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Financing solutions to foster industrial decarbonisation in emerging and developing economies

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Financing solutions to foster industry decarbonisation in emerging and developing economies

By Joseph Cordonnier and Deger Saygin (1)

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Abstract

Industry decarbonisation is a cornerstone to reach net-zero emissions by this mid-century. The diversity of industrial activities, processes and products, the complexity of global industrial value chains, and the international competition make industry decarbonisation a challenging objective. Annual investments in low-carbon technologies for industry decarbonisation need to increase by a factor of three to five by 2030 compared to current levels to align industrial emissions with net-zero pathways. This Working Paper analyses available financing solutions to scale up investments at pace, especially in emerging and developing economies where industrial production is growing rapidly whilst available finance is limited. It highlights de-risking and financial instruments and models that can help accelerate investments and draws lessons from 12 financing industry decarbonisation case studies which demonstrate how private capital can be mobilised.

Keywords: climate change, climate mitigation, de-risking instruments, economic instruments, financial instruments, greenhouse gas emissions, industry decarbonisation, industry value chains, low-carbon technologies.

JEL Classification: G23, L60, O14, Q54, Q56, Q58

Résumé

La décarbonation de l'industrie est une pierre angulaire pour atteindre zéro émission nette d'ici le milieu du siècle. La diversité des activités, processus et produits industriels, la complexité des chaînes de valeur industrielles à l'échelle mondiale et la concurrence internationale font de la décarbonation de l'industrie un objectif de taille. Les investissements annuels dans les technologies bas-carbone pour la décarbonation de l'industrie doivent être multipliés par un facteur trois à cinq d'ici à 2030, sur la base des niveaux actuels, pour aligner la courbe des émissions industrielles avec les trajectoires vers zéro émission nette. Ce rapport analyse les solutions de financement disponibles pour accroître les investissements au rythme nécessaire, particulièrement au sein des économies émergentes et des pays en développement, où la production industrielle augmente rapidement, mais où les ressources financières utilisables sont limitées. Il met en évidence les instruments de réduction des risques, instruments financiers et modèles de financement qui peuvent contribuer à l'accélération des investissements, et tire des enseignements à partir de 12 études de cas illustrant comment les capitaux privés peuvent être mobilisés.

Mots-clés: changement climatique, atténuation du changement climatique, instruments pour la réduction des risques, instruments économiques, instruments financiers, émissions de gaz à effet de serre, décarbonation de l'industrie, chaînes de valeurs industrielles, technologies bas-carbone.

Classification JEL: G23, L60, O14, Q54, Q56, Q58

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Abbreviations and acronyms

ASEAN	Association of Southeast Asian Nations
BAT	Best Available Techniques
CAPEX	Capital Expenditures
CCUS	Carbon Capture, Use and Storage
CEFIM	Clean Energy Finance and Investment Mobilisation
(C)CfD	(carbon) contract for difference
CO_2	carbon dioxide
CO_2-eq	carbon dioxide equivalent
DRI	Direct Reduced Iron
EBITDA	Earnings before interest, taxes, depreciation and amortisation
ESG	Environment, Social and Governance
FID	Final Investment Decision
GDP	Gross Domestic Product
GHG	greenhouse gas
Gt	gigatonne
GW	gigawatt
H_2	hydrogen
IEA	International Energy Agency
IRR	Internal rate of return
IPCC	Intergovernmental Panel on Climate Change

IPPU	Industrial Processes and Product Use
IRENA	International Renewable Energy Agency
IRR	Internal rate of return
ISIC	International Standard Industrial Classification of All Economic Activities
KPI	Key Performance Indicator
kt	kilotonne
LeadIT	Leadership Group for Industry Transition
MSME	micro, small and medium enterprise
Mt	megatonne
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
OPEX	Operating Expense
NPV	Net present value
PtX	Power-to-X
R&D	research and development
ROCE	Return on Capital Employed
SBTi	Science-based Targets initiative
SLB	Sustainability-Linked Bonds
SLL	Sustainability-Linked Loans
TRL	Technology Readiness Level
USD	United States dollar
WACC	Weighted average cost of capital

Executive Summary

The industry sector is a major source of greenhouse gas (GHG) emissions, accounting for more than a third of the total worldwide. Industry's net-zero transition with low-carbon technologies is necessary to put the sector's emissions on a path consistent with the Paris Agreement. Yet, progress is too slow to meet these objectives, and annual investments for industry decarbonisation need to increase by a factor of three to five by the end of the decade compared with current levels. This is critical for emerging and developing economies, where industrial output is rapidly growing, and where industrial processes could have higher GHG emissions per unit of output compared to advanced economies.

This working paper analyses the main financial challenges to scale up investments for industry decarbonisation at a pace consistent with net-zero pathways, especially in emerging and developing economies. It highlights the complexity of decarbonising the industry sector, which covers a wide number of activities and products across complex value chains. In particular, it emphasises the need to use a holistic approach considering value chains to measure and understand the emission trends of the industry sector, and how decarbonisation technologies can be implemented. It also shows that the investment gap remains significant, despite the increasing availability of public finance and technical assistance from the financing community and development organisations, and the emergence of innovative financing instruments such as blended finance, which are both critical to mobilise private capital at sufficient scale and pace.

Investment decisions in decarbonisation projects are impacted by several factors such as high upfront costs, access to financing, or revenue uncertainties. This working paper acknowledges that other challenges, such as technology risks, lack of infrastructures or policy uncertainties, can deter investment decisions and should be addressed prior to developing specific financing instruments. Yet, even when an enabling environment for investment is established, this paper points out that new financing instruments and models can still be needed, notably to mobilise private capital for industry decarbonisation, as illustrated in the case studies prepared with financial institutions and industry actors.

Further, the paper highlights a range of available de-risking and financial instruments that can help overcome these hurdles, drawing on lessons from the 12 case studies that support the deployment of decarbonisation projects in the industry sector. While findings of this working paper are relevant for both advanced economies, and emerging and developing economies, challenges to industry decarbonisation across the industrial value chain of emerging and developing economies are specific and, thus, require dedicated solutions. According to the learnings from the case studies, solutions include technical assistance to establish robust pipelines of projects, increasing the replicability potential of de-risking tools, and developing carbon pricing mechanisms.

This paper complements the Framework for industry's net-zero transition (Framework), a step-by-step approach through which the OECD and emerging and developing economies, including Egypt, Indonesia, South Africa and Thailand, collaborate to improve enabling conditions and design financing solutions that can accelerate industry's transition, as part of the OECD Clean Energy Finance and Investment Mobilisation (CEFIM) programme. Outcomes contribute to a better understanding of successful financing instruments and models and provide inputs to the OECD's collaboration with emerging and developing economies for the exchange good and best practices with countries, industry sub-sectors, and low-carbon technologies, including about how private capital can be mobilised and investments can be de-risked.

1 Introduction

The manufacturing industry is responsible for more than a third of the global carbon dioxide (CO_2) emissions (IEA, 2023[1]). Achieving complete industry decarbonisation has only become central to many countries' strategies to reduce greenhouse gas (GHG) emissions in recent years. Moreover, the use of financing instruments to align the industry sector with net-zero transition pathways is still a nascent area, both for financial institutions and industry actors. To date, the main focus has been on regulatory support, improvement of energy efficiency, and development of renewable power. New investments in emission-intensive technologies could prevent the achievement of the climate goals set out in the Paris Agreement. Despite the technological and industrial development and efforts to increase the commercial readiness of less mature low-carbon technologies, many decarbonisation technologies remain costlier than conventional ones. Therefore, their market uptake remains limited. For instance, while a total annual low-emission hydrogen production of 300 million tonnes (Mt) could be needed by 2050 for industry decarbonisation, less than 1 Mt has been produced in 2022.

Besides the urgent need to establish a level-playing field and a conducive enabling environment for industry players to invest in clean technologies, it is key to understanding how these technologies and projects can be financed. Two major challenges need to be overcome to unlock and mobilise private capital: first, there is only a limited supply of public finance for industry decarbonisation; and second, there is a lack of tailored financing instruments to de-risk and improve the economic viability of projects. These instruments need to be tailored to the characteristics of the manufacturing industry sub-sectors, to the development stage of the technologies, and to the needs of industry actors, from multinational corporations to small and medium-sized enterprises. Yet, there is a lack of information on the available financing instruments and structures for industry decarbonisation.

This working paper analyses key challenges, risks, and issues concerning the development of viable business models and financing mechanisms to enable investments in low-carbon projects. It aims to provide insights and showcase various financing instruments that can support the manufacturing industry's transition towards net-zero emissions, supported by case studies. The paper acknowledges the diversity of low-carbon technologies and projects that contribute to industry decarbonisation. Thus, it includes examples and considerations for a wide array of industry activities, including but not limited to hard-to-abate sectors.

This working paper is meant to provide evidence on instruments and financing structures available to finance industry decarbonisation. It can be instrumental for governments willing to operationalise their decarbonisation strategies, in particular in emerging and developing economies. Further, it can increase awareness of financial institutions intending to increase the share of their portfolio in alignment with the Paris Agreement, and of industry actors investigating financing options.

With this backdrop, the paper is structured as follows. Chapter 2 provides the context of industry decarbonisation financing, drawing upon a large body of literature. Chapter 3 presents insights on mechanisms guiding investment decisions, providing an analytical approach to identify where economic and financing instruments are being applied in the industry decarbonisation landscape. Chapter 4 presents 12 case studies developed through a combination of desk research and interviews with financial institutions. The case studies demonstrate how financing instruments for industry's net-zero transition are being implemented, their impact on improving the business case of low-carbon projects, as well as their

potential for mobilising private capital. This chapter also analyses and creates linkages between the lessons learnt from the case studies and the challenges and solutions described in the previous chapters.

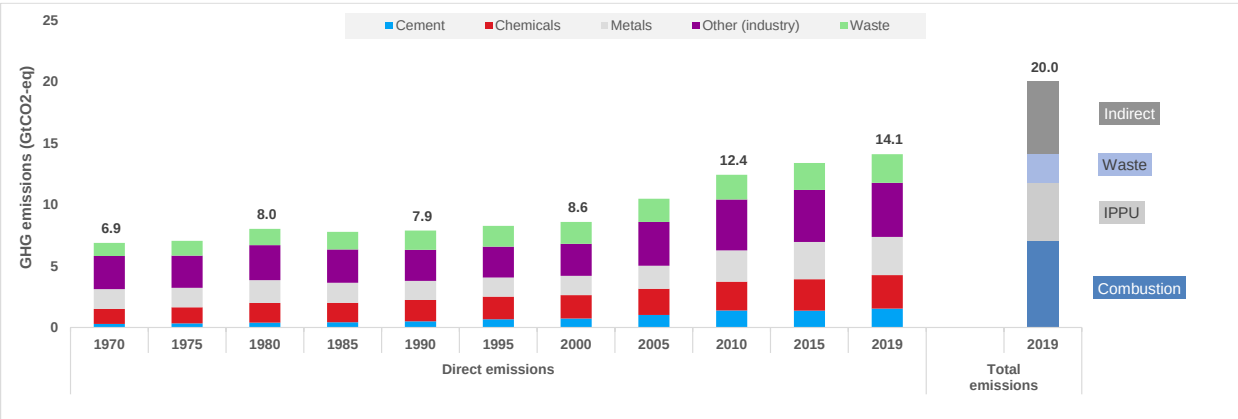
While the backdrop and most of the challenges, technologies and financial instruments for industry decarbonisation described in this paper are relevant for most countries, this paper highlights specific challenges faced by emerging and developing economies to identify how to effectively deploy these solutions. Indeed, the projected growth of industrial activities until 2050 is located primarily in those regions and their industrial production often has a higher carbon intensity than in advanced economies. Wherever possible, the case studies draw lessons from the implementation of a given financing instrument to propose a regional or country-specific answer. By doing so, it intends to facilitate the OECD's collaboration with emerging and developing economies by providing insights into the landscape of financing industry decarbonisation and complements the OECD Framework for industry's net-zero transition, as part of the OECD Clean Energy Finance and Investment Mobilisation (CEFIM) programme.

2 Understanding the challenges to decarbonise the industry sector

Manufacturing industry value chain and emissions trends

The industry sector is a major source of carbon dioxide (CO_2) emissions globally. The Intergovernmental Panel on Climate Change (IPCC) estimates that, globally, industrial direct GHG emissions amount to 14.1 gigatonnes (Gt) CO_2 equivalent (CO_2-eq). When adding 5.9 Gt CO_2-eq of indirect emissions, GHG emissions worldwide attributed to the industry sector for 2019 reached 20 Gt CO_2-eq, i.e. 34% of all GHG emissions (see Figure 2.1). In 2019, around three quarters of the climate impact of GHGs emitted by the industry sector was due CO_2 emissions, while methane emissions (CH_4) contributed to slightly less than a fifth, and emissions of all other GHGs combined to less than 10%. The combustion of fossil fuels to generate process heat is the major source of direct CO_2 emissions, followed by industrial processes and product use (IPPU), and waste (Bashmakov et al., 2022[2]).

Figure 2.1. GHG emissions in the industry sector



Note: IPPU: Industrial Processes and Product Use (IPPU); total GHG emissions are split as follows for the year 2019: fossil fuel combustion: 7.1 Gt CO_2-eq; electricity and district heat: 5.9 Gt CO_2-eq; industrial processes: 3.1 Gt CO_2-eq; products use: 0.2 Gt CO_2-eq; other non-CO_2: 1.5 Gt CO_2-eq; waste: 2.3 Gt CO_2-eq.
Source: (Bashmakov et al., 2022[2])

The manufacturing industry covers a range of activities and subsectors, as described in the categorisation of manufacturing activities under Section C of the International Standard Industrial Classification of All Economic Activities (ISIC) (United Nations, 2008[3]) (see Table 2.1). The industry structure differs with respect to plant size and consumption, as each of these categories covers a wide array of actors and processes. For instance, energy-intensive and high-emitting activities are represented by a few thousand

plants, while some other subsectors are dominated by micro, small, and medium enterprises (MSMEs) and low-emission intensity.

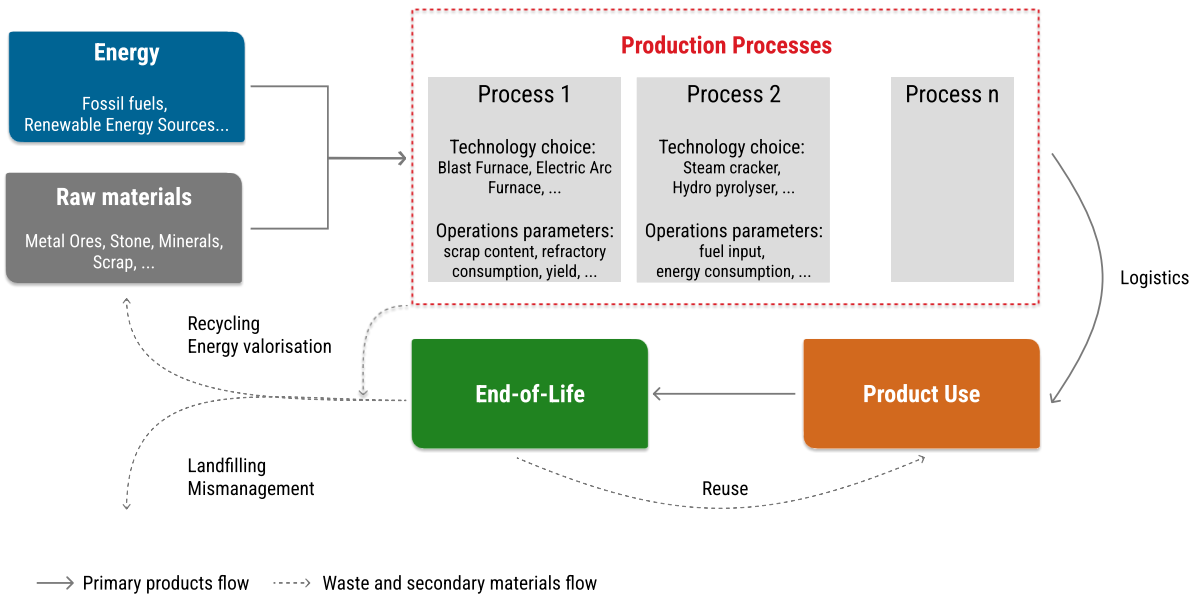
Table 2.1. Classification of manufacturing activities

ISIC Rev. 4 label	Code
Manufacture of food products	10
Manufacture of beverages	11
Manufacture of tobacco products	12
Manufacture of textiles	13
Manufacture of wearing apparel	14
Manufacture of leather and related products	15
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16
Manufacture of paper and paper products	17
Printing and reproduction of recorded media	18
Manufacture of coke and refined petroleum products	19
Manufacture of chemicals and chemical products	20
Manufacture of basic pharmaceutical products and pharmaceutical preparations	21
Manufacture of rubber and plastics products	22
Manufacture of other non-metallic mineral products	23
Manufacture of basic metals	24
Manufacture of fabricated metal products, except machinery and equipment	25
Manufacture of computer, electronic and optical products	26
Manufacture of electrical equipment	27
Manufacture of machinery and equipment not elsewhere classified.	28
Manufacture of motor vehicles, trailers and semi-trailers	29
Manufacture of other transport equipment	30
Manufacture of furniture	31
Other manufacturing	32
Repair and installation of machinery and equipment	33

Source: (United Nations, 2008[3]).

Industry's net-zero transition requires a comprehensive approach that considers the entire value chain, from raw materials and energy sourcing to the products' use and end-of-life management. This approach helps to identify and structure the challenges, opportunities, and solutions to reduce carbon emissions towards developing bankable project pipelines. Figure 2.2 depicts this approach in detail with a focus on material flows within the manufacturing industry and parameters that affect the carbon footprint of the sector. This is particularly important as services, raw materials, parts and components are often traded internationally, and industrial goods are distributed to end-consumers around the globe. About 70% of international trade today involves global value chains (OECD, 2020[4]). For example, a smartphone assembled in China might include critical materials from Latin America, silicone chips from Singapore, and be sold to a European customer who will eventually dispose of the phone. This is different from the power sector, where much of clean technology investments are taking place. Indeed, the power sector's value chain can be abridged as a single-step conversion of primary energy to electricity which is subsequently transmitted and distributed to end users, mostly in national or regional markets.

Figure 2.2. Simplified industry value chain



Note: Secondary materials are any materials that are not the primary products from manufacturing and other industrial sectors. These materials can include residuals from production processes, products that have been recovered at the end of their useful life.

The complexity of the industry value chain also echoes the diversity of actors involved in industry decarbonisation and their interactions. For instance, implementing a decarbonisation technology can require the involvement of a university or a technology company to lead the research and development (R&D) efforts, an engineering company to design the asset, a construction company to implement it and a manufacturing company to integrate it in its processes. Furthermore, developing the market for low-carbon solutions requires multiple collaboration models between industrial customers and suppliers, for instance to boost demand for low-carbon products, or to increase the circularity of the supply chain (World Economic Forum, 2022[5]). Cross-sector collaboration can also be instrumental for decarbonisation, for instance to develop common infrastructures for carbon capture use and storage (CCUS), renewable power and renewable hydrogen in industry hubs.

Beyond industry actors, the governance of the industry sector requires collaboration between many actors. Indeed, there is no single policymaker governing industry decarbonisation, as typically industry is not regulated by any single government authority, but its activities are covered by several government entities. Furthermore, as most industrial goods are traded globally, there is a need to rely on international institutions, while streamlining their roles and functions (Otto and Oberthür, 2022[6]).

Box 2.1. Challenges related to the industry sector's emissions across the value chain

The industry sector's CO_2 emissions are generally regarded in the context of direct emissions that derive from industrial processes[1] and from the combustion of fossil fuels to generate process heat. However, this only covers a share of the total industrial emissions which include indirect emissions from the generation and supply of power, non-energy use emissions, emissions during product use (e.g. emissions released from solvent use) and waste management (e.g. incineration of plastic waste).

The industry value chain begins with the sourcing of raw materials and energy. Low-cost and continuous supply are both critical for ensuring industry's competitiveness. For many years, their availability has shaped industry's location choices besides other production factors such as low-cost labour. The raw materials may be extracted from non-renewable natural resources, such as mined ores and minerals. Substituting those with biomass products from sustainably managed areas or sourcing secondary raw materials from waste and industrial by-products can reduce the environmental and carbon footprint. However, it is not always possible to supply sufficient volumes of these materials with a similar quality as the mined materials. The industry sector consumes heat and electricity, and large plants operating continuously require stable flows of cheap energy to run smoothly and remain competitive. While renewable energy sources, such as hydropower, biomass, solar and wind, have the potential to meet the global energy demand, their conversion to heat, fuels and electricity can prove complex and costly, compared to fossil fuels.

