is carried out and the economic performance indicators are calculated.

Normally the European Union, in order to evaluate a project as comprehensive as possible, requires both financial and economic analysis.

The financial analysis aims to quantify, year by year, the amount of financial resources that the project generates, to be considered naturally net of investments. Once quantified, in terms of cash flows and taking into account the time structure, the question is whether the amount of these resources is sufficient to offer an adequate remuneration to the parties involved or not.

The authors of the document present only a part of the analysis related to the financial sustainability of the project, but in reality, for completeness, further specifications, that are missing in the paper, would be needed.

There is in fact no mention about the time variable, which is an essential component of the analysis, just as there is no mention of the Net Present Value calculation, which allows to measure in monetary terms the value created by an investment project and to determine if the project is profitable or not. It’s therefore clear that the gap in several data of the project doesn't allow to make a complete financial assessment.

With regard to the financial sustainability of the project, it can be said that "a project is financially sustainable when the risk of running out of cash in the future, both in the operational phases and during the investment, is expected to be zero"[28].

To verify the financial sustainability of the project and to comply with the principle of full cost recovery (imposed by the Water Framework Directive) and the "polluter pays" principle; it has been calculated a tariff for water-related services which should cover all operating, maintenance and administrative costs which comprise fixed and variable costs for the WWTP and for the collectors, as well as capital replacement costs (depreciation) (see Table 17).

This means that the cumulative cash flow of revenues should exceed the cumulative cash flow of the costs of the project in all years of the reference period.

This wastewater tariff, that allows the full cost recovery of wastewater collection and treatment services, in 2014 was set at € 0.09 per cubic meter of water consumption for domestic consumers, but after the construction of the WWTP, the tariff was increased to € 0.7 per cubic meter by 2018.

Table 17: Incremental operation and maintenance costs of wastewater services, expressed in EUR thousand

	2018	2027	2044
WWTP			
Salaries	85	132	277
Repair and Maintenance	25	32	51
Total Fixed Costs	*110*	*164*	*328*
Electricity	137	195	383
Materials and Chemicals	17	20	28
Dewatered Sludge Disposal	5	6	12
Total Variable Costs	*158*	*222*	*423*
Capital Replacement Costs	8	78	155
Total Incremental Costs of WWTP	**276**	**464**	**906**
Wastewater Collectors			
Repair and Maintenance	30	39	61
Capital Replacement Costs	3	30	60
Total Incremental Costs of Wastewater Collectors	**33**	**69**	**122**
Total Incremental Costs of WWTP and Collectors	**309**	**533**	**1028**

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

[28] European Commission (2014), *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*, available at https://op.europa.eu/it/publication-detail/-/publication/120c6fcc-3841-4596-9256-4fd709c49ae4

To conclude, they proceed with the economic analysis to determine the net economic benefits of the project.

In the table below, the benefits deriving from the project are evaluated. As a consequence of the wastewater treatment, benefits are expected in terms of Nitrogen (N) and Phosphorus (P) reduction, GHG reduction through BOD reduction and Suspended Solids (SS) reduction. The assessment includes different concentration according to project use or non-use; in the latter case the values are based on the results of the water analysis. The reduction of pollutant loads is also calculated (see Table 18).

Table 18: Reduction of concentrations in wastewater effluent in mg/l and reduction of pollution loads in wastewater effluent (total volumes per year in thousand kg)

Concentrations	**"Without Project"**	**"With Project"**	**Reduction**
N	50	15	35
P	10	2	8
BOD	360	25	335
SS	460	35	425
Pollutant loads	**2018**	**2027**	**2044**
N	18	23	26
P	3	4	5
BOD	141	185	206
SS	181	236	263

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

For the determination of total benefits, average shadow prices are finally calculated, which reflect the environmental benefits in terms of nitrogen, phosphorus, BOD and SS.

