



EIB impact report 2020

Climate action, environmental sustainability
and innovation for decarbonisation

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Introduction

Welcome to the first edition of the European Investment Bank's new impact report, the successor to the Bank's annual EIB Operations inside the European Union report.

This new report takes a fresh look at how EIB operations improve lives around the world by measuring the effectiveness of our investments in three key areas:

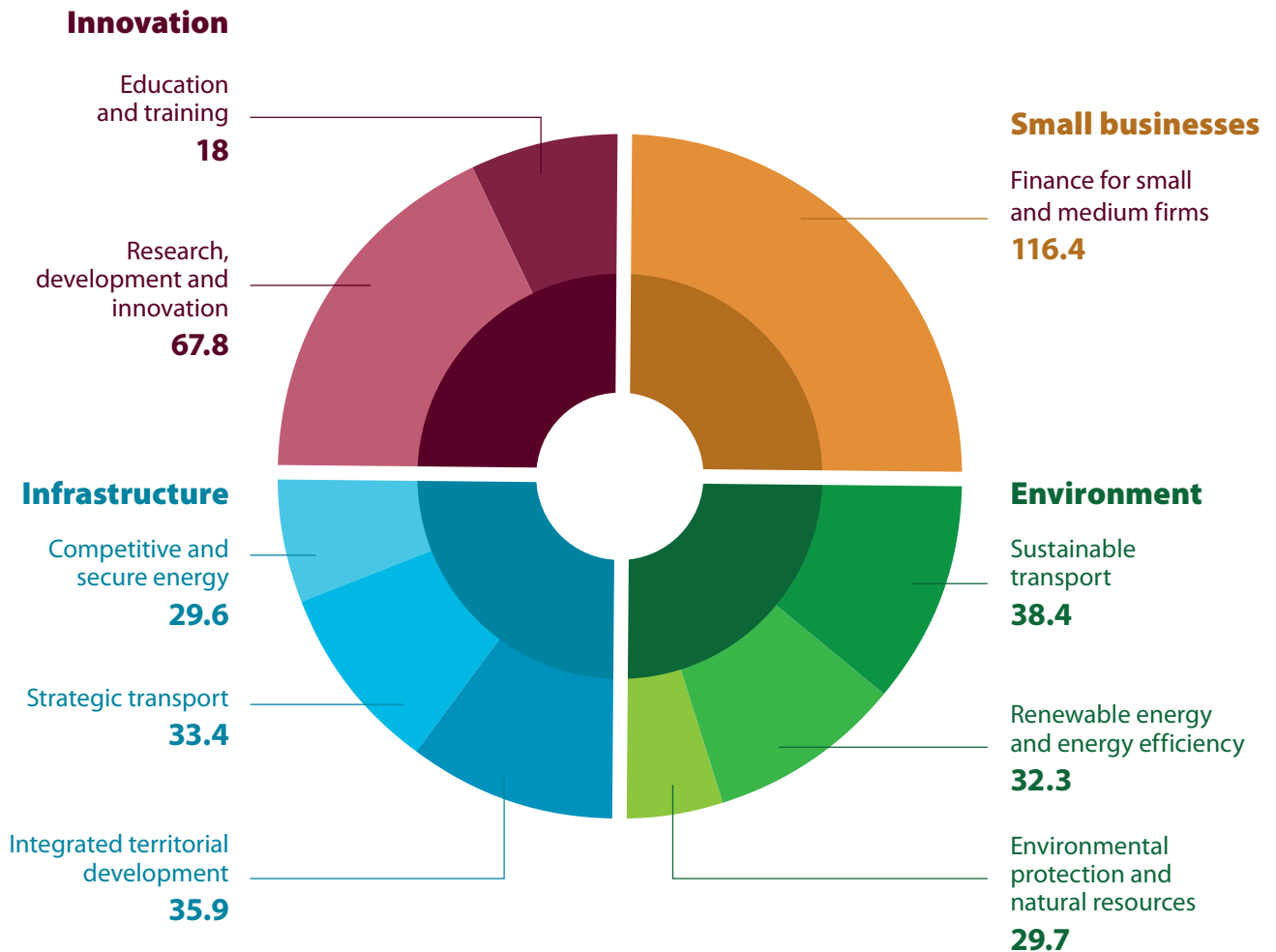
- **Additionality:** The EIB's role is to step in where the market has failed to deliver. The EIB has recently revised its internal procedures to enhance the assessment and measurement of its additionality, ensuring that the Bank's presence in a project brings a quantifiable improvement over what would have otherwise been possible.
- **Impact:** The EIB now measures how its investments contribute to the United Nations Sustainable Development Goals (SDG). By doing so, the EIB is signalling its commitment to supporting the United Nations' Decade of Action to create peace and prosperity for people and the planet. The Bank will continue to report regularly on the impact its global operations have on the SDGs.
- **Climate:** Because 2020 was the year the EIB assumed its new role as the European Union's climate bank, this year's report focuses on barriers to investment in climate action, environmental sustainability and research and development and innovation (RDI) for the decarbonisation of energy-intensive industries. This report takes a closer look at the barriers to investment and innovation, and explores how the EIB's additionality can help investment in these critical sectors to flourish, making a difference to communities throughout the world.

IN A NUTSHELL

- **The EIB delivers additionality and impact all over the world by supporting investment projects that address market failures in a wide variety of economic sectors, improving social welfare across the globe.**
- **In terms of contributions to the SDGs, the EIB's reach is most notable in climate action and environmental sustainability, as well as in infrastructure investments.**
- **The EIB observes and identifies the investment barriers that can hold back projects and slow down economic development. The EIB's long-time involvement and experience in financing a broad range of investment projects allows it to develop solutions that address some of these investment barriers.**
- **Fragmented regulation and fragmented markets across Europe, difficulties coordinating public funds and a lack of planning for public sector investments are holding back projects dealing with climate action, environmental sustainability and research and development for the decarbonisation of energy-intensive industries.**
- **The EIB has been able to improve the viability of projects by blending financing with the European Commission, by focusing on financial intermediaries that cater for small businesses working on climate action and environmental sustainability and by providing advisory services for investment projects.**

Lastly, the report also provides a more technical assessment of the challenges facing investors in the economic sectors in which the EIB is particularly active. As the following chart illustrates, the Bank's lending supports projects in a wide range of sectors in the European Union and beyond.

EIB's lending mix over 2015-2020 (€ billion)



More information relating to EU operations is available on the EIB's website, in the form of [project stories](#) and [data](#).

How the EIB measures its impact

This report is aimed primarily at readers who already have a certain familiarity with the Bank. It highlights the additionality of the Bank's involvement in the projects it finances.

As the European Union's bank, the EIB is charged with implementing public policy. In that role, the Bank ensures that all operations meet its requirements of **additionality** and **impact**, and are **eligible** for its support.

What is **additionality**? Additionality refers to how the Bank's intervention can enable or strengthen a project — typically a project that could also benefit public welfare — in a way that the market alone would not achieve. When markets fail to function efficiently, they often do not generate socially desirable outcomes. Market failures can inhibit private sector investors from delivering the optimal level, scope and/or quality of investment for societies, providing room for public banks, such as the European Investment Bank (EIB), to make a difference. If the market failure did not exist, the private sector would likely have made the needed investment.

The Bank's **eligibility** rules ensure that activities are in line with the EIB statutes and EU policy objectives. All projects financed by the Bank must contribute to the EIB's goals in its main spheres of activity: sustainable cities and regions; sustainable energy and natural resources; innovation, digital and human capital; small and medium-sized enterprises (SMEs) and mid-cap finance; climate action and environmental sustainability; and economic and social cohesion.



An EIB loan will help ArcelorMittal meet its decarbonisation objectives.

Until the end of 2020, the EIB used its Three Pillar Assessment (3PA) to measure additionality and impact for its EU projects, while projects outside the European Union were assessed using the Results Measurement framework (ReM). Both methodologies rated projects according to criteria that fell under three main pillars: the furthering of EU policy objectives; project quality and soundness; and the EIB's contribution to the project. The charts below illustrate the 2020 performance of the EIB's different products under each pillar.