Production processes encompass a series of operations to transform raw materials into finished products. These processes may involve several stages, such as treating the raw materials, manufacturing base products, giving them a suitable shape, assembling, and packaging them. For a given process, specific actions can lead to limiting the CO_2 emissions. First, the choice of technologies and assets can be pivotal, as they could require different raw materials and energy inputs to produce the same output. Then, once a technology has been selected, its operations parameters can be optimised, for instance through digitalisation to optimise the production process, or by improving the energy efficiency of the process. In addition, the design of an industrial product can be optimised to minimise its needs in basic materials, without impacting the services it provides.

The product use stage involves the consumption of the finished product by end-users, including individuals or other businesses. This can lead to further energy and resource consumption. For instance, a car's total lifetime emissions include not only those generated during its manufacture, but also the fuel-combustion emissions as the consumer uses the vehicle. Behavioural changes can affect the emissions of this step of the value chain: sharing goods (e.g. car-sharing) and increasing the lifetime of products reduce demand for industrial goods, thus limiting the overall emissions. Another action is to incentivise the consumption of sustainably produced goods, even though there are many barriers to overcome to achieve these changes. For instance, many industrial goods do not currently provide any indication of their carbon footprint. In addition, green goods are often sold at a premium, which can prevent their access for less well-off consumers. Yet, it is worth noting that a significant cost increase in the intermediate could result in a minor cost change on the final product. This is the case when ethylene cost increases by 50% but only results in a less than 1% price increase for a bottle of water (Energy Transitions Commission, 2018[7]).

The final stage of the industry value chain involves the disposal or recycling of the product at the end of its useful life. This stage includes the management of waste, including the disposal, as well as the recycling and repurposing of materials for future use. The end-of-life stage can have significant

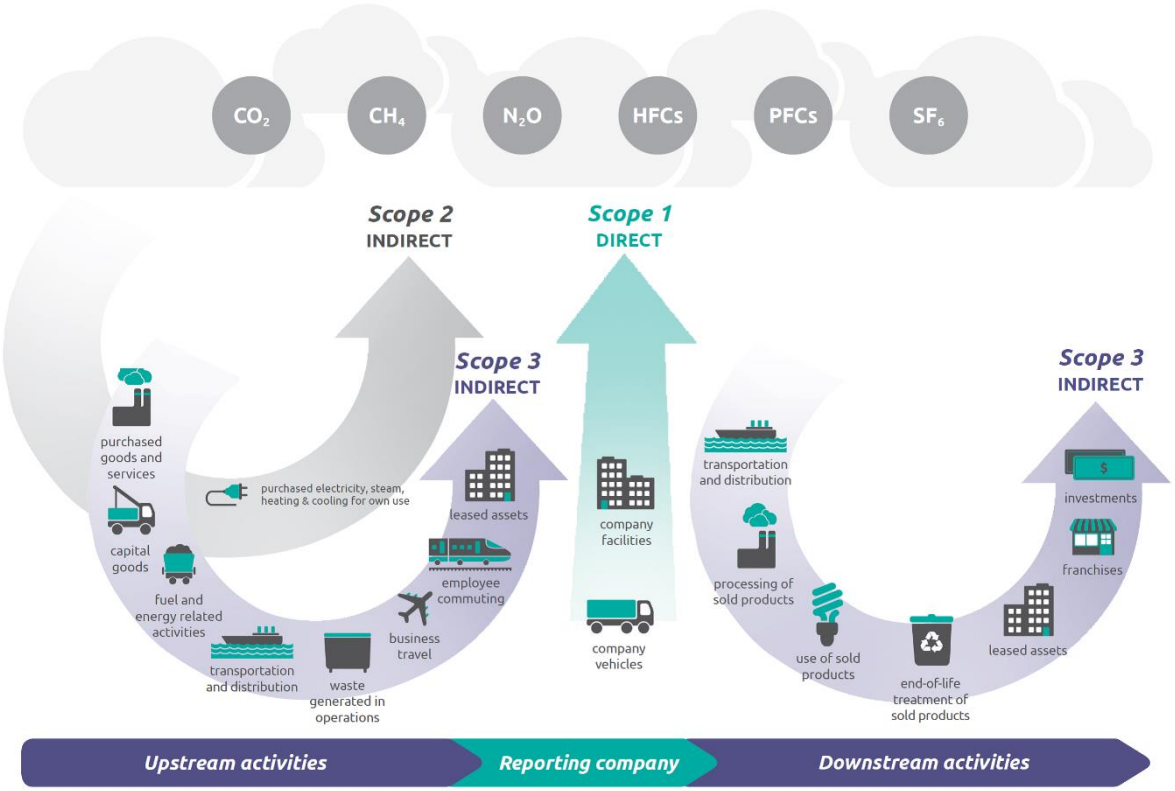
[1] These CO_2 emissions are the result of production processes that chemically or physically convert raw materials to chemicals, minerals or metal products.

environmental and social impacts, and many industries are working to develop more sustainable and circular end-of-life solutions, for instance through eco-design. One challenge to overcome is the sorting, collection and logistics of waste flows. In addition, there can be a technological challenge to recycling and upcycling, for instance only a few types of plastics can be chemically recycled at competitive prices, which leads to the current practices of incineration, landfilling and waste mismanagement.

Attributing GHG emissions to specific subsectors of the manufacturing industry can be challenging, notably because manufacturing has significant impacts on other activities.[2] In order to encompass this complexity, this paper uses a value chain approach to elaborate on the linkages between other activities beyond the manufacturing sector, when relevant. Furthermore, other sources of emissions across the industry value chain labelled as indirect emissions stem from the generation of purchased electricity and heat, but as well on the upstream and downstream parts of the value chain (see Figure 2.3). However, several subsectors such as the manufacture of chemicals and chemical products (e.g. fertilisers), the manufacture of non-metallic mineral products (e.g. cement, lime, glass), the manufacture of basic metals (e.g. steel, aluminium), or the manufacture of paper and paper products, are particularly scrutinised in decarbonisation pathways, as they are energy-intensive, require high-temperature processes often requiring fossil fuels, and require breakthrough technologies to achieve net zero emissions.

[2] For instance, refineries, cement factories or steel plants require significant extraction of raw materials and production of energy. Similarly, manufacturing food products, textile and wood products has a direct impact on agriculture, forestry and fishing. Industry is also closely related to transportation and construction sectors, as it supplies the materials and products for these sectors, and conversely requires buildings and transportation systems to operate. Therefore, implementing new industrial technologies can have knock-on effects across the value chain. For instance, the switch of steel production processes from blast furnaces to direct reduction of iron requires different energy sources, new grades of raw materials and generates different by-products. In turn, the industry sectors that were using these by-products will also need to adjust their processes or raw material sources. That may lead to a redesign of the industry value chain, including relocation of some activities, and diversification of supply chains.

Figure 2.3. Overview of GHG Protocol scopes and emissions across the value chain



Note: CO_2: Carbon dioxide; CH_4: methane; N_2O: nitrous oxide; HFCs: hydrofluorocarbons; PFCs: perfluorocarbons; SF6: sulphur hexafluoride. The definition of scope 1, 2 and 3 enable to classify direct and indirect emissions that occur in the value chain of an entity reporting its GHG emissions.
Source: (GHG Protocol, 2011[8])

In addition, there is no consensus on the definitions of environmental sustainability of different types of investments and economic activities, although sustainable finance taxonomies prepared by the financial regulators and released at national and regional levels aim to close this gap. For instance, the taxonomy of the European Union covers industry sub-sectors such as cement, steel, aluminium, and hydrogen as a cross-cutting technology (OECD, 2020[9]), and the Association of Southeast Asian Nations (ASEAN) has set up technical review bodies to review screening criteria for the classification of industrial activities under the ASEAN taxonomy for sustainable finance (ATB, 2023[10]). Progress notwithstanding, sustainable finance taxonomies still lack details or alignment between regions to categorise manufacturing industry investments in a consistent manner.

Current limitations of the manufacturing industry decarbonisation

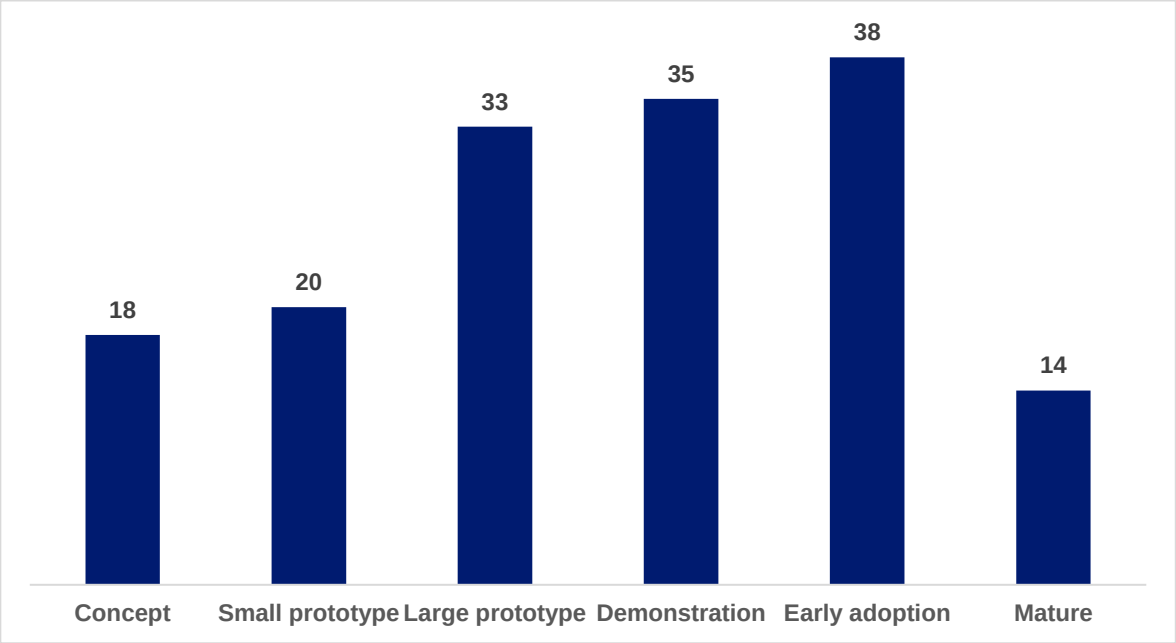
Industry decarbonisation is a complex issue and it is necessary to break down the challenge into smaller steps to provide an informed policy response. For instance, the activities constituting the manufacturing industry and scope of emissions at each step of the value chain needs to be defined. In addition, the array of approaches and technologies that can help to reduce emissions in each industry subsector need to be identified. The deployment of these technologies needs to be accompanied by similar efforts in supporting infrastructures. Furthermore, it will be necessary to have recourse to policy, economic and financing instruments to establish a sustainable industry sector.

The slow pace of industry decarbonisation initiatives so far can partly be explained by the diversity of production processes, energy and material needs, and products manufactured. This diversity requires a tailored analysis as there is no uniform approach to reduce GHG emissions arising from industrial activities. Each high-level technology solution has its own characteristics and challenges related to financing and will affect specific industry subsectors, type of actors, and steps of the industry value chain. Therefore, there is no silver bullet to decarbonise the sector. Overall, five high-level technology solutions across the industry value chain from production, product use to the waste management can put the industry sector on a net-zero emission pathway, and decarbonising any industry subsector will rely on a combination of them (OECD, 2022[11]):

- shifting to a circular economy by increasing reuse and recycling and by reducing demand
- improving energy efficiency of the production process
- substituting fossil fuel use for process heat generation with direct use of renewables, including renewables-based electrification and shifting the power supply to renewables
- switching to biomass and synthetic feedstocks based on low-carbon hydrogen and CO_2
- decarbonising production processes by carbon capture use and storage (CCUS).

While most technologies necessary for this transition are well identified, many of them, such as CCUS and low-emission hydrogen, are at early stages of commercialisation. Other ones, such as direct electrification or circular economy approaches, require major changes in existing processes and industry value chains, as well as significant investments to be operationalised at scale.

Figure 2.4. Number of clean energy technologies ranked by level of maturity in the industry sector



Note: The Clean Energy Technology Guide assesses the level of maturity of technologies that contribute to achieving net-zero emissions, including 158 individual technologies for the industry sector. It highlights that many technologies to decarbonise industry are not yet available at scale or are still at an early stage of commercial deployment.
Source: (IEA, 2023[12])

Evidence shows that investments that contributed to the abatement of greenhouse gas (GHG) emissions in the industry sector have mainly focused on the “low-hanging fruits”, i.e. solutions with limited technology and financial risks that bring immediate economic benefits. This is illustrated by the continuous

improvements in energy efficiency that, on average, saves 1% of industrial energy demand on an annual basis (IEA, 2022[13]). Such projects result in production cost savings thanks to the lower energy intensity of processes and can have short payback periods. However, in emerging and developing economies or for small and medium enterprises, implementing such energy efficiency technologies can prove challenging, for instance, because of transaction costs, when credit risk profile of the company is weak, or when perceived political and country risks are high.

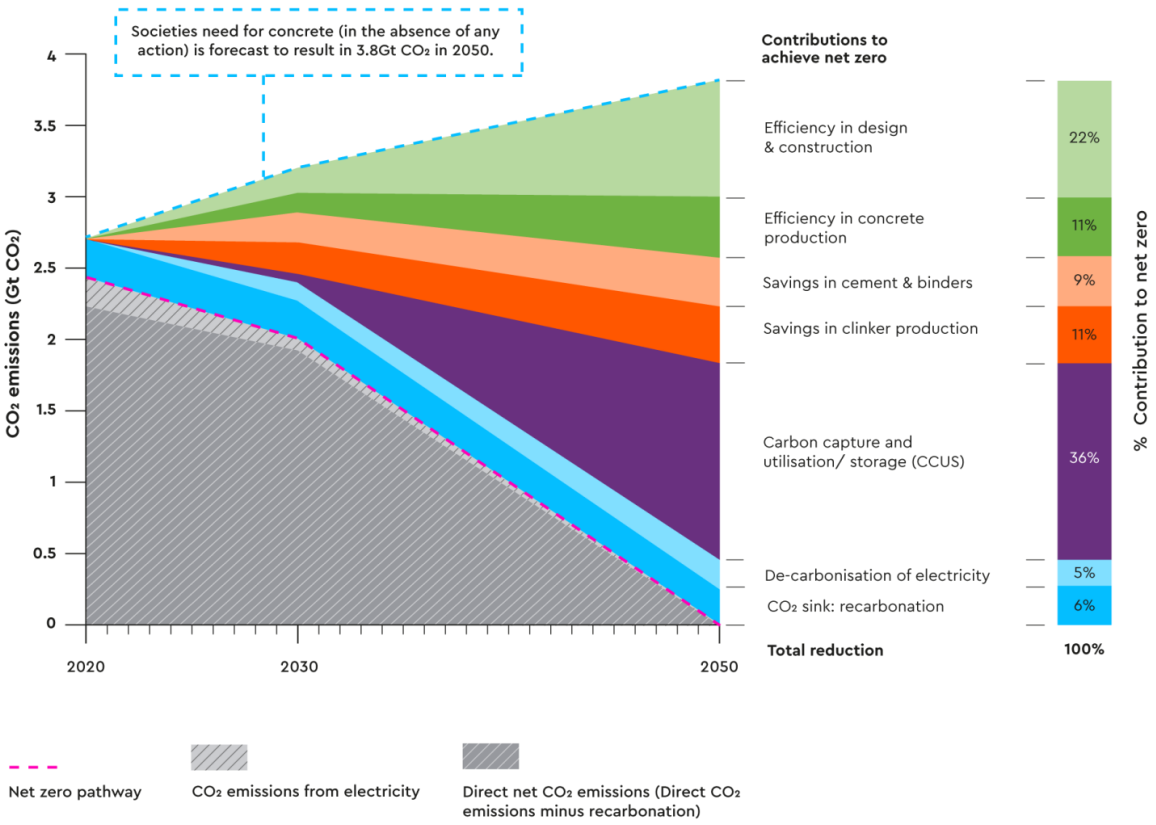
Energy efficiency can significantly reduce the carbon emissions of the industry sector. If all industrial processes would switch to best available techniques, total demand for energy would decline by around 25% (Fawkes, Oung and Thorpe, 2016[14]) (IEA, 2021[15]). Yet, the improvement of current processes won't be sufficient to achieve net-zero emissions, notably because materials extraction and transformation and use is expected to continue growing (IRP, 2019[16]).

The low-carbon technologies needed to achieve a complete decarbonisation such as CCUS have typically high perceived risks, thereby creating investment barriers. These technologies are characterised by being highly capital intensive and with higher operating costs than incumbents and they typically have insufficient performance track records. At the same time, interest from investors in low-carbon technologies such as low-emission hydrogen is growing, because they are foreseen to play a major role in achieving net-zero emissions. This could lead to the creation of new markets, driven by private or public customers of industrial products targeted to buy more sustainable goods. In addition to economic hurdles, the deployment of these technologies could be hampered by the lack of infrastructures, such as pipelines, ships, or harbour chemical parks for hydrogen supply, or CO_2 pipelines and storage facilities for carbon capture and storage.

Credible net-zero pathways for the industry sector rely on a combination of these breakthrough technologies and continuous improvement projects. Therefore, specific solutions are required that address the characteristics of each industry subsector and each step of the value chain (see Figure 2.5).

Figure 2.5. Example of a cement and concrete industry roadmap towards net-zero emissions by 2050

Achieving net-zero emissions rely on a combination of actions and technologies across the value chain



Source: (GCCA, 2022[17])

Investment gap to align the manufacturing industry with a net-zero pathway

Decarbonisation investments in industry are happening at a smaller scale and much slower pace than what is required to be consistent with net-zero pathways. Reaching net-zero emissions for this sector by this mid-century will require a significant scaling up of investments in low-carbon technologies in the coming few decades. Building these technologies will be necessary. While the global annual capital expenditures (CAPEX) in the materials industry amounted to around USD 300 billion between 2016 and 2020 (S&P Global, 2021[18]), annual investments in new production plants compatible with net-zero pathways for chemicals, steel, cement and aluminium production currently only amount to USD 15 billion. This needs to increase to USD 70 billion by 2030 and USD 125 billion by 2050.[3] It is estimated that around 40% of these investments would take place in China, around 30% in high-income countries and 30% in emerging and

[3] Other estimates show higher sectoral investments. For instance, annual investments in clean steelmaking capacity could range between USD 100-300 billion, in ammonia plants between USD 36-59 billion, while additional investment in smelting technologies (such as low-carbon anodes) for aluminium could require a cumulative USD 200 billion by 2050 compared with a business-as-usual scenario (Mission Possible Partnership, 2022[81]) (Mission Possible Partnership, 2022[82]) (Mission Possible Partnership, 2023[83]).

developing countries. These investments would correspond to around 2% of the total investments needed to decarbonise the global economy (ETC, 2023[19]).

However, investments in new assets are only a fraction of the financing needs, as the lion's share of the investments to decarbonise industry needs to take place all across the value chain. The global annual average capital investment in energy-related investments for the decarbonisation of the industry sector stood at USD 158 billion between 2016 and 2020 (IEA, 2021[20]).[4] These investments need to double by 2030 and triple by 2050 to reach around USD 500 billion per year, representing slightly more than 10% of the total investments needed to put the whole energy system on a net-zero pathway (IEA, 2021[20]). This would correspond to USD 10-15 trillion cumulative investments in energy technologies required for the industry sector to achieve net-zero emissions by 2050.[5]

It is difficult to attribute existing investments for industry decarbonisation to key financing actors. For instance, the Climate Policy Initiative (CPI) only identified an annual average of USD 7 billion per year for the industry sector in 2019-2020, with more than 95% stemming from national and multilateral development finance institutions, and nearly no investment from private institutions, reflecting a lack of consistently collected or traceable data (Climate Policy Initiative, 2022[21]).

Investment needs assessments are highly dependent on the envisaged pathways and technology scenarios to reach net-zero emissions. Low-carbon technologies can be classified under circular economy approaches, energy efficiency, electrification with renewable power, low-carbon and renewable energy (heat) and feedstocks, and carbon capture, use, and storage. The contribution of these technologies to a net-zero pathway for a given industry subsector depends on a large number of technological, political, market and economic factors, which may also vary across countries. Therefore, there exist a multitude of net-zero pathways and corresponding investment needs assessments for each subsector, and *a fortiori* for the industry sector as a whole. For instance, if demand for bulk materials and commodities grows further than estimated, and if secondary and substitute materials remain limited, higher volumes of raw materials and new production capacity would be necessary, triggering greater investment needs.