The methodology used is based on the estimation of shadow prices for goods resulting from human or productive activities, that have no market value and have an environmental impact.

Wastewater treatment is considered as a process from which a desirable output (clean water) and unwanted outputs (suspended solids, nitrogen, phosphorus) are obtained.

It's therefore estimated the avoided cost (or environmental benefit) of removing pollutants in wastewater treatment.

The inputs needed to do the wastewater treatment are energy, staff, reagents and maintenance and others. In addition, the volume of wastewater treated by the plant (m^3/year) and the relative weight of each pollutant component (kg/year) is also taken into account.

For the calculation of these shadow prices, it's necessary to assign a reference price for the desired output, that is, the treated water. Although the value of water is not normally determined by the market, it's assumed that its price may depend on its destination and potential users.

On the basis of the average values paid by the Serbian authorities for wastewater treatment projects, the reference price of reused water and the shadow prices of unwanted outputs are determined (see Table 19). These shadow prices represent the avoided costs and for this reason they are classified as benefits.

In this case, as before, not all the data necessary to calculate the shadow prices are made public, but, referring to the European CBA, to measure the direct benefit of the project results, i.e. treated water and reduction in terms of pollutants, it can be used the users' marginal Willingness-To-Pay, which measures the maximum amount that consumers are willing to pay for a unit of a given good or service.

Table 19: Shadow prices for unwanted outputs for reuse projects in EUR/kg

BENEFIT	UNIT VALUE
External benefit of abated N	26.182
External benefit of abated P	79.268
External benefit of abated BOD	0.058
External benefit of abated SS	0.010

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

Finally, from the difference between the total economic benefits and the total economic costs, it's possible to obtain the net economic benefits, or economic net present value (ENPV), whose value amounts to € 8.07 million (see Table 20).

Table 20: Discounted economic benefits and costs

BENEFITS AND COSTS	EUR	%
External Benefit of abated N	7,312,747	35.18
External Benefit of abated P	4,215,998	20.28
External Benefit of abated BOD	96,398	0.46
External Benefit of abated SS	16,620	0.08
Health Benefits	3,517,205	16.92
External Benefits	*15,158,968*	*72.92*
Incremental Revenues	5,627,175	27.07
Total Economic Benefits	**20,786,143**	**100.00**
External Costs	157,489	1.24
Investment Costs	8,257,358	64.95
Incremental Operation and Maintenance Costs	4,298,262	33.81
Total Economic Costs	**12,713,108**	**100.00**
Net Economic Benefits	**8,073,035**	

Source: Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

This wastewater project will create external benefits for a value of € 15.16 million in terms of present value and revenues for a value of € 5.6 million. The main benefits are related to the removal of nitrogen (35% of total economic benefits) and phosphorus (20% of total economic benefits). Finally, health benefits amount to 16% of total economic benefits.

Economic costs include external costs, investment costs of the project equal to 65% (€8.26 million) and incremental operation and maintenance costs, with a percentage weight of 34% (€ 4.3 million).

Among the external costs, we can find the increase in CO_2 emissions resulting from the incremental consumption of electricity by the WWTP (which is calculated at 475t per year). "Applying a long-term average unit economic value of CO_2 emissions of € 25 per tonne, the external cost of CO_2 is € 12,000 per year"[29].

In addition, the cost of the land occupied by the WWTP, which is assumed to occupy an area of 0.8 hectares of land, is also taken into account. "Due to the small size of the land to

[29] Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

be occupied, and very limited alternative uses (farmland or housing area), the opportunity cost of the land is set to zero"[30].

Conclusion

The analyzed project deals with wastewater treatment in the southern part of central Serbia. In order to comply with EU environmental legislation and to obtain their co-financing for the project (it's not possible to know from the available data what co-financing is required), the Government of Serbia has decided to evaluate the project using a cost-benefit analysis based on the guidelines published by the European Commission.