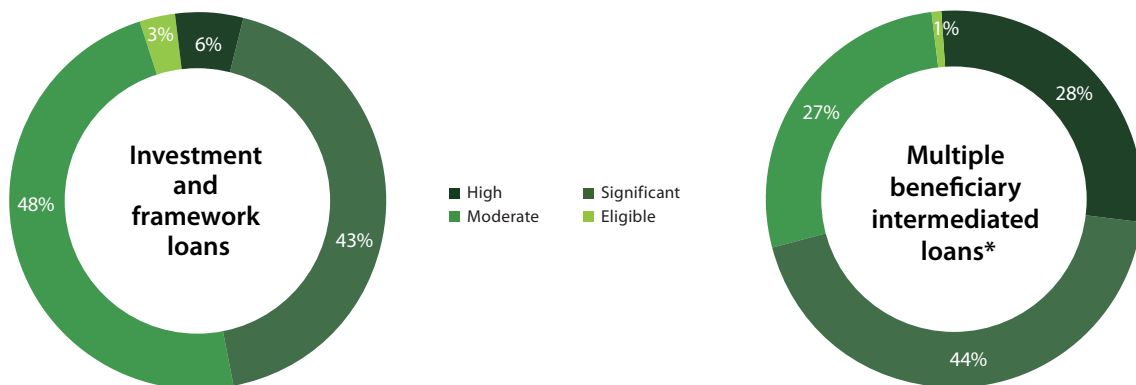
Contribution to EU policy objectives



Project quality and soundness



EIB's contribution to the project



* Including guarantees and portfolio equity operations.

In January 2021, the EIB introduced a new Additionality and Impact Measurement (AIM) framework. It integrates 3PA and ReM into a single framework for operations in the European Union and beyond while taking into account the particularities of operations outside the European Union. The AIM framework retains a three-pillar structure and provides a refined and streamlined model which ensures that EIB financial support results in additionality by:

- addressing suboptimal investment situations resulting from market failures. In other words, **why** the EIB intervenes in a specific project;
- influencing the investment activity undertaken (in terms of scale, scope, structure, quality and/or time) to avoid suboptimal investment — how the project adequately addresses suboptimal investment, and **what** difference EIB support can make;
- providing support that complements what is available from other sources of financing — **how** EIB financing and advice can strengthen projects.

As a public bank, a key feature of EIB operations is that they must always constitute a response to suboptimal investment arising from some market failure. Market failures compromise the efficiency of the markets in delivering optimal results for society. They are classified as follows:

- **Public goods** for which it is impossible or undesirable to levy a charge because anybody can consume those goods and because individual consumption does not reduce the availability of the goods to others (for example flood prevention schemes).
- **Externalities**, for example costs (industrial pollution) or benefits (planting new forests, which absorbs carbon) that are created without asking consumers to pay for the benefit. Carbon and environmental externalities are the most relevant market failures for climate-related investments.
- **Imperfect competition**, for example firms or other parties that may be able to change the supply and prices in a market, notably where there are few — or perhaps only a single — producer or buyer. Transport and energy networks are examples of natural monopoly markets.
- **Incomplete or missing markets**, which arise when certain goods or services are not produced, despite the desirable impact they may have. Active coordination between partners is important, and that cooperation does not happen automatically through the pricing mechanism of normal markets. Cross-border projects, for example, often warrant coordination by the public sector.
- **Imperfect/asymmetric information**, which means that information must be complete and equally shared among all producers and consumers for markets to work efficiently. However, consumers know more about their own preferences than producers. Similarly, producers usually know more about their product than consumers. Financial markets have particularly high information requirements, and the market may fail to provide the credible information needed to supply socially beneficial financial products.

One key example is markets' failure to supply credit or other financial products to small and medium-sized companies, especially innovative or fast-growing ones. These companies typically lack collateral and credible information about their future prospects, and they are not followed by professional rating agencies. Another example concerns irreversible long-term investments. The market often fails to supply credit with very long tenors to match assets' economic life or a project's ability to pay back funds because the financial benefits are generated over a long period.

EIB financial interventions address these market failures. The Bank's AIM framework has been designed to ensure that each project effectively addresses one or more of these situations.

Addressing additionality

This report aims to highlight the Bank's role in generating additionality, particularly in helping to address the investment challenges facing projects for climate action and environmental sustainability and research, development and innovation for decarbonising energy-intensive industries. It presents an overview of barriers to climate-related and environmental investment in the European Union during the five years from 2015 to 2019, drawing on the EIB's substantial experience of financial operations in these domains. The EIB's intention is to illustrate the issues that must be overcome for the market for green investments to function efficiently.

Delivering impact

This report also illustrates the impact of the EIB's financing, which is assessed using project-level output and outcome indicators. Collecting data about every project the Bank finances enables it to ensure projects make a real difference to the lives of people throughout the world. In this context, as the EU bank, the EIB has sought to align its reporting with the United Nations' Sustainable Development Goals (SDGs).

The EIB's contribution to the UN Sustainable Development Goals

The EIB's AIM framework ensures that all the Bank's projects have a positive socioeconomic impact, in addition to sound financial returns. The impact of the Bank's involvement is measured by gathering a detailed set of output and outcome data for every project that receives EIB support. This data ensures that the concrete benefits of the EIB's activities are calculated not only in the context of an individual project, but at a sectoral, national and international level as well.

The United Nations' 17 Sustainable Development Goals (SDGs) provide a framework for measuring international efforts to end world poverty, protect the planet and ensure that everyone can enjoy peace and prosperity. Since 2016, the EIB has been using its project-level data to track and publish its contribution to the SDGs. In its role as the EU climate bank, the EIB has expanded its reporting on its SDG contributions to demonstrate the full impact of its investments throughout the world. Climate action is at the heart of the EIB's mission, but the Bank's impact reaches far beyond climate-specific goals, in line with the sustainability objectives embedded within EU political priorities.

Mapping EIB contributions to the SDGs

In deciding how to report its contributions to the SDGs, the Bank consulted widely with other multilateral development banks (MDBs), notably through the MDB Working Group on Managing for Development Results. The Bank's new methodology enables its contribution to each of the SDGs to be recorded in financial terms as well in terms of physical project outputs and outcomes, while remaining aligned with the approaches adopted by its peers.

The new mapping methodology formalises the relationship between the EIB's project-level indicators and the SDGs. All indicators are mapped to the appropriate SDGs independently of project context, and may be mapped to up to three different goals. Each project thus contributes to all of the SDGs for which its data has been mapped.

This approach offers a number of benefits. It takes into account the full range of interactions and interlinkages among the SDGs, minimises the number of arbitrary decisions required in the mapping process, and is in line with the methods used by other development banks. It therefore has the potential to facilitate comparability and aggregation among different development banks.


















For each project, an automated, rules-based process maps the following data to the SDGs:

- **Project results** — concrete, sector-specific measures of project outputs and outcomes, expressed in physical units (such as the number of people receiving improved healthcare, GWh/year of energy saved, etc.)
- **Economic sectors** according to the NACE classification¹
- **Eligibility criteria** or **policy objectives** based on the EIB's public policy goals
- **Geographical location** — country or region in which a project is located
- **Operation and product type** (such as microfinance)
- **Mandates and initiatives** (such as the Economic Resilience Initiative)

Nonetheless, mappings may be modified by the Bank's experts should the need arise, as long as the change is clearly justified. Generally, though, the process is as streamlined and standardised as possible. When Bank experts do intervene, they ensure that the full range of interactions among SDGs is taken into account so that progress in some areas is not made at the expense of others.

Mapping the output/outcome indicators of individual projects to the SDGs allows the EIB to present the impact of its financing operations clearly and concisely. A selection of indicators from projects signed in 2020 is presented below to illustrate how impact is attributed from projects to the goals.