A key challenge to finance industry decarbonisation is the difficulty of implementing the required technologies while maintaining competitiveness with conventional processes (McKinsey, 2018[22]). Decarbonisation projects require novel approaches, notably when implementing new technologies as they may lead to higher risks and may slim down profits. Industry actors have experience in handling large financial resources to optimise their assets and business models and financial institutions are building capacity to finance industrial low-carbon projects. Yet, investments to decarbonise the industry are still lagging behind what is required. This calls for a sound understanding on the financing instruments and sources that can prop up these investments across industrial value chains.

Initiatives from the public and private actors in the industry sector to align financial flows with climate objectives

Many industrial companies, financial institutions, nations, regions and cities have announced net-zero pledges with low-carbon technologies playing an important role (Net Zero Tracker, 2023[23]). A few countries and regions have outlined decarbonisation pathways in their manufacturing industry sectors (European Commission, 2018[24]) (Ministère de la Transition écologique, 2020[25]) (United States Department of Energy, 2022[26]). Many of the updated nationally determined contributions prepared by

[4] This number includes items such as energy efficiency investments, investments in low-emission hydrogen or CCUS. However, this does not include the total CAPEX of industrial plants (such as cement kilns, aluminium smelters, or electric arc furnaces), nor supporting infrastructures, and is therefore underestimating the actual total capital investments in the industry sector.

[5] This excludes most of the supply-side and infrastructures investments, such as electricity generation and networks.

countries since 2020, as requested in the Paris Agreement, now include industry sector in their scope, whilst only two-thirds include detailed transition measures (LeadIT, 2022[27]). These efforts are promising, although there is a long way to go for climate plans to cover all global industrial emissions. Frontrunner countries and regions for decarbonisation have released industrialisation plans integrated with the whole-of-economy strategies that aim to ensure competitive low-carbon manufacturing, such as the Inflation Reduction Act of the United States (The White House, 2022[28]) and the Green Deal Industrialisation Plan of the European Union (European Commission, 2023[29]). However, the alignment of many industrial companies to the Paris Agreement still varies per region, and emerging and developing economies are lagging behind (Transition Pathway Initiative, 2021[30]).

Sustainable finance markets have been growing rapidly in recent years, increasing from below USD 200 billion until 2017 to USD 1.6 trillion in 2021 (OECD, 2023[31]). A number of investors are embracing this approach for their portfolio allocation, supported both by shareholders and beneficiaries. Environment, Social and Governance (ESG) scoring and reporting has the potential to be an important tool to address challenges related to information on sustainability risk and opportunities and to ensure that capital is allocated to investments that support the low-carbon transition and sustainable growth, including for industry sector investments. Yet, shortcomings will need to be addressed by policies and good practices to improve the consistency, comparability and quality of core ESG metrics in disclosure (OECD, 2022[32]).

Transition finance is another emerging approach, focusing on the dynamic process of becoming sustainable, rather than providing a point-in-time assessment of what is already sustainable (OECD, 2022[33]). As such, it can provide solutions for including hard-to-abate energy-intensive industries such as steel, cement, and chemicals. An increasing number of corporates are issuing sustainability-linked financing frameworks, describing in particular how they plan to finance their climate transition plans (Boffo and Patalano, 2020[34]).

Despite capital availability and this growing number of initiatives, low-carbon investments in the manufacturing industry remain limited globally, maintaining its dependence on fossil fuels. Pipelines of investable, investment-ready and bankable projects are still missing, and a large share of newly installed industrial capacities rely on fossil fuels. This warrants urgent attention from governments and the investment and financing community to avoid carbon lock-ins and future risk of stranded assets (OECD/The World Bank/UN Environment, 2018[35]) (OECD, 2018[36]).

However, the deployment of finance to decarbonise industry will require enabling conditions to minimise overall risks and attract investments. To move from genuine interest to actual financing by the private sector an adequate public policy and regulatory environment for investments and follow concrete steps are needed to create a level-playing field for the implementation of low-carbon technologies. The public sector role encompasses the development of national and sectoral decarbonisation roadmaps. It also includes further actions, such as R&D support, an effective regulatory environment to streamline permitting and licensing processes, access to infrastructures, intervention through implementation of regulations and economic instruments in areas that require specific support.[6]

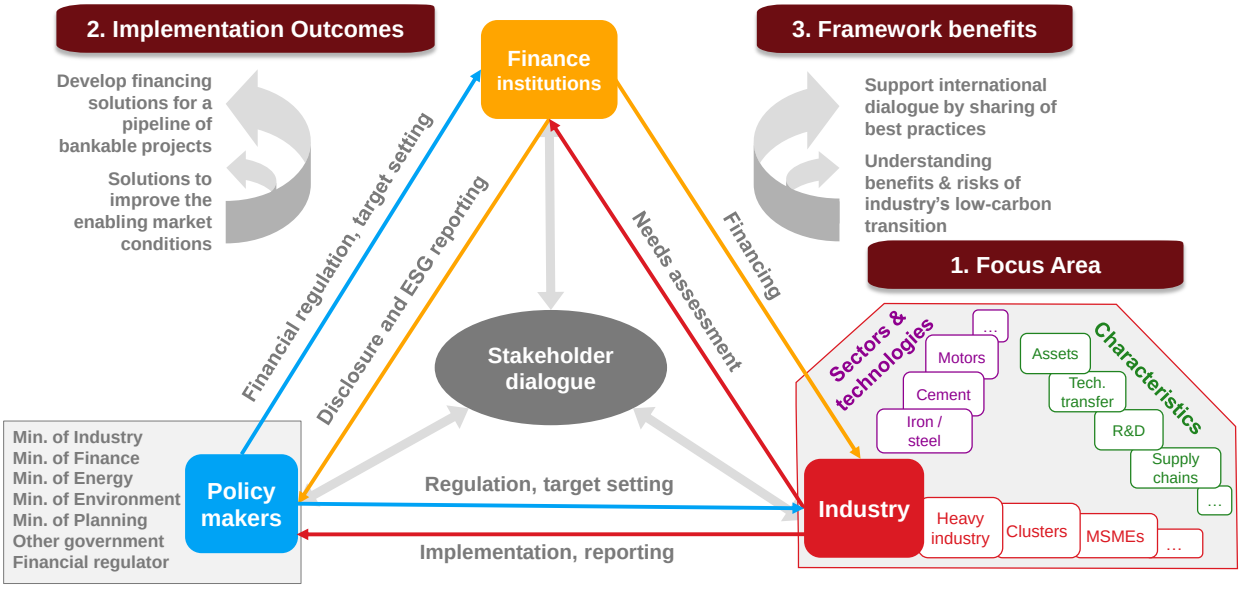
OECD contribution to financing industry decarbonisation

The OECD's Clean Energy Finance and Investment Mobilisation (CEFIM) programme was established in 2019 under the OECD Environment Directorate. The programme works with emerging economies to accelerate finance and investment in renewable electricity, energy efficiency and industry decarbonisation.

[6] More generally, creating an enabling environment extends to additional actions with an indirect impact on investment decisions, such as implementing GHG emissions measurement standards or establishing transparent definitions and emissions thresholds for low-carbon industrial products.

It helps eight partner countries[7] to mobilise private finance for these clean energy developments and supports the conditions to enable a bankable pipeline of projects. In September 2022, the CEFIM programme released the "Framework for industry's net-zero transition," which proposes a step-by-step approach to assist emerging and developing economies in improving the enabling conditions and designing financing solutions that can accelerate industry's transition. Egypt, Indonesia, South Africa and Thailand are currently collaborating with the CEFIM programme to implement the Framework at a country-level in various sectors, such as iron and steel, textile or chemicals production. The Framework implementation aims to help identify the source of financing and the instruments that can underpin low-carbon investments across industrial value chains (see Figure 2.6).

Figure 2.6. Key stakeholders and pillars of the OECD Framework for industry's net-zero transition



Source: (OECD, 2022[11])

Box 2.2. Contribution of the OECD to industry decarbonisation beyond financing

Industrial decarbonisation is a cornerstone to realise net-zero emission targets and offers opportunities to improve people's living conditions. Encompassing a wide range of topics, the OECD provides data-driven and fact-based analyses and policy advice to support governments and industry in this essential journey towards net-zero emissions.

The OECD plays a central role in ensuring the availability of high-quality and comparable data to monitor and measure progress towards climate ambitions. The International Programme for Action on Climate features key indicators that help to track progress towards climate objectives and provide a snapshot of country climate action. The OECD Inter-Country Input-Output (ICIO) database, when combined with statistics on carbon dioxide (CO_2) emissions from fossil fuel combustion and other industry statistics,

[7] Colombia, Egypt, India, Indonesia, the Philippines, South Africa, Thailand and Viet Nam.

can be used to estimate demand-based CO_2 emissions. In various sectors such as steel production, the OECD provides dashboards or trackers to monitor progress on industrial decarbonisation efforts.

Decarbonisation requires a significant scale-up in low-carbon technology deployment and the related investments to put industry's CO_2 emissions on a pathway aligned with net zero. Most of the needed technologies are at demonstration phase or early stages of commercialisation, and many of them are capital-intensive. OECD analysis shows that science, technology, innovation and industrial policies are crucial to achieving carbon neutrality, and it provides advice on how the current level of innovation and research and development can be scaled up to meet the net-zero challenge. A range of OECD reports also highlight the importance of fostering wider use of best available techniques (BAT) for industrial decarbonisation. Further work assesses how value chain approaches can be incorporated into BAT determinations and related environmental regulatory and policy concepts to accelerate progress towards identifying practices that more effectively consider an industry's entire value chain to reduce overall environmental impacts.

Financing risks and challenges for industry decarbonisation range from high upfront costs of most low-carbon technologies and capital access of companies to high costs of capital that reflect these risks and revenue uncertainties. The OECD Framework for industry's net-zero transition assists emerging and developing economies in assessing how private capital can be mobilised through innovative financing reinforced with enabling conditions for investments to overcome barriers and minimise overall risks (OECD, 2022[11]).

Challenges for industrial decarbonisation are global, but circumstances across regions, countries and industries differ significantly. Transition affects various industry issues and may disrupt the broader economy and industrial development policies. In a recent report for the 2023 Japanese G7 Presidency, the OECD highlighted how differences in assets, inputs used, the business environment and innovation efforts make for heterogeneous decarbonisation pathways in the global steel sector (OECD, 2023[37]).

These differences underline that effective industrial decarbonisation requires an inclusive approach. While industrial decarbonisation is often associated with large-scale industrial entities active in energy-intensive industries, OECD work shows that SMEs and entrepreneurs have a significant footprint as well and can help find the solutions needed for successful industrial decarbonisation. OECD work shows that SMEs in energy intensive sectors and elsewhere often face challenges that are different than those of larger companies. Moreover, young firms and green entrepreneurs play a central role in finding the solutions to address climate change.

International collaboration will be particularly important to achieve net zero emissions. Indeed, the exchange of best practices can help accelerate the deployment of technologies and effective policies. In addition, many industrial goods are traded globally. The OECD Policy Dialogue on Global Value Chains, Production Transformation and Development provides a global platform for policy dialogue and knowledge-sharing between countries from Africa, Asia, Europe and the Americas, aiming at improving evidence and at identifying policy guidelines to support production transformation and sustainable and inclusive participation to local, regional and global markets. In this respect, it is also important that the OECD and the IEA have been tasked to provide the interim secretariat for the Climate Club, which was established following the German 2022 G7 Presidency, and which is expected to provide a further platform for delivering on industrial decarbonisation. The Inclusive Forum on Carbon Mitigation Approaches (IFCMA) helps improve the global impact of emissions reduction efforts around the world through better data and information sharing, evidence-based mutual learning and inclusive multilateral dialogue. It brings together all relevant policy perspectives from a diverse range of countries from around the world, participating on an equal footing basis, to take stock of and consider the effectiveness of different carbon mitigation approaches.

3 Considerations related to financing of industry decarbonisation

This chapter presents insights on mechanisms guiding investment decisions for the decarbonisation of the industry sector, building on a review of the literature. It focuses on financing instruments and aims to better understand the financing challenges which lie at the core of the Framework for industry's net-zero transition and explores solutions to overcome these challenges. This is particularly important for emerging and developing economies, where industrial production is growing, financing risks are more pronounced, and access to financing resources for industry decarbonisation fall short of the needs to achieve net-zero emissions.

In this report, considerations pertaining to enabling conditions are only briefly summarised to ensure the reader perceives the full picture. Technology research and development discussions are outside of the scope of this paper.

Conditions to finance decarbonisation projects in the industry sector

Assessment of the economic viability of projects

Most industry companies are active on competitive markets and their investment decisions rely on the impact of the project on the companies' financial performance. In order to convert net-zero strategies into actual decarbonisation projects, industry actors need to build credible transition plans, i.e. a time-bound action plan that outlines how an organisation will transform its assets, operations and business model towards a trajectory aligned with climate science recommendations to limit global warming (CDP, 2023[38]). Business models of these projects need to demonstrate a sufficient return on investment and competitiveness to rationalise investment decisions. Low-carbon technologies are often expensive, but a sound business model can show how a low-carbon project can nevertheless be cost competitive compared to the traditional incumbent project or can lead to a profitable business case, for instance by addressing niche markets that are ready to pay higher prices for sustainable products. To evaluate potential projects, companies develop business models that consider various profitability indicators (Box 3.1).

Box 3.1. Business models and Key Performance Indicators (KPIs) for investment decisions in projects

Companies invest capital in new projects to expand their operations, improve efficiency, or develop new products. These projects can include building new facilities, upgrading existing assets, or implementing process improvements.

Business models typically assess the costs and benefits of the investment over the project's lifetime, including initial investment costs and projected revenue and operating costs. A number of parameters will influence the project's estimated financial flows. For instance, on top of the cost of the technology itself, the debt/equity ratio, the cost of capital or the debt tenure will impact the future financial performance of a project. The revenues and operating cost might by strongly influenced by market scenarios, such as the energy price forecasts or evolution of carbon pricing (e.g. in case a price floor is imposed), and by the ability to optimise the asset utilisation rate.

Key Performance Indicators (KPIs) help companies determine the feasibility and potential profitability of the project, as well as any risks associated with the investment. Project financial models use KPIs such as net present value (NPV), internal rate of return (IRR), and discounted payback period. NPV measures the net present value of the project's future cash flows, while IRR calculates the project's rate of return. Discounted payback period is the time required for the project to generate enough cash flows to cover its initial investment. Investors usually determine a benchmark value for one or several of these indicators, which determines if a project is investable or not.

For industry decarbonisation projects, companies may develop specific additional indicators, such as a GHG emission abatement cost. This indicator represents the cost of reducing greenhouse gas emissions, typically measured in dollars per metric ton of CO_2 equivalent. It helps companies evaluate the cost-effectiveness of different decarbonisation options and prioritise investments. In 2020, the manufacturing industry accounted for over one third of all companies using or planning to use an internal carbon price (CDP, 2021[39]).

Companies optimise the structure for corporate and project financing based on financial metrics, such as Return on Capital Employed (ROCE), or debt over Earnings before Interest, Taxes, Depreciation and Amortisation (EBITDA) ratio, as well as according to the availability of their own and external resources. For instance, in emerging and developing economies where perceived political and macroeconomic risks are high, projects usually require a higher share of equity than in advanced economies. Factors influencing the level of risk perceived by investors include: a) level of confidence in existing government policies; b) government support of industry and innovation; c) technology maturity; and d) domestic operational knowledge (Lee and Saygin, 2023[40]). As many low-carbon technologies are capital-intensive, project developers often aim to reduce their cost of capital by increasing debt financing, which can be sourced from public and private resources. Given emerging economies' public budget constraints and global competition to attract public finance from international resources, private finance will need to supply the lion's share of the total needs. This will require financial institutions to learn how to build internal capacity to assess industry decarbonisation projects and scale up their resources allotted to industry's financing. This may pose a particular challenge to emerging and developing economies which often have underdeveloped domestic capital markets.

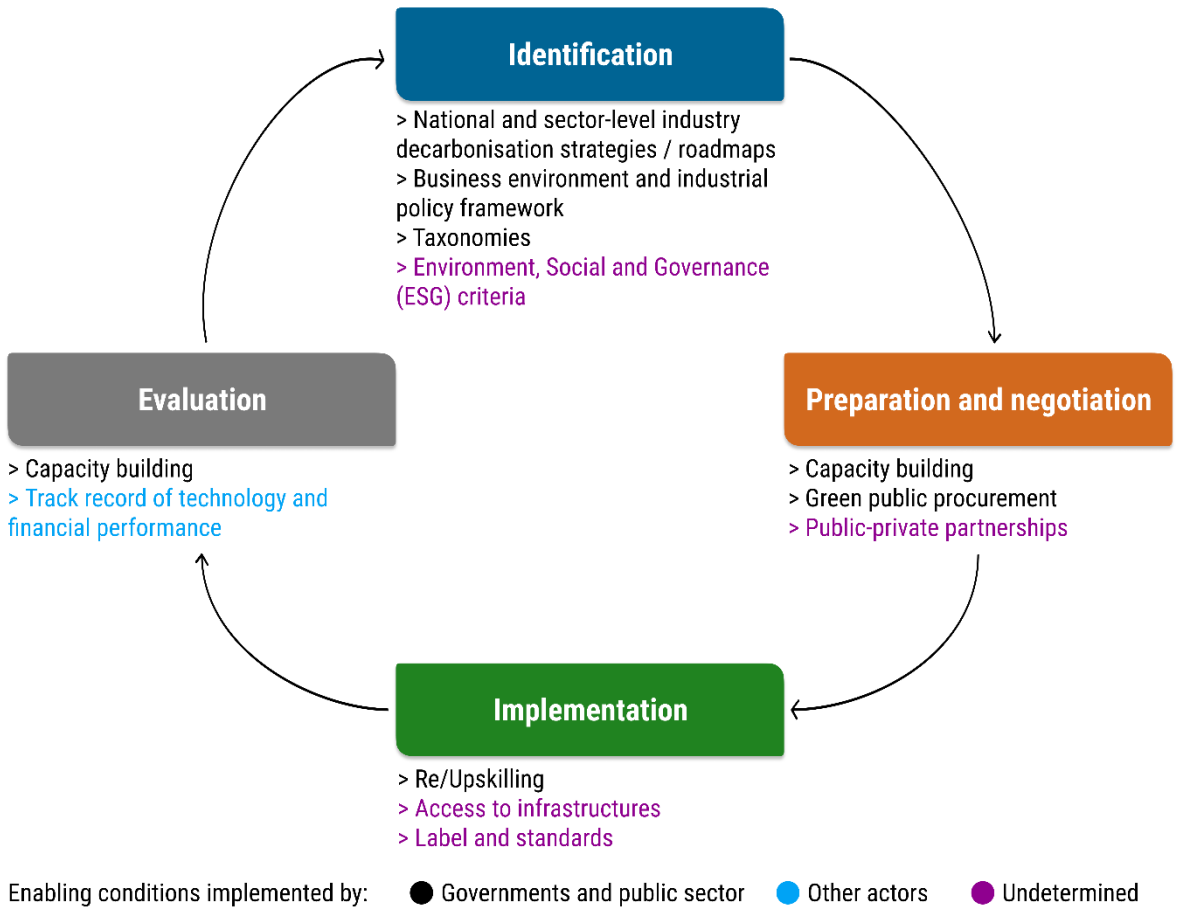
Investment decisions in decarbonisation technologies have knock-on effects across the value chain. For instance, the switch of steel production processes from blast furnaces to direct reduction of iron requires different energy sources, new grades of raw materials and generates different by-products. In turn, the industry sectors that were using these by-products will also need to adjust their processes or raw material

sources. That may lead to a redesign of the industry value chain, including relocation of some activities and diversification of supply chains.

Enabling environment for investments

Enabling conditions are necessary to create a conducive environment for investment in decarbonisation projects. They cover a wide array of dimensions, notably: institutions and governance; policies and regulations; infrastructure; and human capital (World Economic Forum, 2022[5]). The public sector, and in particular policymakers, have a key role to play in lowering the risks of, and thus the barriers to private capital investment in decarbonisation projects, by establishing a supportive policy environment (Swiss Re Institute, 2022[41]). For instance, an industrial company may select the location for a new plant using a low-carbon technology based on the availability of infrastructures to support the project integration, or on the stringency of policy measures fostering clean technologies, such as carbon pricing. Figure 3.1 depicts key enabling conditions that can help alleviate risks across the project's investment cycle.

Figure 3.1. Key enabling conditions to de-risk industry decarbonisation projects



Note: (i) Availability, transparency and quality of data is critical throughout the investment cycle. (ii) Business environment and industrial policy frameworks include both regulatory tools (such as standards, certificates or mandates), information instruments (such as labels and audits) and economic instruments (such as taxes or tradable permits).