In particular, the financial analysis was not carried out but only the financial sustainability of the project was assessed: a tariff for those who will use water services was set; therefore this tariff, fixed for each cubic meter of water consumed by domestic consumers, will cover the costs generated by the project. Subsequently, the economic analysis is also carried out to assess the economic feasibility. Projects are considered economically feasible when the value of benefits exceeds the costs incurred.

The only part missing, compared to the 7 steps included in the European CBA is step 7 corresponding to a risk assessment; in the paper, in fact, the authors do not refer to the risks related to the project.

The table below shows the main information related to the project and the analysis of the results obtained (see Table 21):

[30] Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

Table 21: Main project information and results

Location	Brus, Serbia
Reference period	2015 – 2044
Useful life	25 years
Total cost of the investment	€ 8.16 million
Conversion factor	1
Economic discount rate	5.5% in real terms
Economic Net Present Value (ENPV)	€ 8.07 million
Economic internal Rate of Return (ERR)	13.4%
Benefit-Cost Ratio (B/C Ratio)	1.64

Source: Personal elaboration based on Bodroza, D., Djukic, M., Jovanoski, I., Lazic, M., Munitlak Ivanovic, O. (2016), "Cost-benefit analysis of an infrastructure project and a cost-reflective tariff: A case study for investment in wastewater treatment plant in Serbia", *Renewable and Sustainable Energy Reviews*, 59, 1419–1425

As a general rule, any project characterized by an ERR below the social discount rate or by a negative ENPV should be rejected, because it would mean that too many socially useful resources are used to achieve too little benefit for the community. In this case, the ENPV is positive and the ERR is higher than the social discount rate. Moreover, the B/C ratio is higher than 1, therefore the project can be considered socially desirable.

What benefits will the community get?

The project would be socially beneficial for the community because, in addition to the environmental benefits, the collection and treatment of wastewater will help the municipality to improve its image, attract new people, encourage economic activities and tourism. This could, however, lead to an increase in future property prices, but it's currently not possible to make a precise quantification.

With regard to health benefits, the municipality has estimated benefits of € 93.00 per family per year. Indeed, the treatment of wastewater would imply fewer working days lost by patients and therefore there would be lower health care costs.

5.2 Project Evaluated with Green Climate Fund Evaluation: the case of Mali

The next document analyzed[31] refers to a funding proposal submitted to the Green Climate Fund to finance a project capable of contributing to the climate issues of a specific country: Mali. We recall, in fact, that the GCF finances low-emission and climate-resilient projects and programmes to contribute to the challenges of climate change in different countries.

First of all, the project promoter, the Government of Mali, must demonstrate the impact that the project will have on climate change in terms of mitigation, adaptation or both and must identify the areas of strategic impact to which the project contributes. It must also specify the project size (see Table 22).

Table 22: Main project information

Location	Mali
Reference period	2019 – 2023
Project size	Medium (US$ 50 - 250 million)
Type of project	Mitigation energy project
Mitigation strategic impact area	Energy access and power generation

Source: Personal elaboration based on Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

Phase 1: Financing information

The total cost of the project is estimated at € 46,282,115, divided into two tranches:

- The first tranche provides for a cost of € 34.25 million, of which € 25.97 million are the expected GCF financing and € 8.3 million in the form of co-financing by the West African Development Bank.
- The second tranche provides for a cost of € 12.03 million, of which €9.68 million are the expected GCF financing and € 2.35 million in the form of co-financing by the West African Development Bank. The second tranche will cover the rest of the funding and must be submitted after the mid-term evaluation.

[31] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

- Furthermore, additional funding will be provided by the private sector which will contribute with an extra of € 8.5 million for the whole project, of which € 6.2 million for the first tranche.

Phase 2: Project description

The growing demand for energy from non-electrified communities has led to an intensification of the energy supply process. In the past, the provision of energy services was mainly available through the use of fossil fuels, whose prices were subject to high volatility and high transport costs; as Mali has no fossil fuels on its territory.