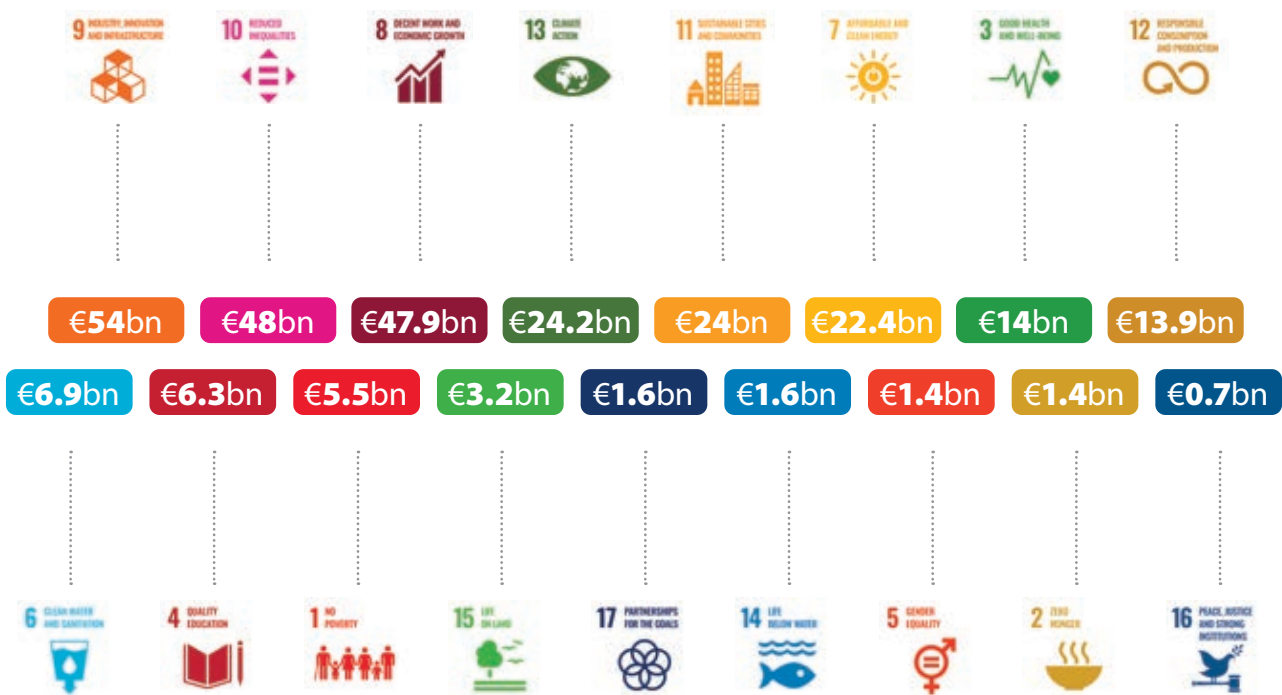
¹ NACE is the acronym used to designate the various statistical classifications of economic activities developed since 1970 in the European Union. NACE provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (such as production, employment and national accounts) and in other statistical domains.

Selected project indicator	EU + non-EU	SDG
Patients treated (#)	282 564 978	
<i>of which recipients of COVID-19 vaccine</i>	280 000 000	
Students in education facilities benefiting from EIB finance (#)	1 006 165	
Persons benefiting from safe drinking water (#)	29 581 249	 
Persons benefiting from improved sanitation services (#)	15 552 299	
Households which could be supplied with the energy generated by the project (#)	8 960 130	 
Electricity generation capacity (MW)	10 196	
<i>of which from renewable energy sources</i>	83%	
Power lines installed or upgraded (#)	29 113	
Smart energy meters installed (#)	6 977 633	 
New subscribers with SG services enabled (#)	2 600 000	
New satellites providing broadband internet services (#)	60	
Households in new or refurbished social and affordable housing (#)	65 915	 
Additional trips made on EIB-financed public transport during the year (#)	380 454 687	 
Persons facing reduced risks of flooding (#)	1 830 000	
Persons with reduced exposure to drought risk (#)	8 739 830	 
New forests planted (ha)	145 076	 

EIB impact visualised through the SDGs

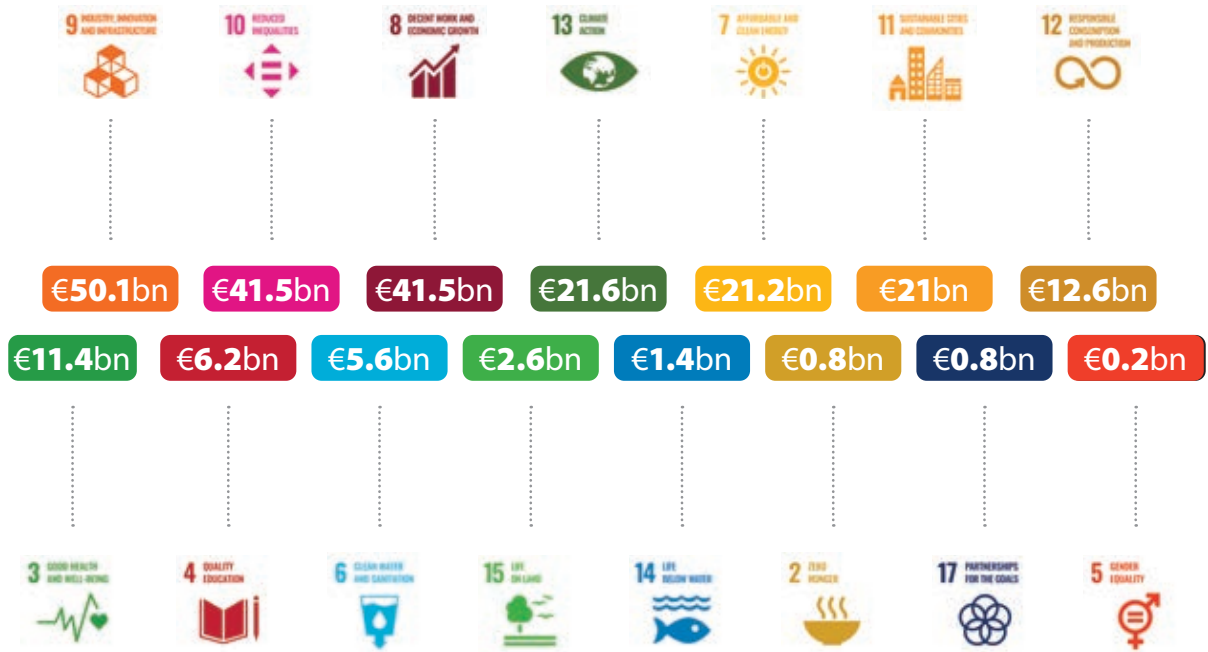
2020 was the first full year for which SDG mappings were available for all projects signed. The following charts give a clear visual summary of the EIB's impact, tracking its contributions to the SDGs across all geographical areas and then separately inside and outside the European Union. These charts confirm the impact EIB financing had in these crucial areas, and illustrate the Bank's commitment to its role as the EU climate bank.

1. The EIB's 2020 contributions to the SDGs — inside and outside the European Union*

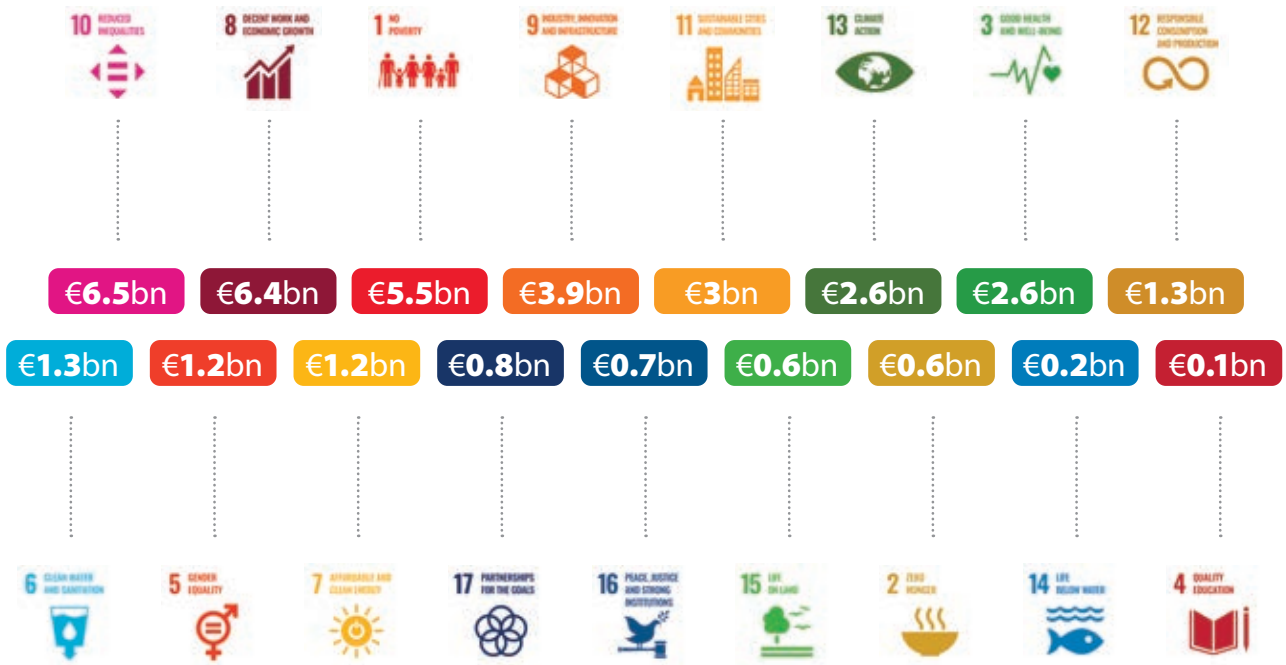


* The financial contributions to the SDGs presented in this report are based solely on the EIB's own resources and co-financed activities. Third-party funded operations are not taken into account.