A key goal of implementing enabling conditions is to mitigate the actual and perceived risks associated with industry decarbonisation projects (Johansson et al., 2021[42]). While risks are present throughout the

project's investment cycle, the overall risk profile at the project level is expected to decrease as the project advances. This is due to the identification and mitigation of risks throughout the different phases of the project. The nature of risks also varies. During the identification and preparation phases of a project, policy and market risks are prominent, especially in high-risk countries and for breakthrough technologies. In the implementation phase, execution risks become the primary concern. These risks include technical and operational risks such as inadequate infrastructure, equipment failures, or supply chain disruptions. For instance, a company investing in a large-scale carbon capture and storage project may face technical challenges in designing and building the infrastructure needed for the project, leading to delays and cost overruns.

Industry actors evaluating greenfield plant projects can consider that supporting infrastructures, such as access to road, railways, ports or low-carbon electricity, are out of the project scope, as this would increase the project's scope and create additional risks (Cordonnier and Saygin, 2022[43]). In emerging and developing economies, lack of infrastructure constrains social and economic growth (Gurara et al., 2017[44]). Many countries aim to grow by structurally changing their economies with industrial development, thereby rapidly expanding and upgrading infrastructure. Closing the infrastructure deficit will also be critical to ensure that emerging and developing countries are competitive and better integrated with industry value and supply chains. New governance and partnership approaches may be needed, such as public-private partnerships of industrial clusters, to ensure that such new projects are not put on hold. In the evaluation phase, risks associated with project outcomes and stakeholder satisfaction are evaluated. Infrastructure must be sustainable, climate resilient, and inclusive of all environmental goals to meet mitigation and adaptation objectives. Investment needs for sustainable development for emerging and developing economies, including sustainable infrastructures, need to increase from an annual average of USD 2.4 trillion in 2019 to USD 5.9 trillion by 2030, representing more than 18% of total estimated gross domestic product (GDP) (Bhattacharya, 2023[45]).

Capacity building is also crucial to providing the necessary knowledge and skills to equip stakeholders with the required skills to identify, assess and implement decarbonisation opportunities. It can take the form of training programmes or knowledge sharing workshops. Another example is the use of taxonomies ensuring the alignment of the project with the country's sustainability goals, that can be used by investors to justify that their investment is making a positive contribution to decarbonisation efforts.

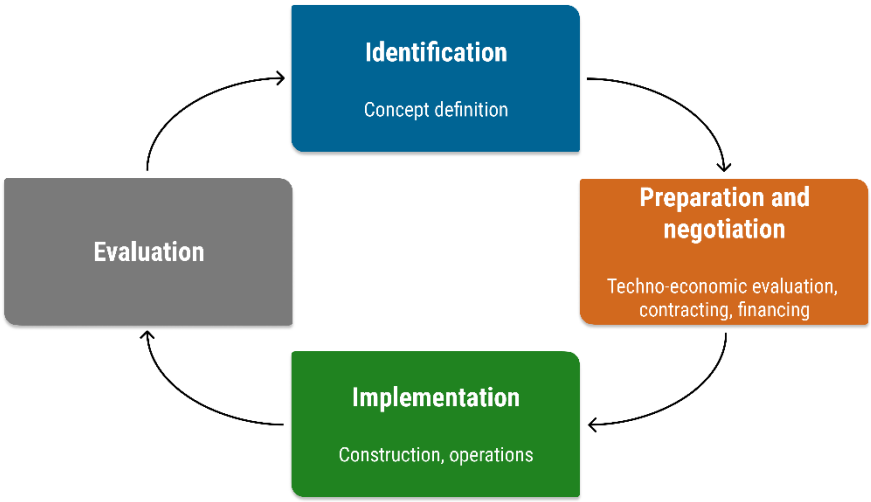
Financial challenges to finance industry decarbonisation

A number of risks need to be addressed to build a robust business model that eventually leads to final investment decisions. The key challenges that have been the main barriers to developing bankable project pipelines are related to (i) the upfront costs and access to affordable finance before the project financial close; (ii) the expected operating costs during the project implementation; and (iii) the uncertainty on revenues due to the lack of predictable volumes and prices, in particular for innovative and for green products.

At the end of a project's implementation, or alternatively a few years after the start of operations, the evaluation of the project aims to compare the achieved performances with the ones that were foreseen in the initial business model. This contributes to create a track record that can be used to back the assumptions and reduce uncertainties for similar, new projects. Figure 3.2 provides a simplified view of a project's investment cycle.

Figure 3.2. Project's investment cycle

The detailed business case analysis of a project takes place during the preparation and negotiation phase, which ends with the financial close.



Challenges related to the upfront costs and access to finance before the project closing

- High upfront costs associated with most low-carbon projects can act as a significant deterrent. For instance, the CAPEX of an electrolysis-based methanol production plant is twice as high as for a conventional natural-gas based plant. While upfront cost is not necessarily a barrier if risk is under control and long-term cash flow is predictable, large-scale projects will typically need a credit rating for international investors to support them. This may be a major challenge in emerging and developing economies where domestic capital markets are underdeveloped. The high upfront costs may also deter international companies to invest in these countries, especially in sectors with regional and global markets coupled with low or volatile margins such as steel or basic chemicals. For complex projects, upfront costs to finance pre-feasibility and feasibility studies can also require large investments, which won't be recovered if the project is eventually not developed.
- Cost of capital is another factor that adds to challenges related to high upfront costs (see Box 3.2). Used for annualising the upfront costs across the project lifetime, cost of capital depends on various factors such as regulatory risk, political risk, or uncertainty on the overall investment environment. These risks are particularly salient in emerging and developing economies, resulting in a higher cost of capital than in advanced economies, and in turn, relatively higher production costs. For instance, for the production of methanol from renewable hydrogen, increasing the cost of capital from 5% to 15% leads to a production price increase of more than 50% over the project's lifetime (World Bank and OECD, forthcoming[46]).
- Currency risk. Borrowing money in local currency in emerging and developing economies could imply a significantly higher interest rate than borrowing in a more stable foreign currency. This can therefore increase the cost of financing. Additionally, matching the asset financing costs and liabilities with the revenue streams from the sale of products is critical to reduce the currency risk. For instance, new technologies in early market phase are typically purchased and imported from advanced to emerging and developing economies, and if the products are sold locally in local currency, the required foreign exchange hedging can lead to prohibitively high financing costs. Lack of local currency financing due to the current under development of domestic financial ecosystems also poses risks to foreign currency denominated investments. This may have

significant repercussions on the developing countries' debt management and may create a vicious circle that slows down the objective to develop local capital markets.

- Access to finance. Especially in emerging and developing economies, access to finance is a major issue. While this may affect all actors in emerging and developing economies, it is typically harder for SMEs to obtain bank loans as opposed to large enterprises. This can be due to the lower creditworthiness of MSMEs, which increases the counterparty risk for the lenders. Therefore, investments are postponed, cancelled, or only a limited share is actually implemented. Given the large share of SMEs' contribution to jobs and GDP, their access to finance needs to be improved and new sources of capital must be unlocked for their transition. Several multilateral development banks have launched programmes to enhance access to finance, such as the European Bank for Reconstruction and Development's Green Economy Financing Facility, which supported a range of small industrial companies to implement efficient processes and technologies, for instance in the food and beverage sector (EBRD - GEFF, 2023[47]).

Box 3.2. Impact of the cost of capital for a green ammonia project

The cost of capital commonly expressed as weighted average cost of capital (WACC), is a critical component in modern finance theory for making investment or divestment decisions, economic profit forecasts, and enhancing performance efficiency (Bruner et al., 1998[48]). It corresponds to the cost that a company incurs to finance its operations or investment projects. It represents the rate of return that investors expect to earn on their investments. The cost of capital includes both the cost of debt and the cost of equity and is usually called weighted average cost of capital (WACC) in project finance transactions.

- WACC = (E/V * Ke) + (D/V) * Kd * (1 – Corporate tax rate)
- Where:
- E/V represents share of equity in the capital structure
- Ke is the cost of equity.
- D/V represents share of debt in the capital structure
- Kd is the cost of debt.

The cost of capital can impact a project's profitability because the cost of financing the project can significantly impact the project's overall cost. This is particularly true for greenfield investments in highly capital-intensive projects such as an ammonia plant, where the capital expenditures can represent up to a third of the total production cost of an industrial commodity.

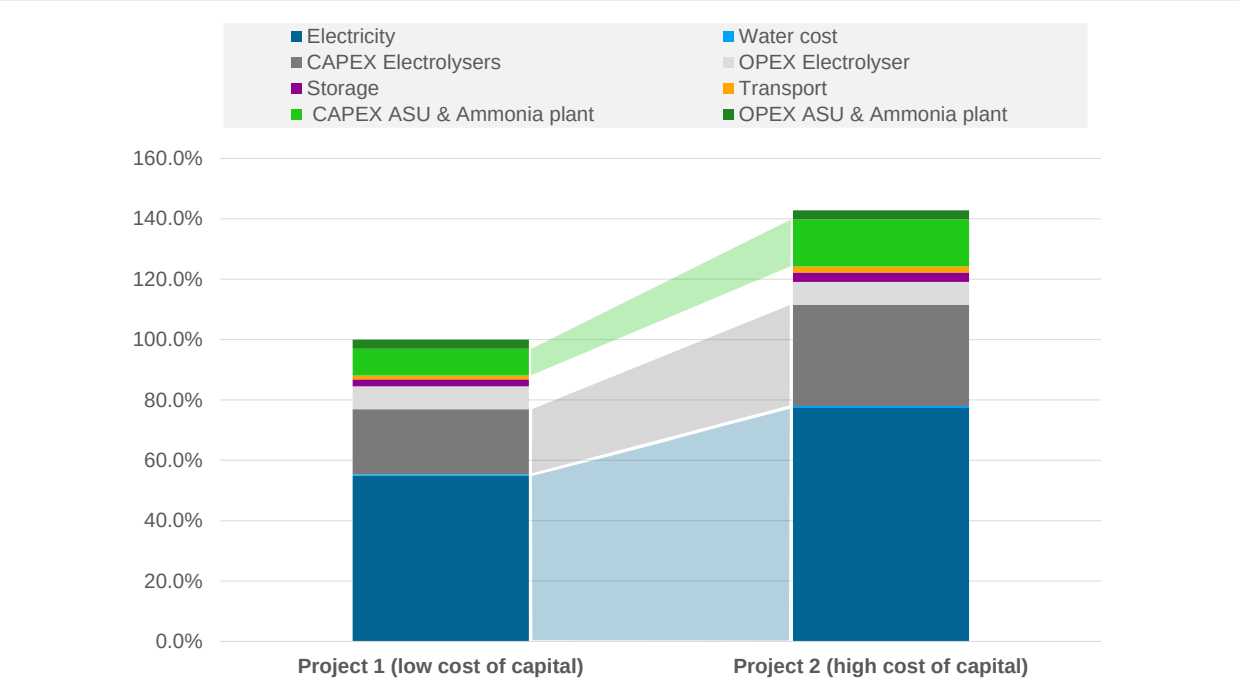
If the cost of capital is too high, the project's required rate of return may not be met, making the project economically unprofitable. The cost of capital tends to be higher in emerging and developing economies, as companies and lenders usually set an additional country risk premium. As such, it is crucial to evaluate how innovative financing solutions such as de-risking instruments or concessional finance eventually improve the cost of capital in those countries.

Several developing and emerging economies have announced plans to produce hydrogen and ammonia from renewable energy sources via an electrolysis process. Setting up a large-scale project typically requires building dedicated wind and solar electricity generation assets, a desalination plant, electrolyser capacity to produce hydrogen, an air separation unit (ASU) to produce nitrogen, a plant using the Haber-Bosch process for the ammonia synthesis, as well as storage and transport infrastructure. The total investment needs for a plant at industrial scale, with an ammonia production capacity of 0.1 million tonnes per year, amounts to USD 300-500 million, driven by the CAPEX of the electricity generation assets, electrolyser and ammonia synthesis plant. A higher cost of capital can significantly increase the production

costs of ammonia, annualised over the entire project's lifetime (Saygin et al., 2023[49]) Figure 3.3 illustrates the gap between two projects with similar assumptions, where only the cost of capital varies. In Project 1, the cost of capital amounts to 2% for transport and storage assets and 5% for all other assets, whereas in Project 2 the figures are respectively 5% and 10%.

Recently, the International Energy Agency (IEA) has initiated the cost of capital observatory (IEA, 2023[50]) that provides an overview of the cost of capital for various energy sector technologies. New insights from this database reveal significant differences across countries' cost of capital that can impact investment decisions, thereby highlighting the need for de-risking instruments and finance models to close the gap for cost-effective investments.

Figure 3.3. Comparison of annualised ammonia production costs in project



Source: Based on data from (Cordonnier and Saygin, 2022[43]) and (Saygin et al., 2023[49]).

Challenges related to revenues and costs from operations

- Higher costs of operations (inputs & raw materials, energy, maintenance, staff, logistics). This risk is particularly salient for new technologies that have different production settings than conventional technologies and processes. For instance, an energy efficient motor drive virtually delivers the same service with a substantially lower electricity demand without requiring any major modifications in the production process. By comparison, although the final products are comparable, the DRI route to iron making is substantially different than the blast furnace method. This may increase the operational costs as the energy related costs (i.e. green hydrogen) could be higher than the costs related to coal needed to produce iron. The perceived risk of higher costs of operations can also increase due to the technology risk, reflecting the uncertainty of the performance of nascent technologies.
- Volume uncertainty. Availability of limited offtaker(s) and small market size reduce investor appetite. If demand is lower than projected or there are no buyers who are willing to pay a higher

premium for new products, investors are not incentivised to put cash in projects that are too risky. For instance, while many emerging and developing economies have announced plans to develop large-scale renewable hydrogen projects for exports, current demand remains limited: foreseen offtakers such as ammonia or steel companies are reluctant to commit on multi-year supply agreements, which are necessary to boost investors' confidence in the absence of a liquid global market for hydrogen.

- Revenue uncertainty (main product, by-products) is a major barrier to financing projects and it also contributes to higher costs of capital. This may stem from inadequate or lack of pricing strategies, as well as the lack of real performance and cost information as well as data related to new low-carbon technologies. The issue of price signalling is further pronounced when carbon prices are low or in the absence of effective carbon markets which disincentives investments. For example, even though producing low-carbon cement by adding carbon capture and storage to the kilns is technologically feasible, only a few companies have actually deployed it, because most customers are not ready to accept a higher price for it.

The challenges described in the previous sections apply to the various low-carbon technologies and approaches needed for industry decarbonisation. Some of these challenges can be overcome by improving the enabling conditions, which can be cross-cutting or sector specific. However, the enabling conditions are only a prerequisite, and projects only get off the ground once financing takes place. Table 3.1 presents how the challenges that lead to financing barriers are affecting different decarbonisation technologies.

Table 3.1. Financial challenges related to industry decarbonisation by low-carbon technology

Low-carbon technology	Industry subsectors and actors that are the most exposed to barriers for implementing this technology	Steps of the industry value chain that are the most exposed to barriers for implementing this technology	Related challenges
1. Circular economy approaches	Downstream of the industry value chain, outside of the manufacturing sector.	Raw Materials Production Processes Product Use End-of-Life (+)	Untested track records Operation costs Volume uncertainty (products and waste collection, transportation, treatment) Revenue uncertainty (industry-specific)
2. Energy efficiency	All sectors, with a primary focus on SMEs.	Production processes (+) Product Use	Untested track records (for some technologies) Access to financing Revenue (savings) uncertainty
3. Electrification with renewable power	Emission-intensive industries operating with high-temperature process heat and a range of SMEs operating with low temperature process heat.	Raw Materials Energy (+) Production Processes (+) Product Use	Lack of infrastructures (weak power grid in some countries) High upfront costs Cost of capital Operation costs (case-by-case basis)
4. Low carbon & renewable energy/heat and feedstocks[2)]	Emission-intensive industries operating with high-temperature process heat.	Energy (+) Production and processes (+) Product Use End-of-life	Operation costs High upfront costs (sometimes) Volume uncertainty Revenue uncertainty
5. Carbon capture, use, and storage	Emission-intensive industries with high CO_2 emissions per plant and with high CO_2 concentration in flue gas.	Production Processes (+) Product Use (for CCU)	Regulatory uncertainty Untested track records Lack of infrastructures High upfront costs Cost of capital Operation costs Revenue/Volume uncertainty

Note: 1) The most exposed steps are marked with (+); 2) Low carbon & renewable energy/heat and feedstocks include low-emission hydrogen and bio-based energy and feedstocks.

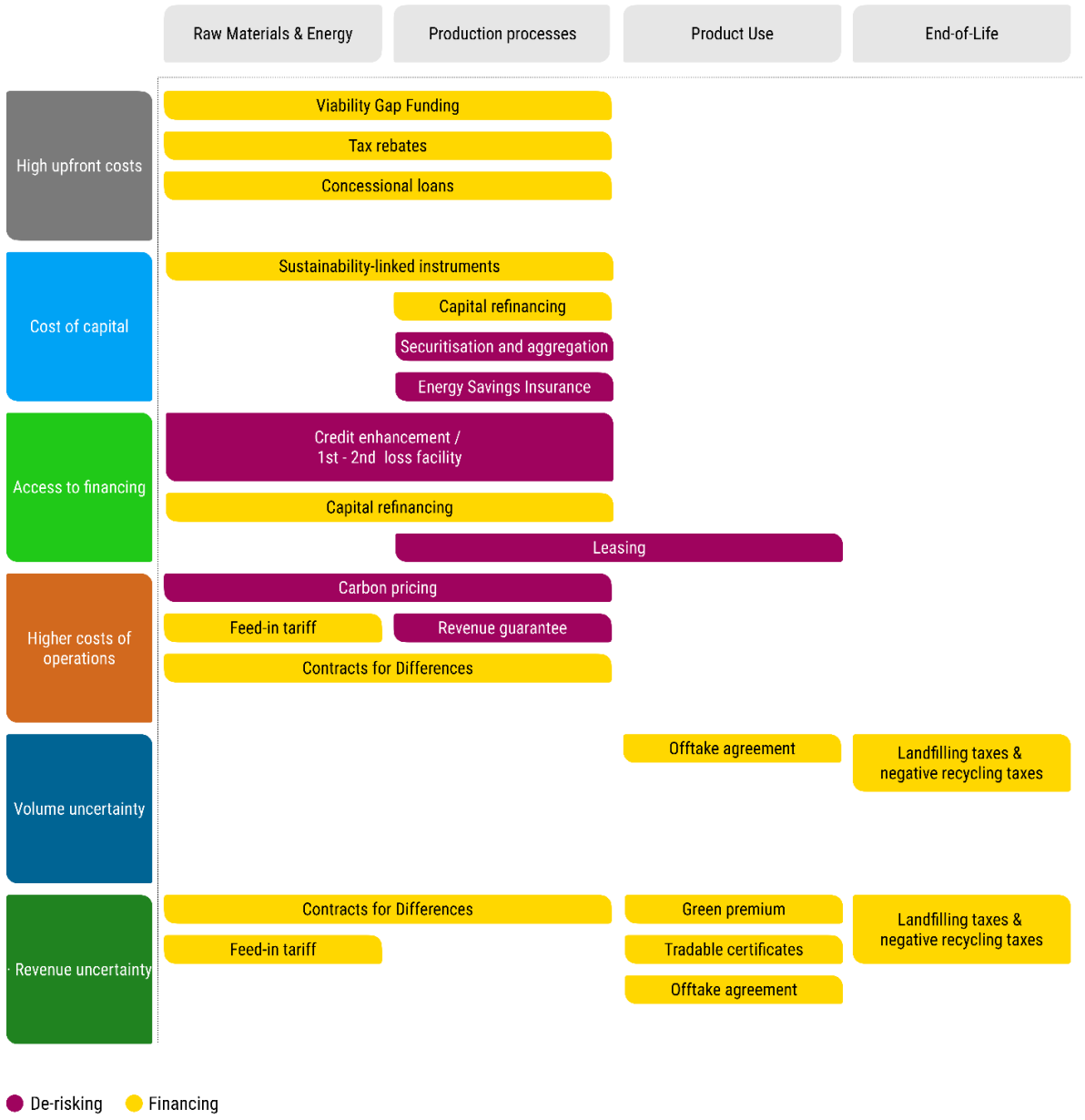
Sources of finance and instruments to finance the industrial decarbonisation

Summary of financing solutions available for industry decarbonisation

Many technologies that are needed to achieve net-zero emissions in the industry sector are at an early commercial phase. As industry actors and commercial finance institutions are not ready to bear the whole risks associated with projects to implement these technologies, specific instruments should be deployed. Tailored instruments can address the various challenges across the value chain. A combination of de-risking and financing instruments can improve the expected economic performance of the industry decarbonisation projects, as presented in Figure 3.4. The figure has been built based on literature review,

and complemented with interviews with around 20 financial institutions to identify potential case studies for Chapter 4 of this report.