The main objective of this project is the promotion of electrification in Mali rural communities through isolated solar photovoltaic systems, to enable a reduction of carbon emissions in the energy sector. This project will allow many communities to have access to electricity, to intensify rural electrification and to reduce the use of fossil fuels as an energy source to benefit of renewable energy. The useful life of the solar photovoltaic power plant is assumed to be for a period of 25 years.

Although Mali's GHG emissions in the world are incredibly low (0.06%), the Government has committed to the Paris Climate Agreement and to contribute to a 31% reduction in emissions in the energy sector. The aim is therefore a gradual reduction in energy production based on fossil fuels, an increase in investments and the use of renewable energy sources such as solar photovoltaic. The high initial investment costs in photovoltaic installations make the involvement of the private sector difficult, as they are required to mobilize resources from the local banking system at too high costs and, given the capacity to pay in rural areas, it's difficult to set an appropriate tariff.

According to a study carried out by IRENA[32] in 2014, Mali appears to be a country with high solar potential and therefore particularly suitable for the development of solar technologies, even if currently the production of electricity from renewable sources amounts to only 3%. IRENA expects that "the average solar radiation is estimated at 5-7

[32] The International Renewable Energy Agency (IRENA) is an intergovernmental organisation supporting countries in their transition to a sustainable energy future.

kWh/m^2/day with a daily sunshine duration of 7 to 10 hours. Thus, the production potential from solar PV is estimated at 7,906 TWh/year"[33].

The GCF requires the project to be divided into two tranches, the first one targeting 50 locations (about 284,000 inhabitants), with an impact of about 80%. The total project targets 70 communities and provides access to electrification in rural areas for about 31,000 households, divided as follow (see Table 23).

Table 23: Equipment installation details

Category	No. of communities	No. of inhabitants	Power (kWp)[34]	Length
1	14	$x \leq 2{,}000$	30 kWp photovoltaic solar power plant	5 Km
2	21	$2{,}000 < x < 4{,}000$	50 kWp photovoltaic solar power plant	8 Km
3	27	$4{,}000 < x < 7{,}000$	80 kWp photovoltaic solar power plant	4,5 Km
4	8	$x \geq 7{,}000$	150 kWp photovoltaic solar power plant	12 Km

Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

"The total installed power will be: 0,42 MW + 1,05 MW + 2,16 MW + 1,2 MW = 4,83 MW[35], while for Tranche 1 will be: 0,42 MW + 2,16 MW + 1,2 MW = 3,78 MW"[36].

In Mali, the owner of the project is the Government, represented by the Ministry of Energy and Water Resources. The Renewable Energy Agency (AER-Mali) will be responsible for the implementation of the project and consequently for the planning, coordination, monitoring and supervision of the project activities. The government authority

[33] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

[34] The kilowatt peak (kWp) is a unit of measurement of the maximum theoretical power that can be produced by an electric generator or vice versa the maximum theoretical power that can be absorbed by an electric load.

[35] MV is the unit of measurement of electrical voltage.

[36] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

responsible for rural electrification is AMADER, which defines the policies of the Ministry of Energy. All persons or entities that want to carry out electricity generation activities must first obtain a Public Service Permit or a Concession Agreement from the Government. Other permits and authorizations are presented in the table below (see Table 24).

Table 24: Permits and authorizations

PERMITS AND AUTHORIZATIONS	ISSUING AUTHORITY
Community Authorization	Local Authority (Town Hall)
Construction Permit	Ministry of Urban Planning and Housing
Environmental Permit	Ministry of Environment, Sanitation and Sustainable Development
Preliminary Permit of 6 months	AMADER
Agreement between AMADER and the Operator	AMADER
Authorization from the Minister of Energy for a period of 15 years	Minister in charge of Energy
Specifications for the operation and maintenance	AMADER

Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

Phase 3: Added value due to GCF involvement

Without financing from the GCF, the Government of Mali would be forced to borrow at excessively high market rates, which is why external support to receive concessional loans and grants, in order to meet climate targets, is necessary. The involvement of the GCF in the project, will allow to satisfy the growing demand of rural communities for access to energy. This aid will include benefits for the whole West Africa and will also promote investments in renewable energy and the creation of a regulatory framework to encourage private sector involvement.