2. The EIB's 2020 contributions to the SDGs — inside the European Union



3. The EIB's 2020 contributions to the SDGs — outside the European Union



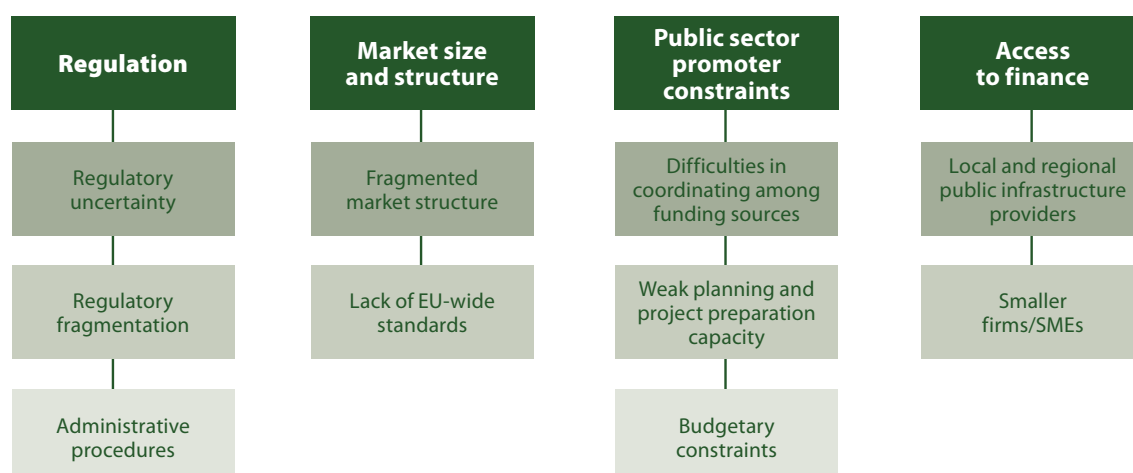
Barriers to investment in the European Union

In addition to the market failures associated with the sectors in which the Bank is active, the EIB's many years of experience have also helped it to identify a series of bottlenecks or barriers to investment. Most investment barriers are structural and sector-specific. However, some financial market failures, such as the access small and medium-sized enterprises have to finance, may also have a cyclical element. Investment barriers slow down or reduce investment in the economy. They diminish the economy's productive capacity and suppress long-term economic growth and employment.

The analysis presented below is largely based on the experience the Bank has gained lending throughout the European Union. The EIB regularly reviews the barriers and bottlenecks to investment in EU Member States that lead project promoters to postpone, scale back or put investments on hold indefinitely. Fragmented markets along national borders, uncertain and fragmented regulation, difficulties in coordination among government levels or entities, and the weak capacity of public sector promoters — which sometimes lack the skills and expertise necessary to identify, define, design, implement and monitor investment projects or programmes — all present hurdles to growth and employment that need to be tackled through targeted action.

The concept of investment barriers is commonly used, but it is not well anchored in economic theory. Consequently, the EIB has developed its own taxonomy of investment barriers² around which the analysis presented here is structured.

EIB taxonomy of investment barriers



2 The publication can be found at <http://www.eib.org/infocentre/publications/all/breaking-down-investment-barriers-at-ground-level.htm?f=search&media=search>

Climate action and environmental sustainability

Climate action and environmental sustainability are key areas of activity for the EIB, particularly in its role as the EU climate bank. The EIB has built up substantial expertise in climate finance as a result of its efforts to meet concrete and increasingly ambitious climate investment targets. Delivering on these targets has provided EIB employees with a unique insight into the opportunities and barriers related to investments in climate change mitigation and adaptation. The Bank has developed its experience in investments contributing to environmental sustainability through activities in a range of different sectors.

It is important to note the substantial contributions that climate and environmental sustainability projects make. For example, renewable energy power generation and low-carbon public transport are inherently low-carbon investments, while investment in wastewater treatment is inherently environmentally sustainable. Investment barriers to such projects are generally sector-specific and have little to do with their green nature. In fact, the greatest barriers to investment in renewable energy generation projects in many EU Member States are delays arising from regulatory uncertainty, public opposition and obtaining the required permits.

At present, investment opportunities in the circular economy are still largely limited to relatively simple recovery efforts (recycling, waste management and disposal). Investment opportunities that capture even more value (such as remanufacturing, refurbishing, reuse and repair) are still uncommon. Circular economy investments in design and improved product usage, or innovative supporting services, are very rare.

Similarly, investments in natural capital (renewable and non-renewable natural resources including air, water, forests, animals, minerals, biodiversity and land) in the European Union are mostly linked to infrastructure projects in specific sectors. Investments in projects that focus solely on natural capital protection and restoration require substantial preparation because they are not immediately bankable. Many of these projects currently benefit from dedicated funding facilities, such as the [Natural Capital Financing Facility](#), with the expectation that they will be scaled up and integrated into EIB activities in the future.

The EIB's principal finance vehicles for climate action and environmental sustainability are lending activities, which primarily concern direct loans and intermediated loans (including those blended with EU budget funds) and, to a lesser extent, venture capital and venture debt. These activities are complemented by a small amount of climate action and environmental sustainability finance dedicated to advisory services that aim to improve the soundness and bankability of projects and to strengthen the ability of project promoters to identify, develop, implement and monitor projects.

Given that project loans and intermediated loans dominate the EIB's climate and environmental activities, this report will leverage the expertise the EIB has gained through these types of operations to highlight the specific barriers to investment.

Regulation

Climate action

When specific information is necessary to determine whether a project can be classified as green, it is crucial that this information is available to all relevant financial market participants. This information exchange requires a common language and definitions that enable the project promoter and financial institution to classify the project as green. Currently, the plethora of different (and changing) voluntary frameworks for green projects and a lack of regulatory requirements makes it difficult for promoters and financiers to adequately assess projects. The EIB expects this situation to improve in the European Union after the adoption of the EU Taxonomy³ and the regulation governing sustainability-related disclosures in financial services⁴, but an immense effort across the market will be required to establish the information flows necessary to track green investments consistently.

The fundamental definitions relating to climate action, and the standards and methodologies used to arrive at such definitions, vary significantly across the European Union. The European Union's [sustainable finance agenda](#) aims to address this problem through a number of products that will define and promote sustainable finance activities, helping to provide clarity to financial participants and thereby channel more investment into sustainable activities. A particularly significant initiative is the prospective establishment of a classification system that will define the economic activities that substantially contribute to the environmental objectives⁵ defined by the EU Taxonomy. These environmental objectives cover climate mitigation and adaptation, water and marine resource conservation, the circular economy, pollution prevention/control and biodiversity/ecosystem protection and restoration. These policy and legislative activities set the framework for financial activities in climate action and environmental sustainability across the European Union.

To improve the classification of climate action investments, the EIB currently tracks its progress against targets by applying a robust, conservative and granular methodology developed in partnership with other multilateral development banks⁶. This methodology is supplemented by internal guidance that allows EIB staff to identify (parts of) economic activities that can be considered to contribute to the achievement of a low-carbon economy and/or promote resilience against projected climate effects — an EIB-specific predecessor to the anticipated EU Taxonomy. The baseline for projects that can be considered as climate action projects under the methodology shifts as new technologies emerge. This methodology can create uncertainty in the market and raise questions about whether a project should be classified as “green.” That uncertainty, in turn, can block investments from institutions that require a green classification.