Figure 3.4. List of financing solutions across the industry value chain



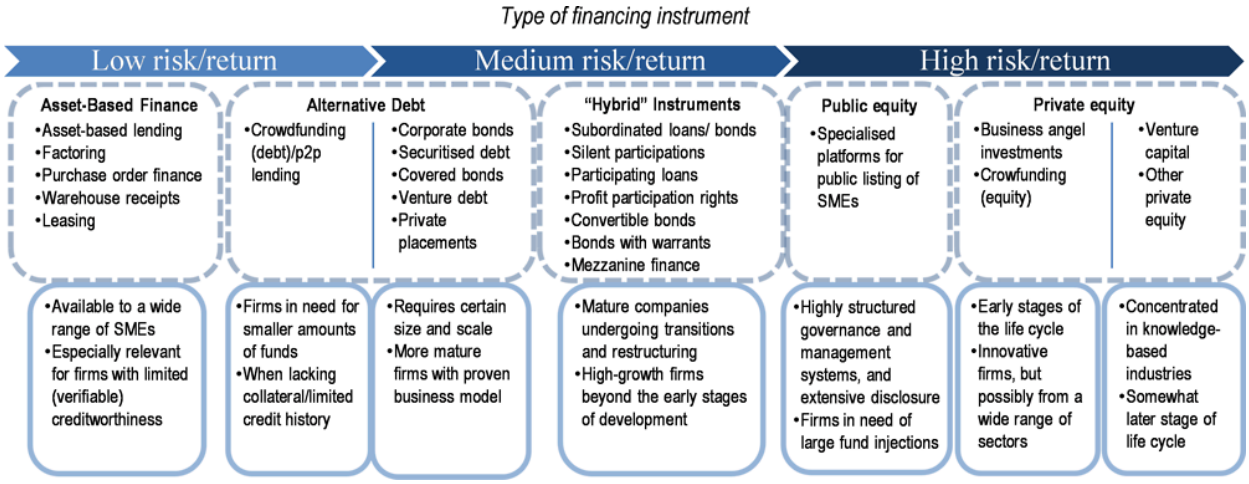
Source: Authors, based on (World Economic Forum, 2021[51]), (OECD, 2022[11]), (Climate Bonds Initiative, 2020[52]), (Cities Climate Finance Leadership Alliance, 2023[53])

Public and private actors involved in financing industry decarbonisation

Financing industry decarbonisation will require public and private funds, both from domestic and international actors. A suite of financing instruments can provide tailored solutions to finance low-carbon investment and overcome the perceived risks of investments when needed (see Figure 3.5). Yet, selecting suitable instruments for industry decarbonisation is not straightforward, because the risks and challenges

vary according to the low-carbon technologies, industry subsector and stage of the project life cycle. Therefore, strategic use of public finance can help to nudge the private sector, for instance through blended finance approaches (OECD, 2022[54]). These measures are essential to overcome market failures that prevent businesses to shift investments towards low-carbon technologies, unless they create immediate revenue benefits (see Figure 3.5).

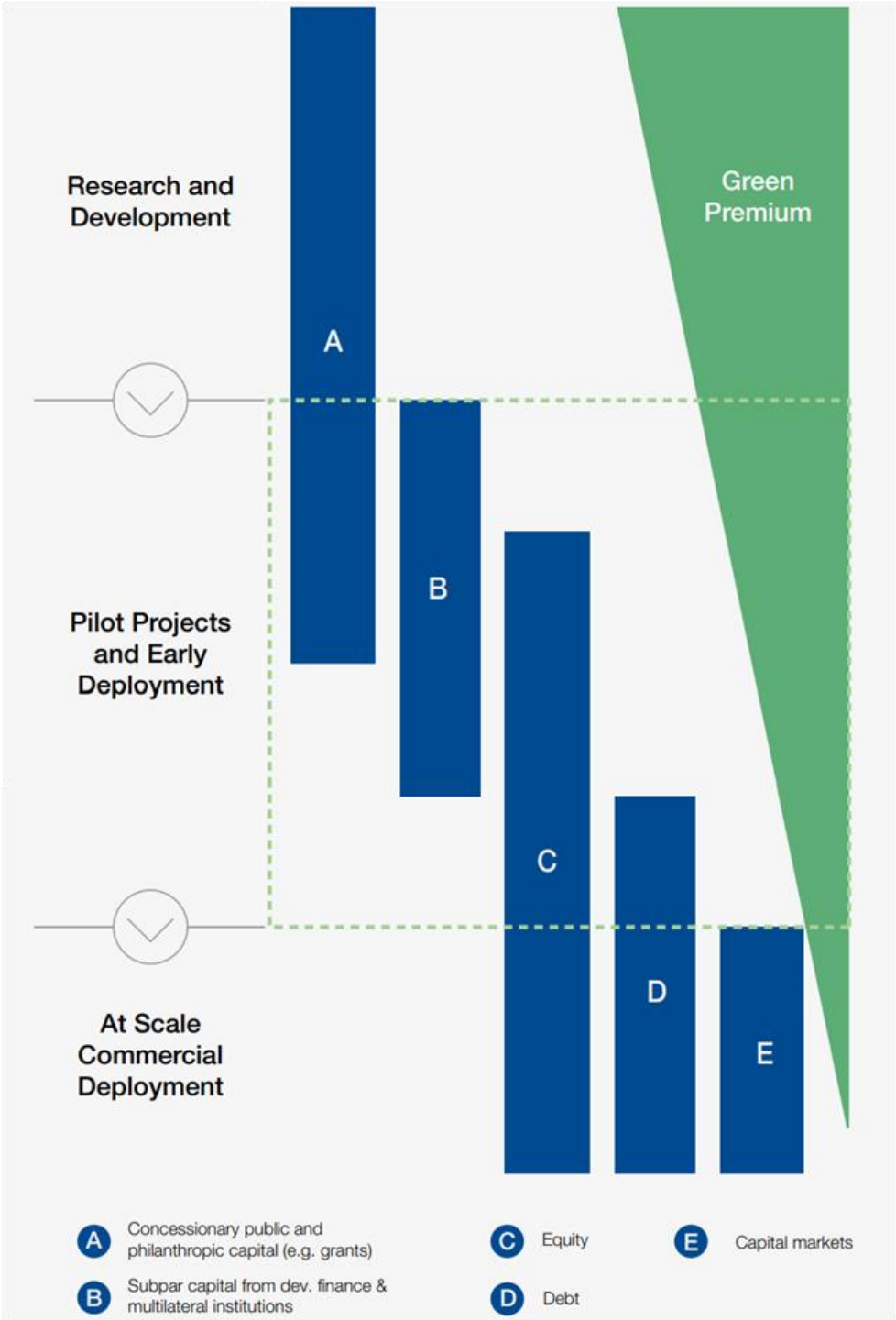
Figure 3.5. Financing instruments by level of risk



Source: (OECD, 2019[55])

A number of actors can provide financial instruments to finance industry decarbonisation, but each actor only proposes a subset of all available instruments (Cities Climate Finance Leadership Alliance, 2023[53]). Public actors financing industry decarbonisation include governments, municipalities and regions, national, bilateral and multilateral development finance institutions (DFIs), sovereign wealth funds, multilateral climate funds, and export credit agencies. Private finance actors include businesses, commercial banks, insurers and other institutional investors and asset owners (philanthropy investors, venture capital funds, pension funds, etc.). The involvement of actors in industry decarbonisation financing varies according to the level of maturity and deployment of technologies (Figure 3.6).

Figure 3.6. Financing sources to support the development and deployment of technologies



Note: Green premium corresponds to the additional cost for a product manufactured with low-emission processes compared to the same product manufactured with conventional technologies.
Source: (World Economic Forum, 2021[51])

While for the energy sector, the Climate Policy Initiative (CPI) and the International Renewable Energy Agency (IRENA) have released the third edition of the *Global landscape of renewable energy finance* in February 2023 that shows in detail the sources and instruments used for financing (IRENA; CPI, 2023[56]),

information available for industry's decarbonisation with low-carbon technologies is by comparison limited. Nevertheless, a wide range of sustainability reporting requirements are being developed, and active investors also play a great role for companies to provide more details on low-carbon investment flows. For instance, European Union Delegated Acts required credit institutions to publish a so-called green asset ratio from 2024 onwards, based on the EU taxonomy (European Commission, 2021[57]). Yet, examples of early implementation are primarily taking place in advanced economies, and progress on emerging and developing countries are slower. There has been a rapid rise of many new industry decarbonisation initiatives in recent years (OECD, 2022[11]). However, although several international financial institutions have expanded their portfolios in this area, many others still do not have a dedicated programme on industrial decarbonisation (Table 3.2).

Table 3.2. Overview of available programmes from international financial institutions for industry decarbonisation

International Financial Institution	Type	Programmes / projects on industry decarbonisation	Details
Asian Development Bank (ADB)	Bank	N/A	No specific industry programme, but industry is covered to some extent under climate finance
African Development Bank (AfDB)	Bank	N/A	Projects targeting industry, but mostly related to capacity expansion
Asian Infrastructure Development Bank (AIIB)	Bank	N/A	N/A
Black Sea Trade & Dev. Bank	Bank	N/A	Industry and materials projects. Limited focus on sustainability, but some equipment modernisation and energy efficiency projects
Climate Investment Funds (CIF)	Financial Intermediary	++	Dedicated industry programme, funds yet to be mobilised
Development Bank of Latin America (CAF)	Bank	N/A	N/A
Eastern and Southern African Trade and Development Bank (TDB)	Bank	N/A	N/A
European Bank for Reconstruction and Development (EBRD)	Bank	++	Manufacturing programme with multiple projects, e.g. green steel
European Investment Bank (EIB)	Bank	+	Industry projects, e.g. Egypt Green Sustainable Industry
Global Environment Facility (GEF)	Financial Intermediary	+	Chemicals and energy efficiency programmes; strategy forthcoming
Green Climate Fund (GCF)	Financial Intermediary	+	Individual projects, especially on EE; strategy forthcoming
International Finance Corporation (IFC)[1)]	Bank	++	Manufacturing sector programme
Islamic Development Bank (IsDB)	Bank	N/A	Mining and construction strategy with emphasis on raw materials industrial value chain, but limited details are available at industry and mining project level
Inter-American Development Bank (IDB)	Bank	+	Individual projects, e.g. on circular economy or manufacturing SMEs.
New Development Bank (NDB)	Bank	N/A	N/A
OPEC Fund for International Development	Fund	N/A	Industry stands as one out of eleven focus areas, but no projects since 2018.
World Bank (WB)[2)]	Bank	++	Industry programme with multiple projects.

Notes: 1) Part of the World Bank Group; 2) this line only corresponds to the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA).
Source: Authors

In its global climate finance landscape for 2019-2020, the CPI estimated that about USD 7 billion per year was channelled to industry (around USD 10 billion when including waste & water sectors), a mere 11% of the total climate finance in the same period (Climate Policy Initiative, 2022[21]). Aid Atlas has mapped total bilateral climate finance for industry (financial and technical assistance) which has averaged USD-130-million a year between 2015 and 2020. This remains a very low share (between 1% and 4%) of total bilateral development finance for industry. According to the Aid Atlas developed by the Stockholm Environment Institute, the top three largest recipient categories are small and medium enterprises (SMEs) development, fossil fuel production sector and fertiliser plants (SEI, 2023[58]). According to the data published by the OECD, industry, mining and construction sectors accounted for 11% (USD 6 billion) of the total private climate finance mobilised by developed countries over the period between 2016 and 2020. During the same period, private climate finance mobilised for adaptation mainly targeted the industry, mining and construction sector (USD 3.4 billion) (OECD, 2022[59]). Yet, CPI, Aid Atlas and OECD estimations are only a fraction of the total global low-carbon investments in the industry sector today, showing that the lion's share of today's investments for industry decarbonisation are being developed by the private sector.

As total investment in low-carbon technologies for the industry sector remains below what is needed to achieve net-zero emission targets, efforts are needed to leverage more private capital. Newer financial instruments for SMEs such as energy savings insurance are now being put into practice in emerging and developing economies (Micale, Stadelmann and Boni, 2015[60]). The volume of issuance of Green, Social and Sustainable Bonds from large industry corporates and private finance institutions is showing rapid growth, although these bonds remain concentrated in developed markets and are far from meeting the financing requirements of developing countries (OECD, 2022[61]). Interest from investors for these products is evidenced by the "greenium"[8] of these bonds on the market. The potential large amounts raised through these instruments can help finance breakthrough and capital-intensive technologies such as renewable hydrogen or carbon capture. As experience in financing such projects remains limited, especially in emerging and developing economies, there is a need to develop capacity within the finance sector to consider and apply the necessary instruments to support industry decarbonisation.

As the high perceived risk level of projects is limiting financing appetite from investors, de-risking mechanisms have a key role to play in increasing the supply of financing for industry decarbonisation. For instance, guarantees, such as partial risk guarantees, can protect investors against specific risks, such as payment defaults. Credit enhancements, such as loan guarantees, can also improve a project's creditworthiness. In particular, public finance actors may set up first and second loss guarantees that compensate lenders if the borrower defaults, in order to crowd in private capital into projects with high perceived risks. These financing mechanisms can help mitigate the risks that deter private investment, making projects more attractive to investors. In turn, this can increase the supply of financing available for public sector projects.

[8] The greenium corresponds to the premium that investors are willing to pay to hold a green bond rather than a conventional bond. This means that investors accept lower monetary returns in exchange for supporting environment-benefitting activities.

Box 3.3. Role of blended finance

Reaching the investment levels foreseen by net-zero pathways will require a larger contribution from private sources than today, particularly in emerging and developing economies. While public finance is important, it is constrained as the public budgets of countries face pressure and countries have limited resources and policy space to expand in view of the significant outstanding needs for other goals. Public finance should rather be strategically used for mobilising underutilised private capital through blended finance approaches (OECD, 2022[54]). Challenges faced by the public sector to mobilise private finance may arise when the project business model does not provide enough assurance to private investors. For example, in emerging and developing economies, industrial projects may face specific risks that deter private investment. These include political instability, regulatory uncertainty, such as unclear permitting and licensing processes, the low reliability of infrastructures, or weak financial institutions.

However, blended finance volumes for industry decarbonisation remain very limited.[9] Over the last decade, the blended finance market amounted in average to USD 10.7 billion annual financing, with only 7% of these flows in the industry sector (Convergence, 2022[62]). An OECD survey estimated that in 2020, the blended finance vehicle investments for the industry sector reached around USD 4 billion, based on close to 200 responses from collective investment vehicles (Dembele et al., 2022[63]).

Lack of capital is not the reason why private sector investments for decarbonisation are not happening. Energy-intensive industry sectors are characterised by large companies that have financial means and industrial experience to invest in capital-intensive projects. For instance, several countries in the Middle East and North Africa region have built prosperity from oil and gas production and export. Revenues generated by these activities are partly held in sovereign wealth funds, which could provide the finance needed for ambitious sustainable infrastructure projects. In many developing Asian countries, public-private partnerships and co-financing projects demonstrate good practices of how private finance can be driven. In Latin America and the Caribbean, the strong presence of a network of national and multilateral development banks has proven to better utilise an already active private sector towards infrastructure investments.

[9] The estimation of volumes highly depends on the definition of blended finance. The OECD defines blended finance as the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries. Convergence focuses on a narrower scope, i.e. the use of catalytic capital from public or philanthropic sources to increase private sector investment in sustainable development.

4 Case studies

This chapter presents 12 case studies, covering several relevant financial instruments that have been put in place by various types of actors to overcome the challenges described in Chapter 3 and summarised in Table 3.1. The case studies pertain to emerging and developing countries wherever possible, in order to illustrate how the specific challenges in these countries can be overcome. Some examples may refer to developed economies, where the key learnings provide insights to replicate a similar scheme in emerging and developing economies. The chapter also presents lessons learned from the case studies and from interviews with financial institutions and companies.

Methodologies and overview of case studies

The case studies have been identified through preliminary desk research on available instruments listed in Figure 3.4, followed by interviews with experts from the financial institutions and companies that had reported the use of these instruments. The selection of the final set of case studies has been driven by the availability and quality of documentation to describe the financing or de-risking instruments, the maturity and track record of these instruments, and the evidence of benefits for industry decarbonisation projects.

The case studies have been elaborated based on a combination of public information, documents provided by experts in the relevant organisations and interviews. Some case studies also benefitted from written comments and additions from the concerned organisations, as well as by internal and external reviewers.

While the selection primarily aims to provide an overview of a large number of financial instruments, it also illustrates the diversity of technologies and projects that can be supported by these instruments. The case studies cover the entire industry value chains. A particular attention has been given to projects that fails to reach final investment decision with conventional financing solutions. This includes less mature technologies such as green steel, green ammonia, or the use of alternative fuels and chemical feedstocks. It also covers conventional technologies such as energy efficiency, especially where industry actors in emerging and developing economies lack access to finance. The case studies provide concrete examples of how the array of risks to finance industry's net-zero transition can be overcome. Thus, a wide array of tools has been analysed, that help attract the necessary capital for the projects and ensure their competitiveness with incumbent technologies, once implemented (see Table 4.1).

Table 4.1. Case studies of financial programmes and instruments deployed to support industry decarbonisation

Organisation	Instrument(s)	Source(s) of finance	Project
Sustainability-linked bonds for industrial companies (CEMEX, Indorama, JSW Steel)	Sustainability-linked instruments	Capital markets	Sustainability-linked bonds for cement, chemical and steel sectors
Export and Investment Fund of Denmark (EIFO)	Buyer Credit Guarantee	Export Credit Agency	CO2-reducing cement technology to Ghana
Hintco / H2Global	Auctions and Contract for Difference (CfD)	Government	Double auction for Green ammonia, green methanol, and electricity-based Sustainable Aviation Fuel (SAF)
Production Linked Incentive (PLI) Schemes	Grants	Government	14 sectors, including products such as advanced chemistry cell (ACC) battery and high-efficiency solar photovoltaic (PV) modules
Department of Energy (DOE)	Grants, loans and tax credits	Government	Inflation Reduction Act Industrial Decarbonisation and Emissions Reduction Demonstration-to-Deployment programme
Inter-American Development Bank (IDB)	1. Result based loans 2. Loans	International financial institutions and development banks	1. Hydrogen development in Chile 2. Support to industrial MSMEs in Panama
NetZero / Puro	Carbon pricing (Voluntary Carbon Markets)	Private companies (Voluntary Carbon Markets)	CO_2 Removal Certificates (CORCs)
European Bank for Reconstruction and Development (EBRD)	CAPEX Grants	Various	Finance and Technology Transfer Centre for Climate Change (FINTECC)
Green Climate Fund - implemented by EBRD	(Concessional) loans and grants	Various	High climate impact technologies
Green Climate Fund - implementation by Xacbank	Energy Savings Insurance (ESI)	Various	MSME Business Loan Programme for GHG Emission Reduction
World Bank, SIDBI, EESL	Credit enhancement and guarantees	Various	Partial Risk Sharing Facility for energy efficiency projects

The case studies illustrate the support brought by domestic and international finance organisations. The investments in the industry sector often come from corporates, but only a small part is allocated to

decarbonisation projects. Commercial finance needs to provide most of the capital required to achieve net-zero emissions. Yet, the lack of bankability of decarbonisation projects or limited access to finance may require public support to give a nudge to and crowd in private investments. Innovative finance solutions are emerging in public and private finance, as well as in blended finance models. For instance, concessional finance instruments provided by Multilateral Development Banks and Development Finance Institutions, have a key role to play in improving the bankability of projects. The analysis will illustrate the diversity of potential finance sources and economic actors that can finance the transition.

Outline of case studies

Financial instrument description

- Actors involved and financial / contractual flows
- Short description of key advantages and challenges to implement the financing instrument

Supported project(s) description

- Country, Industry subsector, size of investment
- Governance/Organisation and how the solution was put in place

Impact of the solution on the project(s)

- Advantages vs conventional financing
- Impact on business model or access to finance
- Explanation of how improving the enabling conditions can complement the financing solution

Lessons learnt and replicability

- Was the solution implemented effectively?
- Did it increase project preparation timeline?
- In case of public source of finance: did the implementation enable the mobilisation of private capital?
- In case of de-risking instruments/guarantees: did any disbursement actually take place?
- Conditions for replicability?

Case study 1: Sustainability-linked bonds - CEMEX, Indorama, JSW Steel

Financial instrument description

Sustainability-linked loans (SLLs) and bonds (SLBs) are the most common "transition finance" instruments whose financial and/or structural characteristics can vary depending on whether the issuer achieves predefined sustainability objectives (OECD, 2022[33]). They are relatively new and innovative performance-based financial instruments that allow companies to raise capital for general corporate purposes, while providing visibility to their ESG targets.