Phase 4: Expected performance

This project aims to provide benefits both from a climatic point of view, through the reduction of GHG emissions from the energy sector and through the supply of energy to non-electrified communities. The use of renewable energy, in fact, will allow a significant

reduction in carbon emissions. It's estimated that the project "will help avoid 41,049 tCO_2/year and 1,027,227 tCO_2 for the entire life of the equipment (25 years)"[37].

To calculate these amounts, the AMS I.L. methodology is chosen as the most suitable methodology to estimate the mitigation impact of this project. It's in fact applicable for projects that have as their objective the electrification of a community through the installation of renewable energy systems, but more specifically for offgrid electricity or isolated grids projects, where at least 75% of consumers must be represented by households.

This method, approved by a committee within the UNFCCC, provides for two types of calculations:

- The baseline calculation
- The emission reduction calculation.

To determine the baseline, it's necessary to know the amount of renewable electricity used by consumers and the number of consumers.

The baseline emissions are calculated as follows:

$BE_y = BE_{55,y} + BE_{250,y} + BE_{250\ plus,y}$

Where:

BE_y = Baseline emissions in year y (t CO_2)

$BE_{55,y}$ = Aggregated baseline emissions for consumers in year y (t CO_2) (consumed $x \leq 55$ kWh of renewable electricity)

$BE_{250,y}$ = Aggregated baseline emissions for consumers in year y (t CO_2) (consumed 55 kWh $< x \leq 250$ kWh of renewable electricity)

$BE_{250\ plus,y}$ = Aggregated baseline emissions for consumers in year y (t CO_2) (consumed $x > 250$ kWh of renewable electricity).

The emission reduction is calculated as the difference between the baseline emissions and the project emissions. However, as the project uses solar energy, the project emissions amount to 0; therefore the emission reduction equals the baseline emissions.

[37] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

The following table shows the estimated power generation and distribution and the household division per year (see Table 25):

Table 25: Estimated power generation and distribution and household division per year

ESTIMATED POWER GENERATION	
Communities Type 1	919,800 kWh
Communities Type 2	2,299,500 kWh
Communities Type 3	4,730,400 kWh
Communities Type 4	2,628,000 kWh
Total Yearly Generation	**10,577,700 kWh**
	10,578 MWh
Estimated Power Distributed	**8,991 MWh**

	Total Households 31,000	Energy (MWh)	Emission Factor
Households that consume < 55kWh/year	60%	5,394,627	6.8
Households that consume < 250kWh/year	30%	2,697,3135	1.3
Households that consume > 250kWh/year	10%	899,1045	1.0

Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

After examining how the estimated 8,991 MWh of power is divided between the various households, it's possible to determine the amount of emission reductions per year and for the entire duration of the project, by multiplying the "Energy (MWh)" by the "emission factor":

(5,394,627 * 6,8) + (2,697,3135 * 1,3) + (899,1045 *1,0) = 41,089 tCO_2/year.

41,089 x 25 years = 1,027,227 tCO_2.

By reducing emissions, it's possible to achieve several objectives, both in environmental, socio-economic and gender terms, such as the reduction of air pollution and GHG emissions, the increase of socio-economic activities, the improvement of health, hygiene and living conditions, a better drinking-water supply for local people, better conservation of pharmaceutical and food products, an improvement of the literacy rate and the lightening of women's work.

The implementation of this project will bring, in addition to the many benefits already mentioned: 600 permanent jobs and 1,500 temporary workers during the construction period who, thanks to the skills acquired, will be able to make themselves useful for similar projects in other locations.