3 https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en

4 <https://eur-lex.europa.eu/eli/reg/2019/2088/oj>

5 Simultaneously avoiding significant harm to the other objectives.

6 As documented in the Annexes of the Joint Report on Multilateral Development Banks' Climate Finance (<https://www.eib.org/attachments/2018-joint-report-on-multilateral-development-banks-climate-finance.pdf>). This form of “self-regulation” based on industry best practice is a common theme on green finance markets, with a prominent example being the International Capital Market Association's Green Bond Principles defining standards for green finance on international capital markets.

Circular economy

The European Union's transition to a circular economy is at an early stage. Regulations, markets, investment tools and practices, including financial risk assessment, are tied to linear models, and externalities (climate consequences or other) linked to those linear business models are generally not taken into account. Although new legislation is in place and regulatory barriers are being addressed in the European Union and within national governments to promote circular business models, products and materials in various sectors, the regulatory framework still creates a number of major obstacles for the transition to a circular economy.

A major barrier is legislation that hinders the use of recycled materials and substances in production processes and the development of secondary raw material markets. The lack of concrete and enforceable requirements for product design that facilitates reuse, repair and recycling is also a barrier. Policymakers still have work to do to develop a level playing field for circular businesses and to remove the investment risk inherent in circular economy projects. The European Commission is addressing many of the existing regulatory barriers with a new [Circular Economy Action Plan](#). The circular economy still lacks a clear-cut definition and classification system, a problem that the EU Taxonomy is expected to help solve. Similarly, as with investments contributing to climate mitigation and adaptation, the EIB applies a classification system and methodology⁷ to guide the origination and appraisal of circular economy projects. The classification system was developed together with the European Commission's expert group on circular economy financing⁸.

Natural capital

The financing of natural capital can be classified into six market-based mechanisms, which are a combination of revenue-raising mechanisms, direct financing mechanisms and programmes to make projects more mainstream: (i) environmental fiscal reform; (ii) payments for ecosystem services; (iii) biodiversity offsets; (iv) markets for green products; (v) biodiversity in climate change funding; (vi) natural capital in international development finance.

The EIB has positioned itself at the forefront of natural capital financing with the implementation of the [Natural Capital Financing Facility](#). This facility is a financial instrument blending EIB funding with European Commission financing. So far, the EIB's experience with the facility has shown that financially viable investments in natural capital happen only when the appropriate economic regulatory framework is in place — and is reinforced by a supportive financial framework. A public sector framework of regulations and incentives is often lacking. The market needs regulated investments and revenue streams to reach its potential, as well as higher sustainability standards and risk awareness, disclosure and transparency to support biodiversity at all levels.

7 https://www.eib.org/attachments/thematic/circular_economy_guide_en.pdf

8 <https://op.europa.eu/en/publication-detail/-/publication/ca9846a8-6289-11ea-b735-01aa75ed71a1/language-en>

Market size and structure

Climate action

In line with the current EU target for reducing greenhouse gas emissions and reaching carbon neutrality by 2050, the future path of decarbonisation will essentially determine investment needs, and therefore set the boundary for the market size and structure of climate finance. European Commission modelling suggests that current investment in power supply, electricity networks, buildings, energy efficiency in industry and transport vehicles will need to increase by €260 billion per year over the coming decade. In other words, investments needs to rise by about 30% from 2021 to 2030 compared with the period from 2011 to 2020. These estimates are likely to increase with the adoption of more stringent greenhouse gas reduction targets for 2030, and they do not take into account investment needed in the bioeconomy, innovation or climate resilience.

Given the wide economic spectrum of climate finance, it is impossible to provide a full picture of investment barriers. But some financial challenges already exist in certain sectors with a pressing need for low-carbon investment, such as the following:

- Transformational technologies that enable **energy-intensive industries** to reduce their carbon emissions are, for the most part, not yet commercially viable. In other words, low-carbon alternatives remain more expensive than conventional processes that rely on fossil fuels. The challenge to investment in low-carbon solutions is exacerbated by pressure from international competition, often from parts of the world with lower environmental and social standards. The European Commission's proposed carbon border adjustment⁹ may help to address this issue.
- The fragmented nature of **agriculture and the food industry** presents challenges for climate investment. A large number of small firms and farms need to move towards lower carbon production to drive overall improvements in the sector. However, it is possible that improvements in current intermediated lending practices, mainly through the adoption of sustainable finance methodologies, will spur climate investment in this sector. This type of lending could facilitate the development of national advisory programmes to support lower carbon production and practices. In addition, fragmented industries also make it difficult to identify and incorporate climate-related risks into the value chain and to improve overall resilience. Even where relevant climate information is available and risk awareness high, smaller producers find it difficult to incorporate this information into practical business planning. For this reason, investments made by competitors act as an important market signal, suggesting that the sector will move towards climate resilience relatively slowly until it reaches a critical mass of investments in resilience and climate action.
- The transport sector needs to achieve the European Union's 2030 climate and energy targets through a combination of decentralisation, decarbonisation (including electrification) and digitalisation. Passenger and freight rail projects are capital-intensive, lengthy and complex. They are typically carried out by the public sector at the municipal/local level and are therefore often constrained by public sector promoters' access to finance. Alternative transport fuels and their infrastructure (such as hydrogen) are still in the early stages of development, and the supply and demand of fuel cell vehicles is currently weak.

⁹ The [Carbon Border Adjustment Mechanism](#) (proposal adopted by the European Commission in July 2021) will impose a carbon levy on imports of carbon-intensive products to ensure that European emission reductions contribute to a global emissions decline, by avoiding the transfer of carbon-intensive production from outside Europe.

- Meeting the European Union's 2030 target for reducing greenhouse gas emissions is likely to involve doubling or tripling the current capacity of renewable power generation¹⁰. Deploying renewables on a massive scale will pose some challenges for energy system integration, local acceptance of projects and coordination between companies and policymakers responsible for energy and climate policy. Investment barriers to renewable energies are mainly developmental. It is generally difficult for promoters to obtain permits and severe restrictions on activities can exist, which is partly a reflection of local opposition to some projects.
- Energy consumption in buildings represents around 40% of total energy demand in the European Union. The renovation rate of buildings is very low, at around 1% to 1.2% per year, and many buildings were built in the 1960s or even before, prior to the implementation of mandatory energy performance standards. This investment gap stems from imperfect information: energy prices are volatile in the short to medium term, while energy needs are determined by unpredictable factors such as the weather. In addition, the variety of contractual relationships in the building sector (involving buyers and sellers, owners and renters, and borrowers and lenders) often reduces the incentives to invest in energy efficiency, as the owner does not usually pay for energy if the building is rented out. These problems are magnified by the high upfront costs and multiplicity of participants involved in energy efficiency investments.

Circular economy

According to a recent study on circular economy barriers in the European Union¹¹, a lack of information and education about the circular economy continues to hamper the market's development.

Because a level playing field does not exist between participants in the "linear" and the "circular" economy, market incentives for circular businesses are currently limited. In addition, consumers are often unaware of circular economy benefits, and are therefore not yet pushing for change. End users also play a crucial role in making products more circular. The active participation of consumers and end users is needed to help products find a new life and not just turn into waste.

A lack of cooperation in the value chain limits circular economy investments. Different organisations in the value chain need to collaborate to find circular solutions, helping to keep resources and materials in a constant loop. The circular economy demands a highly integrated value chain that connects all stages of a product's life cycle. However, the links in this value chain are often weak or non-existent because of an unclear regulatory framework and potential high risks. Collaboration along the value chain needs to be enabled and rewarded. In addition, the low cost of primary raw materials, which favours the linear economy, combined with the upfront investment costs for circular economy projects block new market entrants.

¹⁰ Section 4.2.2.3 of the Communication from the Commission on A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM(2018) 773 final) projects that wind capacity will increase from 140 GW in 2015 to 350 GW in 2030, and then to between 700 and 1 200 GW by 2050 depending on the scenario. Meanwhile, solar capacity will grow from 95 GW in 2015 to 320 GW in 2030, and then to between 500 and 970 GW by 2050 depending on the scenario.

¹¹ Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A. and Hekkert, M.P. (2018). "Barriers to the Circular Economy: Evidence from the European Union." *Ecological Economics*, 150.