Despite the market volatility that characterised the 2020 to 2022 period,[10] the SLL and SLB market has seen rapid and continued growth, mainly due to the increasing appetite from consumers and investors to prioritise businesses that include environmental and social goals in their strategic decision-making. The market size for SLLs and SLBs emerged in 2018 and has raised quickly to a combined USD 540 billion in 2021 (Bloomberg, 2022[64]), reaching one third of the total market of sustainable debt, and showing a robust growth in a declining overall bonds market. SLLs and SLBs represented respectively 26% and 7% of the total sustainable debt market in 2021,[11] and represented the fastest growing segments. Most SLB issuances (88% of total issuance by volume) came from non-financial corporates.

SLLs' and SLBs' financial and structural characteristics (such as the interest rate of a loan or coupon of a bond) vary depending on whether the borrower or issuer achieved sustainability performance targets (SPTs) for a predefined set of Key Performance Indicators (KPIs), which can cover a range of environmental and/or social targets. Generally, a financial compensation is granted to investors if SPTs are not met. SLBs include a penalty mechanism that is triggered in the event of non-compliance with pre-stipulated SPTs. Penalty mechanisms can include coupon step-ups (most common), premium payments upon maturity set as fixed percentage of redemption amount, or obligations to purchase offsets to meet the SPT calculated as a percentage of the nominal amount. In case of SLLs, the interest rate on the loan increases if SPTs are missed.

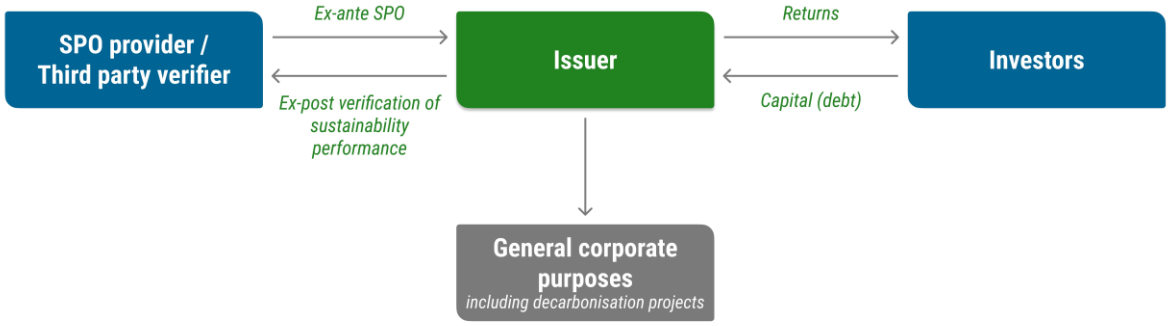
As SLBs are accessible for issuers in any sector and geography, they are often described as a promising financial instrument for issuers in hard-to-abate manufacturing industry sectors such as iron, steel, and petrochemicals production, who aim to raise financing for the entity's decarbonisation. The sectoral breakdown of SLB issuances highlights the growing use of SLBs in industry subsectors. In 2021, the industry sector issued the second largest share of SLBs by volume (with the first being utilities). According to (Climate Bonds Initiative, 2022[65]), most sustainability-linked bonds (nearly 60% in Q1 2022, around USD 14 billion) target GHG or carbon emission reduction objectives. Of these targets, 77% were verified by the Science Based Targets initiative (SBTi) in Q1 2022, showing a steady increase from the previous year.

The issuance of sustainability-linked instruments is based on a corporate's sustainability financing framework reviewed by Second Party Opinion (SPO) providers, which includes the KPIs and SPTs the company has set. Such frameworks usually follow the International Capital Market Association (ICMA) Sustainability-linked Bond Principles, the ASEAN Capital Markets Forum's Sustainability-Linked Bond Standards and/or the Asian Pacific Loan Market Association's (APLMA), Loan Market Association's (LMA), and Loan Syndications and Tradition Association's (LSTA) Sustainability-linked Loan Principles. ICMA's SLB Principles encourage issuers to get a pre-issuance SPO by external reviewers, which would assess the relevance, robustness and ambition of the selected SPTs and alignment with the SLB Principles. According to the ICMA Principles, the SPO is recommended but not mandatory. In addition, issuers need to report (at least annually) the performance against all the selected targets and seek external, independent verification of this information. According to the ICMA Principles, this post-issuance verification is not only recommended but also necessary and should be made publicly available.

[10] COVID19 pandemic and other macroeconomic factors that affected the global economy, such as energy prices and Russia's war of aggression against Ukraine.

[11] Total annual Sustainable Debt Issuance in 2021 was USD 1,643.7 billion (Sustainalytics, 2022[84]).

Figure 4.1. Basic flowchart of sustainability-linked instruments implementation



Source: Authors

Supported project(s) description

Three case studies have been selected and analysed to highlight the functioning and growth potential of sustainability-linked financial instruments (see Table 4.2). They showcase the approach of companies that aim to decarbonised hard-to-abate manufacturing sectors in emerging markets and developing economies (EMDEs).

Indorama Ventures Limited (IVL) (chemicals, Thailand) is a producer of a wide range of plastic polymers, chemicals, and fibres. Headquartered in Bangkok, IVL was founded in 1994 and currently operates in 35 countries in 6 continents (Africa, Asia, Australia, Europe, North America and South America), with 123 operating sites in 2020. Following a SLL (syndicated loan) issuance in 2020, Indorama Ventures' SLB issuance in 2021 was the largest in Thailand and one of the few in the industry sector in EMDEs. As part of the company's Sustainability Strategy for 2025, IVL has set three SPTs, including a 10% reduction of GHG emissions intensity in the period 2020-25; a 3.5x increase in recycled PET input in the production process; and a 25% renewable electricity consumption by 2030.

CEMEX (cement, Mexico) is a construction materials multinational company headquartered in Monterrey, Mexico. The Company produces, distributes, and markets cement, ready-mix concrete, aggregates, related building materials and urbanisation solutions. CEMEX maintains business relationships in more than 50 countries throughout the Americas, Europe, Africa, the Middle East, and Asia. For the year ended December 31, 2020, the Company had USD 13 billion in annual revenue and just over 41,000 employees. Under CEMEX's sustainability-linked instruments, the coupon and interest rates were tied to ambitious SPTs,[12] including to reduce net CO_2 emission intensity to below 475kg per tonne of cement by 2030 (from 630 in 2015), to incorporate 55% of clean electricity consumption by 2030, and to incorporate alternative fuels (such as biomass, residues) in the cement manufacturing process.

JSW Steel Ltd (steel, India) is a multinational steel company based in Mumbai, and flagship company of the JSW Group. JSW Steel is India's second largest private steel company and the largest steel exporter, shipping to over 100 countries across five continents. JSW Steel was the first company in the steel sector globally to issue a USD-denominated sustainability linked bond. As part of the Sustainability Framework set at corporate level in 2020, JSW was issued a sustainability-linked bond in 2021 to link corporate financing with sustainability objectives, and to ensure material commitment to the Framework's

[12] According to Sustainalytics "Second-Party Opinion: CEMEX Sustainability-Linked Financing Framework", August 2021. Available at: https://www.cemex.com/documents/d/cemex/cemex-sustainability-linked-financing-framework-sustainalytics-second-party-opinion.

implementation timeline. The defined SPT included a reduction of carbon emission intensity of 23% for steel products in the 2020-2030 period.

Table 4.2. Summary of selected sustainability-linked financing instruments characteristics

Company	Instrument	Year	Amount raised	Maturity (years)	Financiers	SPTs
Indorama Ventures	SLL (syndicated loan)	2020	USD 255 million	5	Japanese banks (arranged by Mizuho Bank)	• Composite ESG score
	SLB	2021	THB 10 billion (USD ~292 million)	5, 7, and 10.5	Asset managers, commercial banks, insurance companies, cooperatives, high-net-worth individuals	• GHG emissions intensity • PET recycling rate • Renewable electricity consumption
CEMEX	SLL	2020	USD 3.2 billion	5	N/A	• CO_2 emissions reduction • Clean electricity consumption • Alternative fuels adoption
	SLL (syndicated credit facility)	2021	USD 3.25 billion	5	N/A	• CO_2 emissions reduction • Clean electricity consumption • Alternative fuels adoption
JSW	SLB	2021	USD 1 billion	5 and 10	Fund, asset managers and banks (mainly Asia and US)	• CO_2 emissions reductions

Note: a number of actors have flagged that the use of composite ESG scores could create risks of greenwashing, because of the dependency on assumptions used by ESG ratings and data providers (OECD, 2023[66]).
Source: (OECD, 2022[33])

Impact of the solution on the project(s)

Sustainability-linked instruments analysed in the case studies have been used for corporate financing needs. For instance, they can be used to refinance existing traditional loans, possibly extending their tenure, as SLLs typically have 5-10-year maturities, and linking them to company-wide sustainability KPIs. However, the success in reaching industry decarbonisation goals might need to rely on the development and deployment of breakthrough technologies (e.g. clean hydrogen and carbon capture, utilisation, and storage), which may require project-specific and longer-term financing. This could in some cases require a mix of public (where needed and additional, at concessional terms) and private financing, as some of these investments are capital-intensive and have long payback periods. During the elaboration of the case studies, it emerged that an interesting model to boost the development of low-carbon technologies for industry could be one where companies play a transformational, ”venture capitalist” role, by collaborating with clean technology development companies and start-ups and eventually carrying out equity investments.

Additionally, the issuance of sustainability-linked instruments contributes to mainstreaming sustainability objectives across all functions of a business and to creating synergies across teams within a company, including but not limited to operations, sustainability, corporate finance and purchasing departments. In some cases, fostering this whole-of-business approach requires changes in companies' internal practices and processes. These instruments also allow investors to gain a better understanding of and familiarity with a corporate's sustainability plan, decarbonisation strategy and how they plan to finance it.

Lessons learnt and replicability

Sustainability-linked instruments are relatively cost-effective to put in place for companies that have already defined and committed to reaching sustainability targets and addressing environmental impacts. Based on views expressed in the case studies, the shift towards sustainability and the desire to tap into sustainable finance is often driven by a recognition that decarbonisation is necessary to remain competitive in the long-term, compounded by pressure from both investors and consumers towards low-carbon products, operations, and value chains. A long track record of verified sustainability performance and data disclosure is a major facilitator to engage investors.

SLBs and SLLs are increasingly attractive for both borrowers and lenders/investors. A combination of factors is enabling the replicability of the instrument across industries and geographies. To issuers, it provides a flexible tool for debt raising that can be used for general corporate purposes at convenient financial cost (lenders are increasingly willing to reduce interest rates in exchange for supporting corporate sustainability commitments). Additionally, institutional investors are demanding more information and analysis on material ESG issues, including mandates to invest only in companies with certain environmental and social targets. Therefore, the issuance of SLLs and SLBs help to create documentation and monitoring of sustainability commitments and KPIs, increasing visibility and attractiveness of debt instruments.

One of the most important aspects to ensure the replicability of SLL and SLB financial mechanisms is the credibility and robustness of the defined KPIs and SPTs, and the ability of companies to successfully track and monitor its performance. To ensure the credibility of their KPIs, the Sustainability-Linked Loan Principles (SLLPs) and Sustainability-Linked Bond Principles (SLBPs) provide corporate borrowers, lenders, and investors with a set of guidelines when developing their financing frameworks. A relevant signal for potential investors that the issuer is committed to improving their sustainability performance is having a robust selection process for SPTs. Utilising guidance from the SLLP and SLBP, both the issuer and the borrower can make sure that metrics are relevant, comparable across time, and comparable with instruments issued by peers across industries.

Transparency is also a critical challenge for the adoption of these instruments. The importance of certifiers and third-party verification is of key importance to generate unbiased opinions and to provide assurance to lenders and investors that the instrument is aligned with accepted market principles. SLLs and SLBs should ideally be linked to overarching company-wide transition plans.

Multilateral development banks (MDBs) and development finance institutions (DFIs) have a key role to play as enablers of the preparation of bankable projects in emerging and developing economies, especially in the industry decarbonisation sector, which due to technical complexity of projects might delay project preparation (compared with, for example, renewable energy generation projects). According to (OECD, 2022[61]), development finance providers can substantially expand existing mechanisms and modalities to help build project pipelines that underpin the issuance of green, social, sustainability and sustainability-linked (GSSS) financial instruments.

Case study 2: Buyer credit guarantee - EIFO

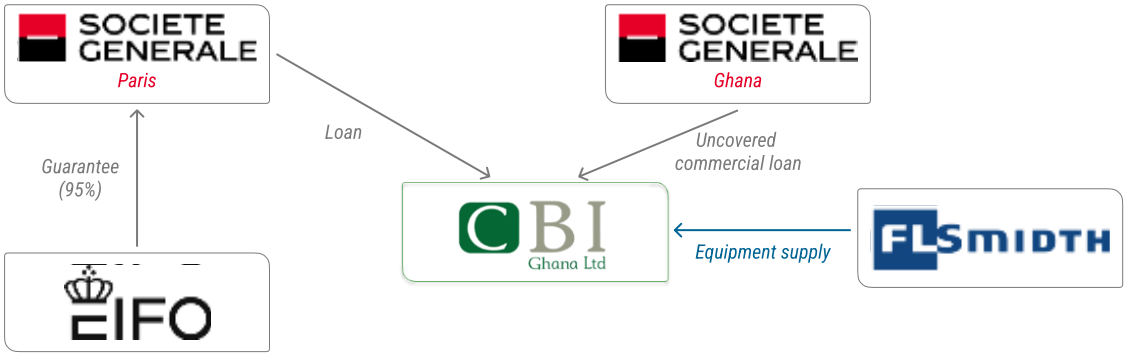
Financial instrument description

A Buyer Credit Guarantee, provided by a country's export credit agency (ECA), is an instrument that covers most of the risk assumed by a commercial bank towards a foreign borrower or buyer of goods from the home country of the ECA. In other words, a commercial bank provides a loan to a foreign buyer and, instead of that bank assuming credit risk on the foreign buyer, this risk is transferred to an ECA. The Buyer Credit Guarantee covers both the commercial and political/sovereign risks.

In countries with high-risk profiles, the Buyer Credit Guarantee is key as it unlocks financing and thus enables the foreign buyer to finance the purchased equipment. In addition to securing a contract for export, the exporter benefits from the certainty of receiving the payment immediately upon deliveries. According to OECD rules (OECD, 2023[67]), the foreign buyer will normally have to make a down payment of minimum 15% of the amount of the order.

The maximum amount available under the Buyer Credit Guarantee is regulated by the OECD rules and linked to the sum of the value of the exported goods and a share of local costs.[13] For such balance sheet financings, the Export and Investment Fund of Denmark (EIFO) can cover up to 95% of the total loan, subject to credit approval. EIFO performs a normal credit evaluation of every project. The guarantee percentage and the decision to participate is decided from case to case. Figure 4.2 provides an overview of the Continental Blue Investment Ghana Limited (CBI) loan structure.

Figure 4.2. Illustration of instrument's structure



Source: EIFO documentation

In order to provide the Buyer Credit Guarantee, EIFO analyses several characteristics of the technology provider (which must be a Danish company), such as economic, environmental and social standards. In addition, EIFO verifies that the company sells equipment or machinery that could be financed via long-term credit of at least six months. EIFO also analyses the creditworthiness of the final customer and the financial institution providing debt to the project.

[13] In Ghana, the maximum eligible amount is the export contract value related to the project x 85% + up to 50% on local costs, if applicable.

Supported project(s) description

CBI[14] is a cement manufacturing company based in Tema, Ghana. CBI was established in 2014 by F. Scott AG, a Swiss investment company, as the controlling majority shareholder. The cement plant became operational in 2018. Currently, the CBI manufacturing facility includes grinding and bagging factories, with a capacity to grind 600 kilotonnes (kt) of cement per annum. CBI has no rotary kiln on site and imports its clinker, mainly from North Africa.

CBI aims to expand its existing grinding plant from 600 kt to 1.5 million tonnes (Mt) per year by establishing a new grinding mill and will furthermore build a new clay calcination unit. The calcined clay will act as a supplement to the imported clinker that is currently used for the manufacture of cement.

The clay calcination unit will use a new technology developed by FLSmidth. CBI will use calcined clay as a Supplementary Cementitious Material (SCM) and substitute a portion of the imported clinker in the finished cement mix with locally sourced clay – without any compromise to the quality of the final product. As a result, the CO_2 footprint of the product will be reduced by up to 20% as compared to current levels. Calcined clay inherently has a lower GHG footprint than clinker because clay contains no, or limited carbonates. Furthermore, the process of calcination of clay requires less energy than clinker production.

Figure 4.3. Flash clay calciner tower – 3d-render

Source: FLSmith, EIFO project documentation

The clay will be sourced locally from an open pit site in Torgorme, in the North Tongu District of the Volta Region. The site and mining rights are leased with local families that will continue to own the land. The excavation process is simple as the clay is dug out at a maximum depth of 10 meters with excavators and loaded onto trucks that transport the clay to temporary storage facilities at the cement plant in Tema. The Mining pit is still under development, but the objective is to supply the clay calcination plant from the startup of operations, expected in 2024.

This landmark project sets standards for modern cement production with a much lower carbon footprint, combined with a high share of local production, with a significant positive impact on local jobs creation due

[14] Before the transaction described in this case study, CBI was wholly owned by F. Scott AG, a family-owned holding company based in Switzerland.

to the local clay sourcing. The project has attracted investments from Norfund, the Danish Investment Fund for Developing Countries (IFU) and the engineering and technology company FLSmidth.

The total investment amounts to more than USD 80 million, funded by a combination of ECA-backed loan provided by Société Générale and 95% guaranteed by EIFO, an untied commercial loan provided by Société Générale Ghana, and equity from the abovementioned investors. The Loan Agreement was signed in March 2022 and the equipment supply agreement with FLSmidth reached effectiveness on 30 March 2022.

Impact of the solution on the project(s)

The Buyer Guarantee's structure provided by EIFO enabled CBI Ghana and its shareholders to get access to attractive, long-term financing. The country rating caps the credit rating applied to CBI. As Ghana country rating was B-[15] at the time of the transaction, this would have limited the ability of CBI to obtain external international funding of this magnitude and tenor without an EIFO guarantee.

The key drivers for CBI Ghana to execute the project were to introduce a new low carbon cement with the same specifications as traditional cement, while producing it at a competitive price. As there are very limited resources of quality limestone in Ghana, a large volume of limestone clinker is imported. With this new calcination technology developed by FLSmidth, clay can partly substitute clinker. As clay is sourced near CBI's plant, it also reduces the foreign exchange risk, as clinker is mostly traded in US dollars whereas cement is sold in local currency.

According to EIFO's analysis, the expansion project is aligned with the EU Taxonomy for green financing, provided that certain criteria in relation to Do No Significant Harm (DNSH) are fulfilled, as listed in the project's Environmental and Social Action Plan (ESAP). Additionally, project financing for this project required to comply with IFC Performance Standards on Environmental and Social Sustainability (IFC ESS), and World Bank Group's Environmental, Health, and Safety (EHS) Guidelines, both General guidelines and EHS Guidelines for Cement and Lime manufacturing.

The Buyer Credit Guarantee also provides benefits to the technology providers. Indeed, it can create or unlock opportunities to offer advanced low-carbon technologies to foreign customers and supports Danish companies in gaining market shares in international markets. The financing mechanism structured by EIFO and Societé Générale made it possible for FLSmidth to sell its technology to CBI.

The project will also have significant impact on the economy of Ghana, contributing to closing the cement demand-supply gap in Ghana. It will add value to local resources (kaolinitic clay), provide job opportunities, reduce dependence on imported resources (clinker), and reduce the cement production's carbon footprint.

Lessons learnt and replicability

Closing the financing gap for decarbonisation projects in emerging and developing countries is one of the main challenges that the global economy is currently facing to speed up the decarbonisation pace and meet the targets set in the Paris Agreement. This is particularly true for energy efficiency and decarbonisation projects in the manufacturing sector, as these projects usually need specific, ad-hoc engineering and specific solutions for each industry sector.

It was key to EIFO that the original founders had a solid track record from similar projects and a long experience with CBI Ghana, and that they remain as both investors and management in the future. Furthermore, the alignment of this project with a pathway to lower CO_2 emissions for the global cement industry was also instrumental for EIFO.

[15] Standard and Poor's rating.

De-risking tools such as the Buyer Credit Guarantee, are key to unlocking private investments and financing in the developing world's industry sector. Due to its simplicity and versatility, this tool is highly replicable, and can be implemented in different geographies for a variety of industries and by a myriad of financial institutions that may be attracted to boost particular economic or commercial objectives. Similar credit guarantees are being implemented by other export credit agencies (ECAs) such as Finnvera (Finland), EXIM Bank (United States), and the export credit agency of the Netherlands, Atradius.