Finally, the cost per t CO_2 eq is estimated using the 3 components listed below (see Table 26), where the "expected lifetime emission reductions" refers to a period of 20 years:

Table 26: Cost per t CO_2 eq during Tranche 1

A	Total Project Financing	EUR 34.25 million
B	Requested GCF Amount	EUR 25.97 million
C	Expected Lifetime Emission Reductions Overtime	821,782 t CO_2 eq
D	**Estimated Cost per t CO_2 eq** (D = A / C)	**EUR 41.7 / t CO_2 eq**
E	**Estimated GCF cost per t CO_2 eq removed** (E = B / C)	**EUR 31.6 / t CO_2 eq**

Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

The amount of emission reductions over the lifetime of the project is 1,027,227 tCO_2 eq, of which 821,782 tCO_2 eq for Tranche 1, at an estimated GCF cost of 31.6 EUR/ tCO_2 eq, significantly lower than the estimated US $40 for the social cost of carbon[38].

The final step is to determine the financial soundness of the project by analyzing the various components available in the following figure, related to Tranche 1 (see figure 34):

[38] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

Component	Activity	Tranche 1				
		Indicative cost	GCF funding		BOAD Co-financing	
		EUR	EUR	Financial instrument	EUR	Financial instrument
1. Capacity building of rural electrification institutions and Technical Assistance	Activity 1.1 Training, raising awareness of stakeholders and dissemination of project activities/results	164,645	164,645	Grant		-
	Activity 1.2 Communicating project results and lessons learned	164,645	164,645			
	Activity 1.3 Capacity building of the Rural Electrification Fund (Fonds d'Electrification Rural -FER)	98,787	98,787			
	Activity 1.4 Technical Assistance on regulatory framework and on Procurement and Contracting of minigrid construction and O&M companies	59,272	59,272			
2. Detailed Engineering and Installation of solar powered mini-grids	Activity 2.1 Preparation of detailed Engineering Studies	853,214	853,214	Grant		-
	Activity 2.2 Supply installation and commissioning of equipments	31,007,376	22,821,475	Loan	7,891,892	Loan
	Activity 2.3 Implementation of environmental and social measures	294,009	-	-	294,009	
3. Support to Productive Use of Electricity	Activity 3.1 Financial guarantee	1,500,000	1,500,000	Loan		-
Project Management Cost		404,269	306,575	Grant	97,694	Loan
Indicative total cost		**34,252,208**	**25,968,612**		**8,283,595**	

Figure 34: Components of the project during Tranche 1 (Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*)

As mentioned earlier, the first tranche provides for a cost of € 34.25 million, of which € 25.97 million as GCF financing, € 8.3 million as BOAD co-financing and € 6.2 million provided by the private sector (which represent the 20% of the investment for the installation of the mini grids).

Component 1 does not generate revenues, unlike component 2 which needs to be analysed in detail through financial and economic analysis; while component 3 concerns a financial guarantee supported by the GCF. This guarantee will cover part of the risk taken by microfinance institutions (maximum 40% of loans considered irrecoverable) and will make it possible to control the interest rates on loans granted to the population.

For the financial analysis the criterion used is the cost price per kWh[39]. This cost has been calculated taking into account the cost of the power plants and mini grids of the project

[39] The valuation is carried out on a constant basis over a period of 15 years.

for the entire life cycle (construction, operation, maintenance and renewal) in relation to the net amount of energy produced during the same period.