Natural capital

Natural capital investments still face significant market barriers. One of the main barriers is the lack of an identifiable and reliable revenue stream. The services provided by nature, such as water or wood for construction, have traditionally remained undervalued or unvalued, though they often provide quantifiable financial and economic benefits, such as lower or avoided costs and sustainable supply chains, in addition to socioeconomic benefits such as health and well-being. Often, an investment's realisable returns are only a fraction of the benefits actually delivered. In addition, benefits accrue to a large number of people over the long term. At the European Union level, the budget required solely for the maintenance of the Natura 2000 network of protected areas is estimated to be €5.8 billion a year (mainly from public funding sources), while the economic benefits accruing to the EU population are estimated to be €200 billion to €300 billion per year¹². Ecosystem services such as flood prevention, improved natural purification of drinking water and enhanced recreational opportunities are provided through the financing of natural capital protection and restoration activities (such as the restoration of alluvial plains, grassland conservation and the conservation of peatlands).

Natural capital projects, by design, tend to be relatively small-scale and are very hard to consolidate to provide economies of scale as they vary hugely in nature and location. All these elements make these investments unattractive for investors who typically favour large-scale, easy-to-structure projects designed to maximise value. For natural capital investments to achieve the scale required, nature-related investments need to be identified and embedded into larger investment programmes with a defined scope or strategy as well as into broader business models, portfolios or supply chains.

The EIB has been able to overcome these obstacles mainly by using financial intermediaries, such as dedicated funds or mission-driven banks catering to smaller projects or investors seeking these kinds of green investments. These investments follow a blended finance structure with a de-risking component, making them more attractive to the market. The [Sustainable Ocean Fund](#) and the [EcoEnterprises Fund II and III](#) are examples of dedicated funds that target investment for natural capital and biodiversity conservation.

¹² European Commission (2013). "The Economic Benefits of the Natura 2000 Network."



The EIB provided €330 million to support the rehabilitation and modernisation of the Afsluitdijk dam, one of the major flood barriers in the Netherlands. Works will include the creation of “fish passages” to help re-establish migration between the sea and the interior lake.

Public sector promoter constraints

Climate action

Adaptation to climate change is typically initiated, financed and implemented by the public sector. Almost all countries in Europe have published a national adaptation strategy, and over half have published a national adaptation plan. These strategies, however, often lack estimates of adaptation investment needs, and do not typically include concrete proposals for capacity-building exercises that would allow local promoters to identify the extent to which a project could be considered a climate adaptation project. However, the approach to climate adaptation is rooted in the understanding that physical climate risk is highly local in nature. As a result, reducing physical climate risk requires a vulnerability assessment at the project level. Identifying adaptation projects is difficult if the promoter lacks the capacity to pinpoint climate risks and to integrate greater resilience into the project’s design. This difficulty is reflected in the relatively low amount of finance dedicated to climate adaptation in the EIB portfolio. A gap exists between the development of national strategies and the translation of those strategies into a pipeline of bankable projects.

Local and regional authorities face many barriers to investments in climate change mitigation, such as a lack of awareness, technical skills and other capabilities and the capacity to identify mitigation investments. Since climate financing classification and reporting requires resources, many (particularly small) authorities facing budget constraints are unable to acquire or build the necessary capacity. A potential solution is aggregating small-scale projects managed by various smaller authorities into a larger portfolio.

Circular economy

The public sector has traditionally been involved in financing waste management infrastructure for residual and separately collected waste. Clearly, in a circular economy, residual waste generation will be minimised and waste management will focus on promoting the higher levels of the waste hierarchy (such as preparation for reuse and recycling). As is often the case, green investments rarely serve a single environmental objective, and circular economy investments are simultaneously low-carbon investments because they aim to reduce the consumption of and the reliance on primary raw materials and to cut the emissions linked to traditional waste management practices.

Projects geared towards expanding waste treatment need to meet the targets set out in the revised [Waste Framework Directive](#), which requires substantial funding. Many public authorities have experimented with public-private partnerships in this sector. However, planning and allocating risks and responsibilities for recycling projects is a very complex task that many municipalities are not equipped to execute. In addition, the financial crisis of 2008 resulted in severe fiscal tightening and budgetary constraints in some EU Member States — and the situation could be further aggravated by the coronavirus pandemic. Public spending by individual countries significantly affects the funding of green projects or those with green aspects, particularly in the water and waste sectors.

Furthermore, the fragmentation of responsibilities for public services and, in some places, the lack of strategic planning and/or an ability to implement projects by some public authorities can result in poor decisions being made with respect to green outcomes, particularly in highly fragmented markets. These factors all inhibit green investments and their performance.

Natural capital

The majority of projects investing in biodiversity and ecosystems underpinning natural capital are financed through public funds and grants. Nevertheless, public funds are becoming increasingly stretched, even for investments with direct social benefits like sanitation and waste management. Therefore, it is clear that public funds are not sufficient to address the existing and future investment needs dictated by ecosystem degradation and biodiversity loss. A growing number of private investors and companies are factoring natural capital considerations into their investment decisions in response to stakeholder pressure, government guidance and regulatory and fiscal developments.

Access to finance

Information gaps, particularly those concerning finance for small businesses, are major barriers to green finance. In general, the smaller the promoter and/or the project — and the more promoters there are — the more difficult it is for a financing institution to obtain the information necessary to classify an investment as green, particularly if that institution is working through intermediaries. The result is that potentially viable green investments are not clearly identified and fail to benefit from tailored funding opportunities.

Climate action

In climate finance, information gaps exist in the internal rates of return for energy efficiency investments. Energy efficiency represents the largest annual investment gap in the European Union, although investment gaps are also present in other sectors. The need to improve the speed of energy efficiency renovations will require better information flows between the client and the financing institution, and the deployment of adequate financial instruments and policies to overcome these financing hurdles.

The EIB's multiple beneficiary intermediated loans (MBILs) illustrate the difficulty of using financial instruments that target small businesses to promote and identify climate action investments. These loans only account for approximately 4% of EIB climate action finance, despite representing almost one-third of total lending. The low share of climate finance in these loans is due to intermediary climate action reporting requirements, promoter capacity and readiness, and the structure of MBILs. Insufficient financial incentives could possibly explain the lack of intermediary capacity and resources to robustly identify green investments. Consequently, only a small number of banks currently have the capacity and a clear strategy in place to make climate action lending a sustainable business activity.

More recently, the EIB has observed a growing interest among its intermediary clients in new sources of climate business, such as innovative climate financing products (energy efficiency upgrades, renewable power generation, green buildings, the circular economy, green transport and climate-smart agriculture, for example). In fact, intermediaries active in the European Union need to make sure they are working to help build low-carbon and resilient economies. Climate risks may have a direct impact on the financial positions of their clients, making this an important element of any credit decision. Financial intermediaries will also need to understand the climate risks associated with their non-climate assets and design measures to mitigate them.

As the impact from — and awareness of — climate change increases, it is important for intermediaries to have a clear strategy for mitigating climate risks and developing climate action portfolios. The road ahead is not straightforward. Despite an increased interest, climate change considerations are far from becoming mainstream business for commercial banks. Developing climate action portfolios requires mechanisms, procedures and tools that can identify, develop and finance eligible projects and report on their benefits as part of standard monitoring activity. Incorporating climate risk considerations into lending decisions requires an understanding of how climate exposure can affect credit risk, and how taking appropriate action could improve the financial intermediary's portfolio.

Despite the substantial needs and unexploited opportunities for climate action investments, many commercial banks still shy away from firm and ambitious climate commitments, arguing that they have limited experience and in-house capacity to deal with the additional administrative burden. Technical assistance and advisory support for banks is crucial to help intermediaries' engage in green lending and to build capacities that enable sustainable lending going forward. The EIB provides such support through the development of advisory and support tools for financial intermediaries and by offering specific advisory packages.

Circular economy

Knowledge and information barriers also seem to affect the financing of circular economy investments. Many circular solutions are innovative by nature and often originate from smaller companies and startups. This poses a problem for the emerging circular models, which have to contend with the challenge of accessing finance, as the financial sector sees circular projects as highly risky and often not bankable.

Financiers often fail to reward circular business models because they do not understand them. It is important to educate financiers and investors so they can correctly value such business models and their longer-term economic potential.

Natural capital

Access to debt and equity finance is very problematic for natural capital investments, which normally involve relatively small, local projects. The promoters tend to be groups (farmers, local communities or conservation groups) that lack sufficient assets to offer as collateral, limiting their access to traditional financing. In addition, the expertise required for successful natural capital investments often exists in silos, with little overlap of knowledge between conservation groups and financiers. Project developers also lack the support they need to structure projects in a way that will attract investment, while most investors lack the competence required to evaluate natural capital investments.