Case study 3: Auction and Contract for Difference (CfD) - Hintco / H2Global

Financial instrument description

H2Global is a market-based instrument to promote the ramp-up of the global renewable hydrogen market and its derivatives. Based on competitive bidding processes, it aims to decarbonise the global economy by accelerating the implementation of Power-to-X (PtX) projects. The programme's hypothesis is that currently, one of the main challenges to scale up the hydrogen economy is the lack of investments in hydrogen and derivatives production capacity in the short-term, as well as the availability of climate-neutral energy sources. Additionally, with green manufacturing and decarbonisation regulations under way (but not in place yet), additional uncertainties about the real value of low-carbon products arise, as well as risks associated with the reliability of current carbon accreditation processes.

As a public-private initiative started in Germany in 2020, the implementation and further development of H2Global is carried out by the non-profit H2Global Foundation, based in Hamburg. Its main objective is to initiate hydrogen products and usage as quickly as possible. The decision on the geographical application of the instrument is made by the public or philanthropic provider of funds.

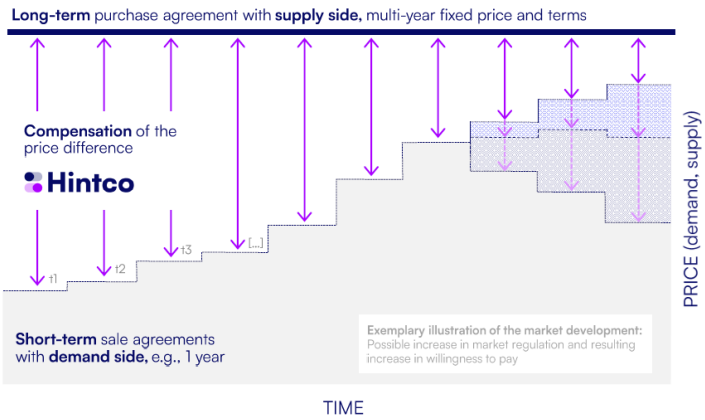
The delay of final investment decisions (FID) in the renewable hydrogen supply chain is preventing the large and economically important CO_2 emitters, such as the EU, from decarbonising quickly and consistently with their roadmap towards net-zero emissions. To accelerate FIDs, the H2Global instrument introduces certainty to supply and demand of hydrogen-based products. Through this instrument, the Hydrogen Intermediary Company GmbH ("Hintco"), will conclude long-term (10 years) purchase contracts on the supply side and short-term (1 year) sales contracts on the demand side. Based on a mechanism in analogy to the Contracts for Difference (CfD) approach, the potential difference between supply prices (production and transport) and demand prices will be compensated by grants from a public or philanthropic funding body.

Figure 4.4. Hintco double auction structure

Source: H2Global

The combination of these long-term purchase agreements with Hintco as a government-backed offtaker provides the necessary investment security to unlock large-scale investments in the short term, resulting in a catalytic effect for ramping up the hydrogen economy. Ultimately, H2Global aims to reduce the price, market, and regulatory risks hindering the early-stage ramp-up of renewable hydrogen, by bridging regulatory gaps and creating business models as well as investment certainty across the entire supply chain. Recently, H2Global has been selected as an implementation instrument for the European Hydrogen Bank (EHB),[16] which is currently being shaped by instruction of the EU Commission in 2022.

Figure 4.5. Compensation provided by Hintco over time – conceptual figure



Source: H2Global

[16] The EHB is an initiative by the European Commission to facilitate both renewable hydrogen production within the EU and imports, to close the investment gap and meet EU hydrogen adoption goals. More information about the EHB can be found here.

Both the purchase and sale prices by Hintco are determined via competition-based bidding procedures as part of tailored funding windows. In line with sustainability criteria, the bids with the lowest supply price and the highest demand price are awarded the purchase and sales contract, respectively, in order to minimise the price difference that is to be compensated. Thanks to short-term sales contracts, H2Global can temporarily benefit from expected increasing market prices for conventional products reducing the gap that has to be compensated in the future. Accordingly, the funds required to compensate the price difference will potentially decrease over the course of the funding period, making it a highly effective and cost-efficient mechanism compared to common subsidy schemes. Hintco has been created with the idea of being a time-limited instrument, until the market develops sufficiently and trading in hydrogen and hydrogen derivatives can take place via conventional market participants and platforms.

Supported project(s) description

The funding source of the first H2Global window is the German Federal Ministry for Economic Affairs and Climate Action (BMWK). The BMWK provided funding of EUR 900 million in 2021. The design of the instrument and the first tender procedures were notified by the EU Commission on 18 December 2021 (European Commission, 2021[68]). In the German federal budget for 2023, a further EUR 3.53 billion has been earmarked for H2Global. The Dutch government also committed to opening a funding window with a EUR 300 million envelope.

Green ammonia, green methanol and electricity-based Sustainable Aviation Fuel (SAF) were identified and selected as products for the first auction of the programme. On the supply side, the programme aims to accelerate the implementation of large-scale electrolysis capacities, and therefore the production of renewable hydrogen and derivatives at lower costs. Additionally, hydrogen and derivatives cost-effective transportation to the EU is also an activity that the programme is eager to support.

Currently, the first auction of the programme is underway, with auction documents prepared and stakeholder consultations done. It is expected that the first contracts will be concluded end of 2023 / early 2024. Sizes of the projects and quantities of products have not been announced, but will be defined during auctions, and limited through the amount of available funding.

Within the framework of the first funding window and in line with the objectives of the German government's economic stimulus programme, H2Global will establish foreign trade partnerships with countries in which renewable hydrogen can be produced efficiently due to their geographical location. In addition, green technologies will be established in partner countries where the local energy transition is supported (i.e. through specific regulation), and a contribution will be made to meet the massive demand for PtX products in Germany and Europe.

Impact of the solution on the project(s)

With H2Global, operators and investors receive the planning and investment security that is required for the development of large-volume renewable hydrogen production capacities, as they can build their business and financing model based on long-term purchase agreements with a solvent contract partner at cost-reflective prices. Simultaneously, on the demand side of Hintco, H2Global enables the integration of PtX products into the economic cycle at competitive prices. This initiative gives the ability to first-movers to generate long-term offtake contracts, and therefore build solid business cases. This initiative allows them to reduce the market disadvantage of entering the market in earlier stages,[17] while maintaining the

[17] Currently, less mature markets for both supply and demand of hydrogen products mean higher production costs and therefore higher purchase prices. One of the main reasons of delayed final investment decisions is that interested parties adopt a “wait-and-see” strategy until the market is more mature. This creates a delay in the development of the market.

advantage of scaling up their business earlier than future competitors (with more time to reduce marginal costs and gain competitive advantages).

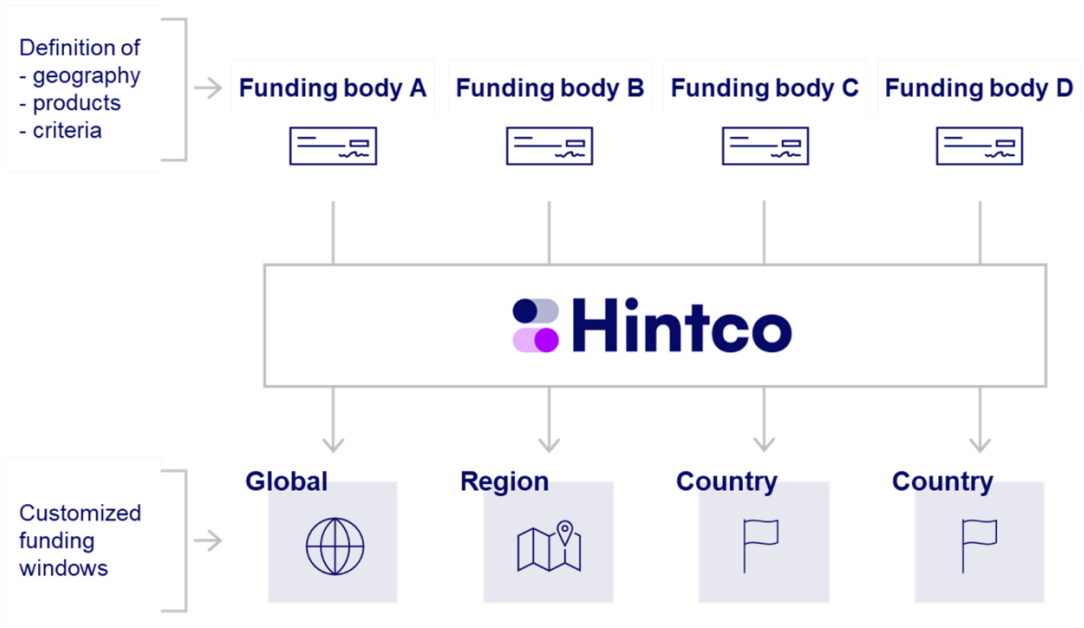
The result is a faster development of infrastructure and production projects on the supply side, and more concrete purchase decisions and contracting on the demand side. Additionally, the initiative provides competition-based price signals and references for the hydrogen global market, which might help facilitate other contracting schemes, such as public tenders or private agreements. Validation of selected technologies and type of projects is also an important market signal.

Improving market regulations and increasing policy targets for renewable hydrogen are additional enabling conditions that would complement and enhance the effectiveness of the market-based solution proposed by H2Global. For example, the REPowerEU plan (European Commission, 2022[69]) sets a hydrogen utilisation goal (based on internal production and imports) of over 20 million tonnes per year by 2030. The German federal government, additionally, has set a 10 GW electrolysis capacity target by 2030. While policy targets can be effective tools to raise awareness of the urgency to build new markets and supply chains, and create demand, the H2Global model complements this by mitigating offtake risks for new hydrogen production projects and making them commercially feasible (by offering long-term purchase contracts).

Lessons learnt and replicability

The H2Global mechanism was designed to allow the configuration and implementation of individually designed funding windows. Tailored to the individual objectives of the funding body (governments, ministries or philanthropists), the flexible instrument allows governments to shape the global hydrogen market through tailored funding windows. Each window shall be defined in terms of geography (e.g. region, countries), product selection (e.g. hydrogen, ammonia, methanol, etc.), technical requirements and sustainability criteria. This way the provider of funds can target the window to its objectives, for example with a focus on the promotion of a specific green technology or the diversification of partnerships with other regions. It also allows stakeholders to address a specific sector or industry.

Figure 4.6. Model for H2Global replicability



Source: H2Global

It is expected that this scheme will be used to determine priorities for each funding and auction round, giving the programme a modular principle, which provides a range of advantages and makes H2Global a more flexible and dynamic mechanism compared to common subsidy schemes. Even if the first tender will be focused on product imports, the programme's design will also enable the promotion of industrialisation and internal supply within Europe or other regions, according to their industrial, technological, and innovation goals. The "dynamic" component of the H2Global instrument (funding price differences) also aims to ensure that the limited public grant is used as efficiently as possible. This distinguishes the H2Global instrument from conventional funding instruments such as CAPEX grants. Furthermore, the effectiveness of the implementation is secured through the financial soundness of Hintco.

For future funding rounds, once the mechanism is proven, even better resource and risk efficiency can be reached. Tools that will give the programme higher reach will be, for example, adding future revenues to finance new projects (project financing schemes with grants as collateral), and market risk-sharing with the supply side. The modular approach, the flexibility to align with short-term supply-demand balance, and the financial robustness of the structure, can make the H2Global initiative a ready-to-scale-up solution for wider market adoption for renewable hydrogen and its derivatives. This would multiply the catalytic effect of the programme. As such, H2Global is well positioned to place green products on the market and initiate the green transformation towards a CO_2-neutral future.

Case study 4: Grants - Government of India

Financial instrument description

Under its Atmanirbhar Bharat (Self-Reliant India) initiative, the Government of India introduced Production-Linked Incentive (PLI) schemes in 2020. The purpose of the PLI is to enhance Indian manufacturers' competitiveness, attracting investments in cutting-edge technology, creating efficiencies and economies of scale as well as enhancing exports.

The total amount committed to the PLI programme was INR 1.97 lakh crore (USD 26 billion). The PLI scheme basically comprises a financial incentive in the form of the reimbursement of between 1% and 10% of net sales over a limited period (up to 6 years) in cash. The incentive improves the economics of the project, thus aiming to develop additional manufacturing capacity. The economies of scale that are expected from a growing manufacturing base is expected to enhance competitiveness of domestic manufacturing in India. For all PLI schemes, awarded companies sign a programme agreement with the Indian National Government and potentially with the State Government if additional incentives are implemented at state level.

This case study focuses on two PLI schemes, namely advanced chemistry cell (ACC) battery and high-efficiency solar photovoltaic (PV) modules. For these items, the incentive period lasts five years and the amount of the incentive depends on total actual sales, performance criteria and local value additions. For instance, for ACC battery companies, the minimum requirements are (i) a local value added of at least 25% in the first two years, and (ii) to increase the value added to at least 60% in year 5. For this scheme, the incentive package is limited to INR 2 000 (USD 24) per kWh of manufacturing capacity. For the solar PV manufacturing programme, incentives are calculated based on expected annual sales and increase with the achieved module performance (from INR 2.25 to 3.75 per Wh).

Supported project(s) description

The PLI scheme was set up for 10 sectors in 2020 and another four sectors were added in 2021, along with additional funding from the Government of India. The schemes are currently being implemented by ministries or departments, as described in Table 4.3. The PLI schemes include relevant sectors for industry decarbonisation, such as the manufacturing of ACC Battery and High Efficiency Solar PV Modules.

Table 4.3. Overview of sectors covered under PLI schemes

Industry subsector	Implementing body	Implementation start
Key Starting Materials (KSMs)/Drug Intermediates (DIs) and Active Pharmaceutical Ingredients (APIs)	Department of Pharmaceuticals	March 2020
Large Scale Electronics Manufacturing	Ministry of Electronics and Information Technology	March 2020
Manufacturing of Medical Devices	Department of Pharmaceuticals	March 2020
Electronic/Technology Products	Ministry of Electronics and Information Technology	November 2020
Pharmaceuticals drugs	Department of Pharmaceuticals	November 2020
Telecom & Networking Products	Department of Telecommunications	November 2020
Food Products	Ministry of Food Processing Industries	November 2020
White Goods (ACs & LED)	Department for Promotion of Industry and Internal Trade	November 2020
High-Efficiency Solar PV Modules	Ministry of New and Renewable Energy	November 2020
Automobiles & Auto Components	Department of Heavy Industry	November 2020
Advance Chemistry Cell (ACC) Battery	Department of Heavy Industry	November 2020
Textile Products: MMF segment and technical textiles	Ministry of Textiles	November 2020
Specialty Steel	Ministry of Steel	November 2020
Drones and Drone Components	Ministry of Civil Aviation	September 2021

Source: (Invest India, 2023[70])

The PLI scheme in ACC Battery[18] aims to set up manufacturing facilities for advanced chemical Battery Energy Storage Systems (BESS), with a total manufacturing capacity of 50 gigawatt hour (GWh) within the next five years. The production-linked subsidy is based on the production level and the percentage of value addition achieved on actual sales. It targets manufacturers setting up production units with a capacity of 5-20 GWh. This scheme is technology agnostic: industry actors can submit an application for any BESS technology. The Ministry of Heavy Industries is in charge of conducting the bidding process, under which investment funds and manufacturing companies are selected. A Request for Proposal (RFP) was issued in October 2021, inviting bids from domestic and international players. The bidding process consists in a two-envelope evaluation process, consisting of a technical and a financial bid. Technical documentation is evaluated and approved by the Ministry of Heavy industries and qualified bidders compete to obtain subsidies in local currency.

The PLI Scheme in High Efficiency Solar PV Modules for Enhancing India's Manufacturing Capabilities and Enhancing Exports has been launched in two tranches, between November 2020 and September 2021. It has the objective to build 65 GW of annual manufacturing capacity of solar PV wafers, cells, and modules. While the programme did not incentivise any specific PV technology, it relied on various technical requirements such as a minimum module efficiency performance of 19.5%. Project proponents can submit offers with different integration across the PV value chain: silicon processing and refining, ingot-wafer manufacturing, and/or cell and module manufacturing facilities. The expected maximum implementation timeline for the industrial facilities is up to 6.5 years, depending on the value chain integration. For this scheme, the Indian Renewable Energy Development Agency Limited, a state-owned company administratively controlled by the Ministry of New and Renewable Energy, is in charge of conducting the bidding process, which is based on similar characteristics as the ACC scheme.

[18] Advanced Chemistry Cells (ACCs) are innovative energy storage technologies that can store electric energy either as electrochemical or as chemical energy and convert it back to electric energy as and when required, such as chemical batteries.

Impact of the solution on the project(s)

Since its initial implementation, PLI schemes have contributed to boosting the manufacturing sector in India, leading to job generation, economic growth and exports in the 14 PLI sectors. Foreign direct investment (FDI) in India's manufacturing sector reached USD 21.34 billion in financial year (FY) 2021-22, compared to USD 12.09 billion in FY 2020-21 (The Economic Times, 2022[71]).

As of June 2023, 733 applications have been approved in 14 sectors, with an expected total investment of INR 3.65 Lakh Crore (USD 40 billion). Among PLI beneficiaries there are 176 MSMEs, mainly in sectors such as bulk drugs, medical devices, pharma, telecom, white goods, food processing, textiles and drones (PIB, 2023[72]).

For ACC battery manufacturing, 10 domestic/international manufacturers submitted proposals for a total of 130 GWh, based on the technical bids opened in January 2022. Three selected bidders signed the Programme Agreement on 28 July 2022. In August 2023, the Ministry of Heavy Industries awarded three beneficiaries contracts to build 30 GWh of manufacturing capacity, with a progressive start of commercial operations from 2024. In addition, 20 GWh have been proposed for re-bidding, and are in the process of being awarded in order to achieve a total of 50 GWh production capacity by 2030 (PIB, 2023[73]).

Lessons learnt and replicability

The PLI programme in the battery energy storage systems (BESS) and solar PV sectors, among others, helped India to increase domestic manufacturing capabilities and shift manufacturing towards higher value-added products. It contributed to improving the basket of India's exported goods and positioning the country in high-potential markets. In addition, the PLI incentive scheme has effectively attracted international investors and companies. It provided both short-term benefits, such as an increase in FDI, GDP, exports, employment and long-term structural benefits, such as the modernisation of the manufacturing sector, thereby increasing capabilities to achieve national decarbonisation targets. Furthermore, investments in the PLI sectors could have a catalytic effect of attracting related industries such as automotive production.

With almost 800 applications to PLIs registered till mid-2023, the programme boosted a number of project preparation, technical and financial feasibility studies. This could help to overcome the lack of pipelines for industry decarbonisation projects, which is a key barrier for financial institutions and investors, especially in developing countries. Therefore, it is expected that the programme would have a positive impact on the speed of implementation of industrial decarbonisation projects.

As PLI schemes have been implemented in 14 different sectors in India, there is evidence to pave the way for replicating the programme in other sectors and countries. Dissemination of insights related to the challenges faced and the success of the programme, both in India and in international fora, could enhance the replicability potential. Financial incentives and an enabling regulatory framework to attract manufacturing companies have been instrumental for the Government of India to successfully implement the PLI scheme.

Case study 5: Grants, loans and tax credits - United States Department of Energy

Financial instrument description

The Inflation Reduction Act of 2022 (IRA), signed into law on August 16, 2022, is a Law promoted by the US Congress and currently under first steps of implementation. The IRA directs new federal spending toward reducing carbon emissions, and seeks to improve US economic competitiveness, innovation, and industrial productivity. Combined with other legislations passed since 2021 (Bipartisan Infrastructure Law;

CHIPS and Science Act), they introduce around USD 2 trillion in new federal investment in the next decade for decarbonisation and modernisation efforts. It also advances President Biden's Justice40 Initiative, which commits to delivering 40 percent of the overall benefits of climate, clean energy, infrastructure, and other investments to disadvantaged regions and communities.

The committed funds will be delivered through a mix of tax incentives, grants, and loan guarantees, under different programmes managed under different federal agencies (Treasury, Department of Energy, Department of Defense, Environmental Protection Agency, among others).

The IRA includes several programmes to reinvigorate American manufacturing by promoting private investments in infrastructure modernisation and decarbonisation of the industrial sector, for instance under the IRA's Industrial Decarbonisation and Carbon Management initiative, such as:

- Expansion of the Advanced Energy Project Credit to include industrial emissions reduction. The Inflation Reduction Act expands the 48C Advanced Energy Project Credit to include projects that reduce greenhouse gas emissions by at least 20 percent at an industrial or manufacturing facility by installing low-carbon heat systems, carbon capture systems, energy efficiency measures, and other pollution reduction technologies and practices.
- Extension and expansion of the 45Q tax credit for carbon capture, utilisation, and sequestration (CCUS). The law extends the existing 45Q tax credit, adds an enhanced credit for direct air capture (DAC), and lowers the carbon capture threshold requirements for certain facilities to benefit from the credit. This tax credit complements funding in the Bipartisan Infrastructure law for CCUS and DAC, including USD 2.5 billion for the Carbon Capture Demonstration Projects Programme, USD 937 million for Carbon Capture Large-Scale Pilot Programmes, and $3.5 billion for Regional Clean Direct Air Capture Hubs.