Although not all the data for calculating the necessary performance indicators are made public, the financial forecasts were based on subsequent assumptions:

- "The facilities start operating from 2021 and their technical lifetime is 30 years for the photovoltaic solar field and the mini-grids.
- The battery and inverter life are 8 and 15 years, respectively.
- Depending on the size of villages, four types of solar power plants shall be considered: 30 kWp, 50 kWp, 80 kWp and 150 kWp.
- The various photovoltaic solar fields have a total power of 4,830 kWp.
- The total annual production is estimated at 14,103,600 kWh.
- Technical losses of production and distribution networks are estimated at 7.5% and 8%, respectively for photovoltaic fields and mini distribution grid.
- The price of electricity is EUR 0.24/kWh (XOF 156 FCFA/kWh) to which will be added a levy of EUR 0.02, leading to a tariff of 0.26 (XOF 174/kWh).
- Photovoltaic fields will run for 8 hours and batteries for 6 hours.
- The operating costs of photovoltaic fields and mini distribution grid are 10% of sales turnover.
- The maintenance cost of photovoltaic fields and mini distribution grid is estimated at 3.5% of the turnover of the power sold.
- The cost of facilities is XOF 10.8528 billion for the hybrid solar systems (photovoltaic solar field + mini grids + connections + batteries + inverters + spare parts + training).
- The average cost for the transmitting of power from isolated plants operated by private operators in rural Mali is about 350 CFA Francs/kWh.
- The periodic expenses for replacing defective equipment are estimated at XOF 5.423 billion for batteries.
- The operating period of the project extends from 2021 to 2035 and the residual value of the investments amounts to XOF 6.58 billion for the photovoltaic solar fields and the mini-grids"[40].

[40] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

On the basis of the above hypothesis, a cost price per kWh of EUR 0,26 (XOF 174/kWh) against an average (current) cost of XOF 235/kWh, is predicted.

Considering the previous assumptions and the contribution of private operators equal to 20% of the value of the assets, the authors of the funding proposal estimate that the Internal Rate of Return (IRR) of the project, at an electricity price of EUR 0.24/kWh (XOF 156/kWh), would be 18% (data for the calculation not available).

Also for economic analysis, data on the economic costs and benefits of the project are not available. The authors of the proposal hypothesize "that the economic costs are equal to 85% of the financial costs to take into account the transfers contained in the pre-tax costs. The assumptions used to calculate the economic benefits are the same as those described in the financial analysis of the project. However, for the economic analysis, the cost is 85% of the total cost of investments"[41].

The economic analysis estimates a particularly high Economic Rate of Return (ERR) of 16.61%, which confirms the economic feasibility of the project, while the financial analysis forecasts a return of 18% for private operators against their contribution of 20%.

In addition, a sensitivity test is also provided to show how the ERR would vary as a result a 10% increase in investment costs, a 10% decrease in benefits or a delay of one year in the project's execution (see Table 27).

Table 27: Sensitivity test

PROJECT ERR	10% INCREASE IN INVESTMENT COSTS	10% DECREASE IN BENEFITS	1 YEAR DELAY IN PROJECT EXECUTION
16.61%	16.00%	15.82%	15.98%

Source: Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*

[41] Mali - Banque Ouest Africaine de Développement (West African Development Bank) (BOAD) (2019), *Mali solar rural electrification project – Funding proposal*, available at https://www.greenclimate.fund/document/mali-solar-rural-electrification-project

Phase 5: Risk assessment

To conclude the evaluation of the funding proposal, a description of the possible risks that could prevent the achievement of the project objectives is provided:

- Construction risk, such as a possible failure in the installation of mini grid equipment. This risk falls within technical and operational risks and can be mitigated by improving the selection process. The probability of occurring and the level of impact are considered low (< 5% of project value).
- Environmental and social risk, which include the development of an Environmental and Social Action Plan (ESAP) during the implementation of the project. The probability of occurring and the level of impact are considered low (< 5% of project value).
- Operational and maintenance risk, such as cleaning, inspection, small repairs of a mini solar network system. This risk falls within technical and operational risks and can be mitigated by an appropriate choice of equipment during construction. The probability of occurring and the level of impact are considered medium (5.1–20% of project value).
- Regulatory risk, which falls within technical and operational risks. The probability of occurring and the level of impact are considered medium (5.1–20% of project value).
- Currency exchange risk, which falls within financial risks and can be mitigated by allowing a 20% deposit in local currency. The probability of occurring is considered low, while the level of impact is considered medium (5.1–20% of project value).
- Country security risk, which falls within environmental and social risks. Due to the project, it's expected that a wider and safer access to energy services will help economic activities and society to feel more secure. The probability of occurring is considered medium, while the level of impact is considered low (< 5% of project value).