In addition, risk sharing and risk reduction mechanisms in this area are still in their infancy and are not readily available to promoters of natural capital investments, further limiting their access to capital.

Technical assistance is often required to make natural capital projects bankable. Technical assistance can help at all stages of project development and implementation, from upstream studies to hands-on detailed designs and monitoring. While some successful facilities exist to help with technical assistance (such as the Natural Capital Financing Facility), there is not enough support to address the gap between potential project promoters and investors.

Research, development and innovation for the decarbonisation of energy-intensive industries

Energy-intensive industries¹³ are central to Europe's progress and prosperity. As stated in the European Commission publication, *A New Industrial Strategy for Europe*, Europe needs industry to become green and digital while remaining competitive on the global stage. The transition to a more green and digital economy will help transform and grow traditional and new industries, support small businesses and drive EU competitiveness.

Energy-intensive industries provide materials and goods that are crucial for a modern economy, such as chemicals, iron and steel, non-ferrous metals (such as aluminium and copper), pulp and paper, non-metallic minerals (glass, cement, limestone and ceramics) and food products. While energy-intensive industries are crucial suppliers for many sectors, they also emit large quantities of greenhouse gases, and are responsible for around 15% of the European Union's total greenhouse gas emissions (excluding land use, land-use change and forestry). They account for up to 30% of emissions worldwide.

Energy-intensive industries have already played a crucial role in helping the European Union meet its climate ambitions. From 1990 to 2015, energy-intensive industries reduced their greenhouse gas emissions by 36%, and were responsible for 28% of the total emission reductions by the European Union¹⁴. A combination of factors have made these reductions possible, such as improvements in energy efficiency, new green fuels (including increased use of biomass), plant closures and lower production levels or capacity utilisation in some sectors, and a major reduction in non-carbon greenhouse gas emissions in chemical and fertiliser production. Energy-intensive industries have disproportionately reduced emissions in their own sectors, but they have also contributed to emissions reductions in other sectors, including transport, buildings, waste and power generation. Energy-intensive industries are at the forefront of low-carbon solutions; looking ahead, these industries will be vital to ensuring a carbon-neutral Europe. Some of the most iconic examples of low-carbon solutions include electric vehicles, wind turbines, solar photovoltaic panels and battery storage, which all depend on energy-intensive industries.

Technological solutions for deep decarbonisation do exist¹⁵, and research shows that achieving net-zero or close to net-zero emissions from energy-intensive industries in the European Union by 2050 is becoming possible. The decarbonisation of industry is technically possible through a combination of solutions that rely on the use of biomass and green hydrogen as fuel, the "electrification of heat" by using low-carbon electricity to heat buildings, carbon capture solutions, the availability of carbon storage solutions and other innovations. However, the majority of these transformational technologies are not yet commercially viable.

13 In line with the study by the Institute for European Studies (IES) at the Vrije Universiteit Brussel (VUB) on decarbonisation of industry, European energy-intensive industries include the following industries: iron and steel, cement, chemicals and fertilisers, refineries, non-ferrous metals, ferro-alloys and silicon, pulp and paper, ceramics, limestone and glass.

14 VUB-IES (2018). "Industrial Value Chain. A bridge towards a carbon neutral Europe. Europe's Energy Intensive Industries contribution to the EU Strategy for long-term EU greenhouse gas emissions reductions." https://www.ies.be/files/Industrial_Value_Chain_25sept_0.pdf

15 See for example: VUB-IES (2018). "Industrial Value Chain. A bridge towards a carbon neutral Europe. Europe's Energy Intensive Industries contribution to the EU Strategy for long-term EU greenhouse gas emissions reductions." https://www.ies.be/files/Industrial_Value_Chain_25sept_0.pdf

ICF/Fraunhofer (2018). "Industrial Innovation: Pathways to deep decarbonisation of Industry." https://ec.europa.eu/clima/sites/clima/files/strategies/2050/docs/industrial_innovation_part_1_en.pdf

European Commission (2018). "Final Report of the High-Level Panel of the European Decarbonisation Pathways Initiative."

European Commission (2019). "Long-term strategy and Masterplan for EII."

Even in cases where solutions are technically viable, the economic challenges are daunting. Low-carbon alternatives remain more expensive than conventional processes relying on fossil fuels, and they are highly risky. Some of the other barriers to low-carbon financing are high capital costs, lack of incentives or revenue models recognising the real value of green products, regulatory uncertainties and long payback times. Investment in low-carbon solutions is also challenged by pressure from global competition, often from regions with lower environmental and social standards. The European Commission's proposed carbon border adjustment may help to address this issue.

Industry decarbonisation will require substantial efforts in research, development and innovation as well as the establishment of innovative markets or business models for low-carbon products. It will require new innovative low-carbon production processes, significant investment in industrial equipment and changes in energy systems. In addition, a vast amount of renewable electricity at competitive prices will be required. In short, decarbonisation will require a completely new, greener industrial and energy ecosystem. The global emission equation is not an easy one to solve. Cutting emissions is associated with an expensive and typically inconvenient burden that will mostly help people living elsewhere — or future generations. Whereas the benefits accrue over decades and centuries, the costs must be paid up front. This long-term horizon poses financial challenges and calls for long-term investors.

Experimentation is needed to determine which low-carbon industrial research, development and innovation holds promise. To avoid locking in technologies with predetermined solutions (“putting all the eggs in one basket”), investment must be spread across a plethora of solutions and technologies, similar to an investment portfolio.

The [European Green Deal](#)¹⁶ sets the objective of creating new markets for climate-neutral and circular products, such as steel, cement and basic chemicals. To implement and lead this change, Europe needs improved customer awareness and the ability to control or audit supply chains and their respective greenhouse gas emissions. New industrial processes and more clean technologies should help reduce costs and create decarbonised and modernised energy-intensive industries. The European Commission's [High Level Group on Energy-Intensive Industries](#) has published recommendations¹⁷.

Europe also needs to significantly increase the large-scale deployment and demonstration of new technologies. This is a challenge beyond the means of any individual EU member. Research efforts need to be mobilised, stakeholders need to come together and collaborate with industry and Member States to support research, development and innovation and demonstration projects, and cooperation needs to be fostered among higher education institutions, research organisations and companies. Experimentation and cross-sectoral and cross-disciplinary efforts are all crucial. **The breadth and depth, scale and speed, and nature and necessity of the twin transition — the green and digital transformation — are unprecedented**¹⁸.

¹⁶ The European Green Deal (COM(2019) 640 final).

¹⁷ https://ec.europa.eu/commission/presscorner/detail/en/IP_19_6353

¹⁸ This is reflected in European Commission President Ursula von der Leyen's Political Guidelines, the priorities set out by the European Parliament and the European Council's Strategic Agenda 2019-2024. The European Green Deal and the Commission's recent *Strategy on Shaping Europe's Digital Future* set the ambition, speed and direction of travel for the years to come.

While an extensive list of decarbonisation solutions for energy-intensive industries has been identified¹⁹ — with vast potential to reduce energy, costs and emissions — many of the available technologies have not yet reached significant levels of market penetration due to a number of market and non-market barriers. These include access to finance, regulatory policy frameworks and volatile energy prices. Key investment barriers and framework constraints include:

- **The need to scale up breakthrough technologies to the point of demonstration and commercialisation.** Most of the potential decarbonisation industrial technologies still need to be tested²⁰. Designing and building a pilot or demonstration plant at scale constitutes one of the biggest challenges facing most of the viable low-carbon technologies. Large capital requirements and the high technology risks related to this part of the research, development and innovation phase make it highly unlikely that the private sector will engage on its own. Bridging this “valley of death,” as it is known, will require significant financing support, including the willingness of the public sector to take on a share of the risk.
- **The need to determine the optimal combination and integration of technologies, including breakthrough technologies.** While some supporting technologies are advancing well on their own, the integration of these different technologies into fully fledged energy production systems remains a challenge. Some examples include hydrogen production, the transformation of biomass into fuels and carbon capture technologies that will need to be integrated into different sectors, such as ammonia and steel production, high value added chemicals and complete systems for carbon capture and utilisation and carbon storage.