Conclusion

The analyzed funding proposal deals with the promotion of rural electrification for 70 communities in Mali.

In order to obtain funding from the GCF for the implementation of the project, the proposal aims to provide all the necessary information regarding the project description and the objectives to be achieved; an accurate description of the potential environmental and social benefits. Particular attention is also paid to gender inclusion within the project.

As regards the financial and economic analysis, it's demonstrated that the project is considered to be financially and economically viable on the basis of the assumptions considered. Finally, the possible risks and the relative probability of occurrence that could arise with the implementation of the project are anticipated.

Based on the information provided and the expected results, the project can be considered profitable and suitable for funding by the GCF, which accepted the proposal on 11 April 2019.

What benefits will the community get?

From an environmental perspective, the project will benefit communities by reducing GHG emissions and strengthening resilience to the negative effects of climate change. Through access to electricity, there also will be benefits in terms of better living conditions for local people, better hygienic-sanitary conditions, greater safety due to public lighting and better care conditions in school and health facilities.

As mentioned above, a particularly important element in the assessment appears to be the gender component. The inclusion of this factor, in addition to the usual cost-benefit analysis, makes the examination even more complete.

Not only from an ethical point of view, but the discrimination that prevents the presence of women in the working sphere leads to less competitiveness (as female skills in addition to male skills could be fundamental) and less economic growth.

The project will have positive impacts for both women and men, thanks to the development of a gender action plan. Access to electricity will allow women to save time in housework, which can be devoted to the development of income-generating activities and education, by contributing to a greater participation of women in the development of the country.

Conclusions

The growing threat of climate change has led to a strong interest in sustainability, environment and climate issues, especially as a result of the Paris Climate Agreement signed in 2015. The world of finance has responded positively to this challenge through the creation of a specific sector: green finance. Within this sector, which is still constantly growing, we find green projects, which are defined as long-term projects aimed at preserving, protecting and safeguarding the environment, in several sectors.

It was therefore considered interesting to study these projects in detail to understand what elements are needed to define a project as "green". Among these, particular emphasis is placed on the financial instruments needed for their financing, as well as the list of activities and sectors that can be classified as sustainable and the required green certifications.

The analysis proceeds with the study of different methods that can be used for the evaluation of a green project. The most common methodology used is the cost-benefit analysis which, in addition to the classic evaluation, also takes into account the identification and quantification of risks and environmental impacts associated with the project and the choice of the corresponding mitigation and adaptation measures. On the basis of the same methodology, has been elaborated the evaluation of the Green Climate Fund, which integrates the gender component within the cost-benefit analysis. The third methodology, developed by the OECD, provides criteria for the evaluation of green projects that are in line with the objectives of the 2030 Agenda. Finally, the latest methodology which has been analysed is the S&P Green Evaluation, a type of assessment based on the assignment of a score related to three components, which are transparency, governance and mitigation or adaptation, to achieve a final green evaluation score.

Although the way to achieve a common standard in green project evaluation is still a long way off, it's possible to identify cost-benefit analysis as the most comprehensive methodology (at the moment) in providing an evaluation, as combines financial and economic analysis with the concept of sustainability, a fundamental characteristic of a green project.

It will be interesting to monitor future developments in this field given the rapid evolution of recent years. The aim will be certainly to standardize at international level both green certifications and associated taxonomies, as well as green project evaluation procedures.

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