Other key barriers include securing adequate and competitively priced low-carbon electricity supply, infrastructure needs, financing challenges, conditions for enhancing circularity and materials efficiency, and regulatory challenges. Adding to these constraints is:

- A highly **competitive and dynamic international environment**. A healthy industrial base in Europe is essential for the development and deployment of low-carbon technologies in the European Union.
- **Time (and timing)**. For most companies in energy-intensive industries, 2050 is just one or two investment cycles away. The barriers listed above will have to be addressed continuously and progressively in the next 12 to 15 years to enable low-carbon technology investments to really make a difference.

19 VUB-IES (2018). “Industrial Value Chain. A bridge towards a carbon neutral Europe. Europe’s Energy Intensive Industries contribution to the EU Strategy for long-term EU greenhouse gas emissions reductions.” https://www.ies.be/files/Industrial_Value_Chain_25sept_0.pdf

20 The majority of them are at technology readiness levels between 5 and 7, although many have yet to reach level 5.

Regulation

Regulatory uncertainty

Decarbonisation roadmaps are being created for certain industries, but regulatory uncertainty remains high. A great degree of uncertainty exists about how regulation could affect the switch from fossil-fuel based production to low-carbon technologies. These uncertainties are creating barriers to the adoption of new technologies as well as to further investments in industrial decarbonisation.

Firms and investors are having difficulty predicting how decarbonisation will play out. For example, new rules from 2021 for the European Union's carbon market, the Emissions Trading System (ETS), were still being discussed throughout 2019, and have only recently been set for industries that have investment cycles of 20 years or even longer. Firms and investors also lack certainty about different policy initiatives — incentives, disincentives and mandated targets — and clarity about those policies' scope and when they will come into force. These barriers are cited consistently across all EU Member States. A lack of regulatory coherence is also a problem as firms navigate a host of agreements and initiatives, such as the Paris Agreement, the European Green Deal, [the Industrial Emissions Directive](#), the circular economy and the carbon trading system.

Most industrial processes still rely on fossil fuels and feedstock. Given the need to decarbonise in a relatively short time, there is a risk that investments will not be aligned correctly. As the regulatory environment tightens over time, increasing the cost of carbon emissions, there is a real risk that assets could become stranded. For example, a coal power plant could become a stranded asset if its emissions are deemed too high for it to continue operating or if carbon taxes make the business unviable. Such a plant could, however, be replaced by a more polluting asset outside the European Union (resulting in "carbon leaking" into the European Union from other countries). This risk of stranded assets could be avoided by focusing on transformational decarbonisation technologies. However, most of these technologies are not yet ready for full-scale commercial deployment, and their commercial viability in markets exposed to global competition is not clear. The ramping up of these new technologies will likely coexist, at least initially, with conventional solutions that need to be integrated with transitional technologies that already substantially reduce greenhouse gas emissions, for example by improving energy efficiency or by shifting at least in part to low-carbon resources.

Regulatory fragmentation

For regulatory concerns, the key barrier is not at the level of EU members, but rather at the global level — EU players vs. non-EU players. The Industrial Emissions Directive is the main EU instrument regulating pollutant emissions from industrial installations. It does not cover carbon emissions, but it does cover other greenhouse gas emissions. The directive provides a high level of emission requirements at the EU level, although EU members may decide to apply stricter rules on their own. Any regulatory uncertainty can block investment, particularly for a project whose economic viability is being tested. Therefore, regulation must be coherent and consistent.

The highly competitive and dynamic international environment — often involving industrial players outside the European Union that originate from countries with lower environmental and social standards — makes investments in low-carbon solutions even harder in EU energy-intensive industries. A key concern for European industry is that unequivocal EU decarbonisation would undermine competitiveness in energy-intensive industries that are highly exposed to global trade²¹. Decarbonisation involves high-risk operations, which may increase EU companies' exposure to international competition that does not have to adhere to the same standards. There is little point in shifting to low-carbon technologies if the costs of the transition result in more imports of materials from less green sources.

It is therefore essential to overcome major barriers and to combine business leadership with ambitious public policies to protect EU industry against unfair trade practices and ensure a level playing field. It is also essential to avoid carbon “leaking” back into the EU economy through imported materials, which could happen if production is moved offshore to avoid costs incurred from the EU carbon trading system. By providing a strong framework, governments provide businesses with the confidence they need to invest decisively in the carbon-neutral economies of the future. Without a healthy industrial base, however, Europe will not be able to develop and deploy low-carbon technologies. Again, the European Commission's proposed carbon border adjustment may help to address this issue. The aim must be to strike a balance between environmental sustainability and international competitiveness.

While there is potential to make energy-intensive industries more circular, major regulatory barriers hamper increased circularity and the more efficient use of materials. In other words, to establish the supportive and stable regulatory framework needed to ensure that energy-intensive industries transition successfully to low-carbon solutions, Europe needs to promote a more circular economy by effectively combining energy recovery and recycling.

Market size and structure

Fragmented market structure

For private sector investments to be profitable they need to reach across the entire EU market — and demand for low-carbon technologies within energy-intensive industries needs to be higher. In some energy-intensive industries, however, a few giants dominate the market and have important roles to play in driving research, development and innovation for decarbonisation. Economies of scale will benefit from more market integration and less fragmentation, helping firms and investors to pool resources. Whereas large projects may have positive economic returns, individual investments can have lower returns or even lose money.

²¹ There are, however, energy-intensive industries in which international competition is less of an issue. In the cement industry, for example, transport costs make it almost impossible to operate across the world and stay competitive. In such sectors, it is important to create markets for green products/materials and to increase acceptance of a price increase for a period of time.

Many low-carbon technologies in energy-intensive industries are still in their pilot phase, with very few having been deployed. Those deployments need to be scaled up — and sped up. The maturity of certain technologies is a barrier that can be overcome by providing funding for demonstration projects and by reducing risk. Nevertheless, experimentation is important. To avoid locking in less-than-ideal solutions, investment must be spread across a plethora of solutions and technologies, taking a portfolio approach.

Public sector promoter constraints

Difficulties in coordinating among funding resources

While a lot can be done at the European level to reassure investors and firms, many of the other elements of carbonisation are outside policymakers' direct control, such as the ability to provide large amounts of low or carbon-free electricity at competitive costs — which is crucial to the energy transition. More consistency within the energy and climate policy framework is needed to ensure that energy consumption and low-carbon policies are compatible.

Fragmented administration also leads to inefficiencies and suboptimal investment. More coordination is needed among industry's research and development efforts for low-carbon technologies and emissions reduction. In particular, companies need to be able to pool smaller projects and better-structured investment programmes.

For example, for carbon capture and bio-based products, new large-scale projects are needed to help bring carbon capture and storage and bioproducts to market. Companies need to be able to share risk at the demonstration phase to enable them to test new technologies. Companies down the value chain should be encouraged to test carbon-based and bio-based products. To do that, they need financial support for their operational and capital expenditures until they begin producing new products.

Access to finance

Large firms, small and medium-sized businesses and higher-risk projects

The main investment barrier for decarbonisation research, development and innovation activities is high market and technological risk combined with high upfront costs and benefits that only accrue slowly over time. For large demonstration pilot plants, the market and technological risk is particularly high.

The long investment horizon (long asset life) of many energy-intensive industries, strong economies of scale and high capital intensity also complicate investment. Improving financing for companies involved in the development and deployment of innovative technologies and in higher-risk projects (resulting from uncertainties about technologies, implementation, market acceptance and development) would help reduce the barriers to decarbonisation research, development and innovation investments. Finding financial structures and instruments that help mitigate the risks inherent in low-carbon technologies would go a long way in helping the development and deployment of new technologies, particularly in the early stage.

Private sector investments in research, development and innovation require a long-term commitment. Outcomes are highly uncertain, and some projects may not even reach commercialisation, which lowers commercial lenders' appetite to finance such investments. Limited access to long-term capital prevents the optimal levels of investment from being met. While these kinds of impediments exist for any company regardless of size, large firms may have well-established contacts and relationships with their commercial lenders. However, small and medium-sized firms and younger companies tend to face additional financial constraints, typically due to a lack of collateral and/or a business track record.

Firms face greater difficulties in financing large low-carbon process investments if the necessary conditions are not in place. Some of those conditions are complementary, such as the construction of demonstration plants, technology and energy costs, energy, existing infrastructure and financing. It is important to point out that low-carbon processes often require more energy than processes based on fossil fuels, so the availability of green electricity at competitive prices is key. These critical conditions will have to be continuously addressed alongside investment in the necessary infrastructure.



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