One of the programmes established by the IRA is the *Advanced Industrial Facilities Deployment Programme*, a USD 5.8 billion programme aimed to provide financial support to industrial facilities in emissions-intensive sectors, such as the iron, steel, aluminum, cement, glass, paper, and chemicals sectors (also defined as "hard-to-abate industries") to complete demonstration and deployment projects that reduce greenhouse gas emissions through installation or implementation of advanced industrial technologies.

This programme complements the USD 500 million provided to the Department of Energy in the Bipartisan Infrastructure Law for Industrial Emissions Demonstration Projects that test and validate technologies that reduce industrial emissions. On 1 June 2023, both programmes were merged and renamed to the "Industrial Decarbonisation and Emissions Reduction Demonstration-to-Deployment" programme, totalling USD 6.3 billion of federal funding. Under the IRA, funding for this programme is available until 2026, and projects must spend all resources and finalise projects before 2031.

Supported project(s) description

Industrial emissions account for roughly one third of the USA's carbon footprint. The Industrial Decarbonisation and Emissions Reduction Demonstration-to-Deployment Programme ("IDERD") will provide competitive financial support to owners and operators of energy-intensive industrial facilities for high-impact, transformational projects to significantly reduce greenhouse gas (GHG) emissions. These projects will be designed to build confidence in the technical and commercial viability of emissions reduction technologies and integrated solutions.

The ultimate goal of the US Government to provide these grants is to solidify a "first-mover" advantage for US industry, bolstering its competitiveness globally for the next decades, and committing to a low-and net-zero carbon manufacturing sector while helping to substantiate a market for low-carbon products. To maximise the transformative potential for these funds, the Department of Energy (DOE) is prioritising a portfolio of projects that offer:

- Deep decarbonisation, by demonstrating significantly less carbon-intensive industrial production processes leading to materials that can be labelled as having substantially lower levels of embodied greenhouse gas emissions.
- Timeliness, through rapid technology demonstrations that can address emissions in the near-term, meet funding horizons, and be replicated by fast followers.
- Market viability, with technological approaches designed to spur follow-on investments for widespread decarbonisation as well as partnerships between buyers and sellers of the materials produced, with special consideration given to industries that are focusing on shifting entire ecosystems and enabling new market structures for low-carbon products.
- Community benefits, tailored through substantial engagement with local and regional stakeholders, as well as labor unions and Tribal Nations across the project lifecycle, supporting environmental justice and economic opportunity for local communities.

The DOE anticipates providing awards to for-profit organisations (companies), and owners and operators of industrial facilities. These organisations can also strengthen projects by partnering with experts, universities, labour unions, community-based organisations, non-governmental organisations, product offtakers, and/or national laboratories.

Given the transformative potential of these funds, DOE seeks first- or early-of-a-kind commercial-scale projects. These could include new technologies that have been proven at a pilot scale but have yet to be deployed commercially, technologies that are being pursued internationally but do not have a foothold in the US, or other early-of-a-kind projects that face market or adoption risks. All projects should incorporate a path from demonstration to deployment that includes sustained operation after completion and substantiate the projects' ability to meet priority criteria.

The DOE will support projects under three topic areas: 1) Near-Net-Zero Facility Build Projects; 2) Facility-level Large Installations and Overhaul Retrofit Demonstrations; and 3) System Upgrades and Retrofits for Critical Unit Operations or Single Process Lines Within Existing Facilities. Projects submitted need to be at technological readiness level (TRL) 7 (advanced technology demonstration and with relevant development at system level) at the time of the award and advance to TRL 9 (implementation, system operation) by the end of the project. Applicants are bound by the cost share proposed in their applications if selected for award negotiations. The cost share must be at least 50% of the total project costs (from private sources), while the awarded projects can enjoy a DOE contribution for up to 50% of total project costs.

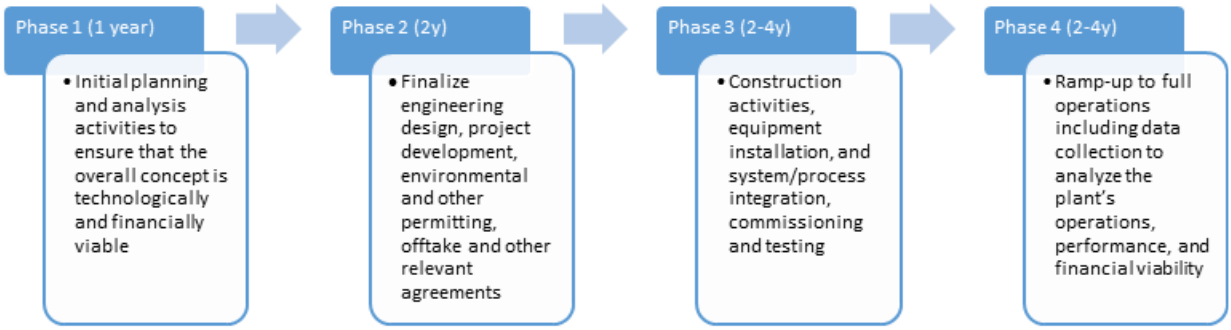
The DOE expects to award up to 65 projects in high greenhouse gas-emitting industries and for cross-cutting technologies. For-profit organisations are eligible for awards under Topic Area 1 mentioned earlier, and owners or operators of a domestic, non-federal non-power industrial or manufacturing facility engaged in energy intensive industrial processes are eligible for awards under Topic Areas 2 and 3.

Impact of the solution on the project(s)

Technology and infrastructure innovation projects are difficult to implement mainly due to their investment characteristics (capital intensive, difficult to reach demonstration at full-scale without significant risks) and market adoption risks. Projects that have reached maturity in technology development and demonstration need early adopters to prove their value at commercial scale. Thanks to the funding and collaboration provided in this programme, project developers and investors can enjoy significant advantages compared to traditional project financing, such as a non-reimbursable grant up to 50% of the total project investment, without the need for a corporate guarantee.

Furthermore, the DOE expects to actively accompany the sponsors throughout the advancement of the project, from concept and design, to construction, installation, and operation. To that end, the DOE applies a four-phase approach (see Figure 4.7)

Figure 4.7. Four-phase approach for projects selected under the IDERD Programme



Source: (DOE, 2023)

To manage implementation risk, the DOE will regularly review and evaluate projects' progress on deliverables through Go/No-Go reviews that will occur between or within phases. During the execution of the projects, the DOE and the funding recipient sign a co-operative agreement, under which both the awardee and the DOE co-ordinate efforts and share responsibilities for the project's execution and successful completion. Through this co-operative agreement, the DOE commits to substantial involvement, including the following:

- The DOE shares responsibility with the recipient for the management, control, direction and performance of the project.
- The DOE may intervene in the conduct or performance of the award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
- The DOE may redirect or discontinue funding the project based on the outcome of the DOE's evaluation of the project at the applicable Go/No-Go decision points.
- The DOE participates in major project decision-making processes.

This co-operative agreement has significant impact on the project's business model, as the DOE acts not only as a co-lead of the different mentioned activities, but also as validator for the project's technology and business model, which may help scale up the technological solution and the commercial reach of the project in the future.

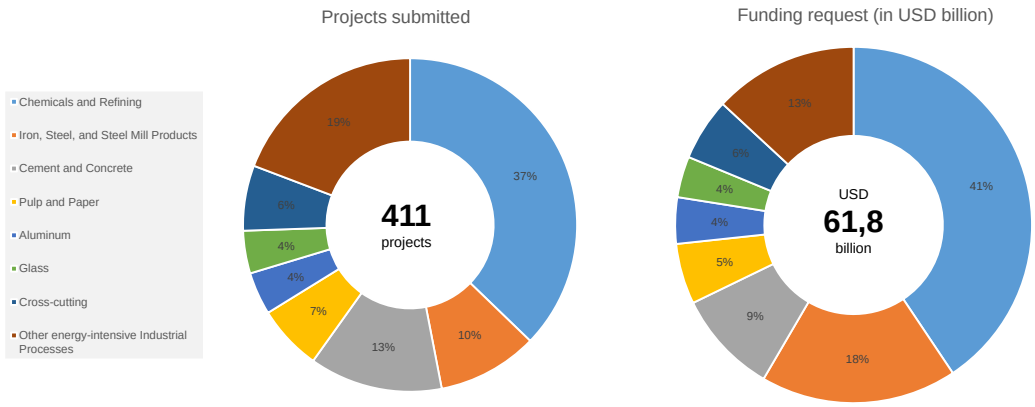
Lessons learnt and replicability

The IDERD programme is in its early stages of implementation. In March 2023, the DOE published the first version of the Funding Opportunity Announcement (FOA), with a description of the programme purpose, the description of the funding opportunity, and the eligibility information and process. The IDERD programme has put in place a resource-efficient selection process. For the first stage of the project selection process, the OCED required project developers to submit Concept Paper for potential projects under the programme.

The programme has shown strong appetite from the manufacturing sector to invest in decarbonisation and modernisation projects. In late April 2023, the OCED received and reviewed 411 submissions. In these Concept Papers, applicants requested more than USD 60 billion in federal funding, roughly 10 times the size of DOE's USD 6 billion solicitation. Concept Papers included, in aggregate, nearly USD 100 billion of private capital investments alongside DOE's federal investment. Applicants proposed projects in all 50 US states (and Puerto Rico) and included a wide variety of technological solutions.

In June 2023, the OCED issued notifications encouraging 130 of the 411 submissions to submit a Full Application. Notifications followed an assessment of each Concept Paper based on evaluation criteria that included decarbonisation potential, timeliness, market viability, replicability, community benefits, and overall project strength. The Concept Paper process allows OCED to provide feedback to potential applicants to ensure they are producing the best applications possible and to better understand the types of final applications the Department will receive. Projects that did not receive the encouragement notification, also received feedback on their projects, and are still entitled to submit Full Applications. Additionally, the OCED held a webinar on June 7, 2023, for participants to hear directly from the office.

Figure 4.8. Projects submitted to the IDERD programme



Note: 99 Concept Papers requesting more than $15 billion in federal funds were submitted under Topic Area 1:Near-Net-Zero Facility Build Projects; 187 Concept Papers requesting more than $40 billion in federal funds were submitted under Topic Area 2: Facility-Level Large Installations and Overhaul Retrofit Demonstrations; 125 Concept Papers requesting more than $5 billion in federal funds were submitted under Topic Area 3: System Upgrades and Retrofits for Critical Unit Operations or Single Process Lines.
Source: DOE

The final application deadline was 11 August 2023, and the DOE expects to select projects for award negotiations in winter 2023/2024. Therefore, the programme's timeline is streamlined and encourages project developers to prepare a full project proposal in 5 months. The programme's application process works as a de-risking mechanism itself, both for the DOE, to successfully implement resources to the most promising technologies and projects, and also for project sponsors and investors, which after the application process, end up not only with the grant and project support, but also with a DOE-validated technology and project.

This mechanism is highly replicable and ready to implement public funding for other projects and sectors of the economy. According to the programme's FOA, "replicable projects that can be deployed with urgency will be best positioned to catalyse follow-on investments to yield the most significant carbon reductions across the industrial sector in the next few decades."

Case study 6: Results-based loans - Inter-American Development Bank

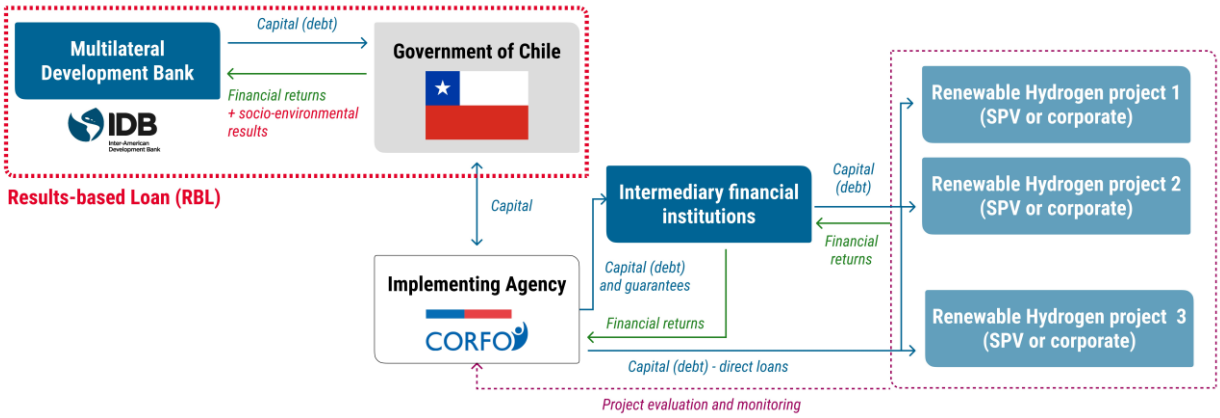
Financial instrument description

The Government of Chile and the Inter-American Development Bank (IDB) have created a USD 400-million financing programme with the strategic objective of contributing to the development of the green hydrogen and derivatives industry in Chile, to further the decarbonisation of its economy (IDB, 2023[74]).

The specific development objectives are divided into two components:

1. to promote private investment in green hydrogen and derivatives projects (USD 350 million)
2. to expand the supply of public inputs for the green hydrogen and derivatives industry and foster domestic demand for such products (USD 50 million).

Figure 4.9. Results-based loan structure



Source: IDB

The "Loan based on results" (LBR) is a public sector sovereign-guaranteed loan in which disbursement of funds are directly linked to the achievement of predefined, sustainable results. These results, and therefore disbursements, are monitored by an independent party. The aim is to help countries improve the design and implementation of their own (new or existing) development programs and achieve lasting results by strengthening good governance and fostering a management culture based on results.

In this case, the borrower is the national Government of Chile, and the executing agency is Chile's Production Development Corporation (CORFO), which is an independent public institution in charge of promoting competitiveness and product diversification. The loan is structured and capitalised 100% by the IDB through ordinary capital, utilising a Flexible Financing Facility (FFF) of up to USD 400 million, with a disbursement period of 6 years, a total amortisation period of 24 years (weighted average life 15.25 years), including a 6.5-year grace period on repayments. Under the flexible repayment options of the FFF, changes to the grace period are permitted provided that they do not entail any extension of the original weighted average life of the loan, or the last payment date as documented in the loan contract. The interest rate is SOFR-based[19] and denominated in USD.

CORFO will structure the different components of the loan according to the objectives established for each component, as follows:

- For Component 1, CORFO will develop specialised financial instruments to support investments in the renewable hydrogen value chain. These instruments will provide credit lines and coverage (guarantees), directly and indirectly to Tier I financial institutions (mainly commercial banks, but also credit unions and stock corporations and funds). Allocation criteria, as well as eligibility and financial characteristics of the instruments will be defined by CORFO at the time of programme implementation.

[19] The Secured Overnight Financing Rate (SOFR) is a benchmark interest rate for dollar-denominated derivatives and loans. It is a broad measure of the cost of borrowing cash overnight collateralised by US Treasury securities.

- For Component 2, CORFO will use its existing development promotion instruments to promote specific objectives such as establish and increase hydrogen demand by end users, training programmes, promotion of innovation and entrepreneurship. This Component, which will count for 12.5% of the total amount of the programme, will be structured as a mix of specific credit lines, subsidies and technical assistance.

This loan includes several socio-environmental contractual conditions to be met prior to and during the execution of the loan, such as: the number of hydrogen and derivatives projects to reach social and environmental permitting; the number of MW of electrolysis capacity installed in the country; renewable hydrogen demand committed by private corporations; the number of employees directly working in the hydrogen and derivatives industry; and R&D investment in hydrogen technologies and processes, etc.

Supported project(s) description

In 2020, the Government of Chile approved its National Green Hydrogen Strategy (Ministry of Energy, Government of Chile, 2020[75]), in which three main avenues are targeted to foster industrial development: the decarbonisation of local energy demand; the decarbonisation of the industrial sector; and substantial industry growth to become a hydrogen and derivatives exporter. Thus, the programme aims to encourage investments in the Chilean industrial sector, mainly focused on the energy sector (power and transport sectors), and in hard-to-decarbonise industries such as fertilisers, chemicals, steel and the prominent mining sector.

Specifically for the energy sector, facilitating the integration of intermittent renewable electricity into the electric power grid is a strategic goal of the programme, aiming to incorporate 5 GW of installed infrastructure capacity by 2025, and 25 GW by 2030. This infrastructure includes electrolyser capacity for hydrogen and its derivatives (ammonia, synthetic fuels, and others). Due to prior experience of CORFO and the IDB in similar programmes, it is expected that each financial operation under Component 1 would be around USD 50 million per project.

Component 2 will offer several instruments to support the green hydrogen value chain, such as credit and subsidies to technology service companies, that will be able to serve industrial and manufacturing companies to help design and execute innovative projects to incorporate hydrogen in their value chains. These projects are capped at USD 4 million and incorporate technical assistance from CORFO. Training programmes and innovation programmes for R&D are capped between USD 240 thousand and USD 480 thousand, with a subsidy component of between 40% and 80%.

The IDB is a Multilateral Development Bank (MDB) supporting the economic and social development of Latin America and the Caribbean (LAC) countries. Founded in 1959, the IDB has 48 sovereign states as members and shareholders, and it is headquartered in Washington, DC. This programme is the IDB's first renewable hydrogen-targeted investment operation, which is very relevant for the LAC region. With this programme, the IDB aims to promote private investment in the hydrogen sector, while incorporating the necessary public input to ensure the optimal socio-economic development.

Besides its traditional public-sector lending institution (IDB), the design of the project included participation of its private sector branch (IDB Invest) and its innovation hub (IDB Lab). IDB Invest has experience in mobilising the private financial sector to finance large-scale infrastructure works, particularly energy, while IDB Lab has supported several renewable energy, energy efficiency, and e-mobility initiatives in Chile to improve the competitiveness of small businesses and spur the innovation ecosystem.

Impact of the solution on the project(s)

Chile is in a privileged position as it has abundant renewable natural resources, such as solar energy in the north and wind energy in the south, as well as offshore. However, the financial system's current state of development does not facilitate the development of bankable project portfolios that exploit these

conditions, making it difficult for investments in GH2 production to materialise. According to data from the International Energy Agency (IEA), the country has 26 projects, but only four have made the investment and are in the construction or operation stage, with limited electrolysis capacity.

Through the implementation of this programme, the Government of Chile is aiming to tackle the main financial barriers faced by renewable hydrogen generation projects, which are linked to risks and uncertainties inherent to an industry in its early stages. On one hand, the track record of GH2 projects is limited in Chile and in Latin America and the Caribbean (LAC). Therefore, providing lower-cost financing specifically targeted to early-movers in the industry would accelerate project deployment, increase operational track record and lower risk perception by mainstream investors and other institutions providing conventional financing.

On the other hand, technology costs and performance uncertainties prevent investors from accelerating FIDs and they are taking a more conservative approach by waiting until the technology reaches maturity. In this sense, technical assistance programmes for project development companies and financial institutions would complement the financing programme, by validating technologies and business models, performing pilot projects, and building due diligence capabilities in the banking sector to further promote the adoption of this and other financing programmes. The IDB has been assisting national governments across LAC to increase technical capabilities of the public sector, including the improvement of regulations and permitting processes, and providing technical assistance for renewable hydrogen roadmaps, strategies, and pre-feasibility studies.

Other advantages compared to conventional financing are the financial and non-financial collaboration with capacity building, such as including training programmes for strengthening the institutional capacity of the implementing agency (CORFO), as well as other research, development and innovation programmes, and including socio-economic national priorities, defining equity and gender equality objectives.

Lessons learnt and replicability

This financing programme is in early stages of implementation. However, from similar programmes the IDB has already deployed across the LAC region, it has been seen that the role of the public sector in generating public initiatives is key to creating enabling conditions for the development of strategic industries at national level. Private investments can be supported by concessional financing and other types of interventions to maximise the positive socio-economic and environmental impact of an entire industry. For that, blended finance and the support from multilateral development banks (MDBs) and national institutions such as CORFO, play a relevant role in designing programmes and sourcing different types of capital.

Credit lines and guarantee funds backed by public institutions, especially with sovereign-guaranteed loans from MDBs, are currently being utilised in different countries of the region to accelerate national renewable hydrogen agendas. Examples in the LAC region include Colombia, Ecuador, Uruguay, and Trinidad and Tobago. Therefore, there is room for further replicability of the program in countries where public interests are aligned with the development of a hydrogen economy.

Case study 7: Loans - Inter-American Development Bank

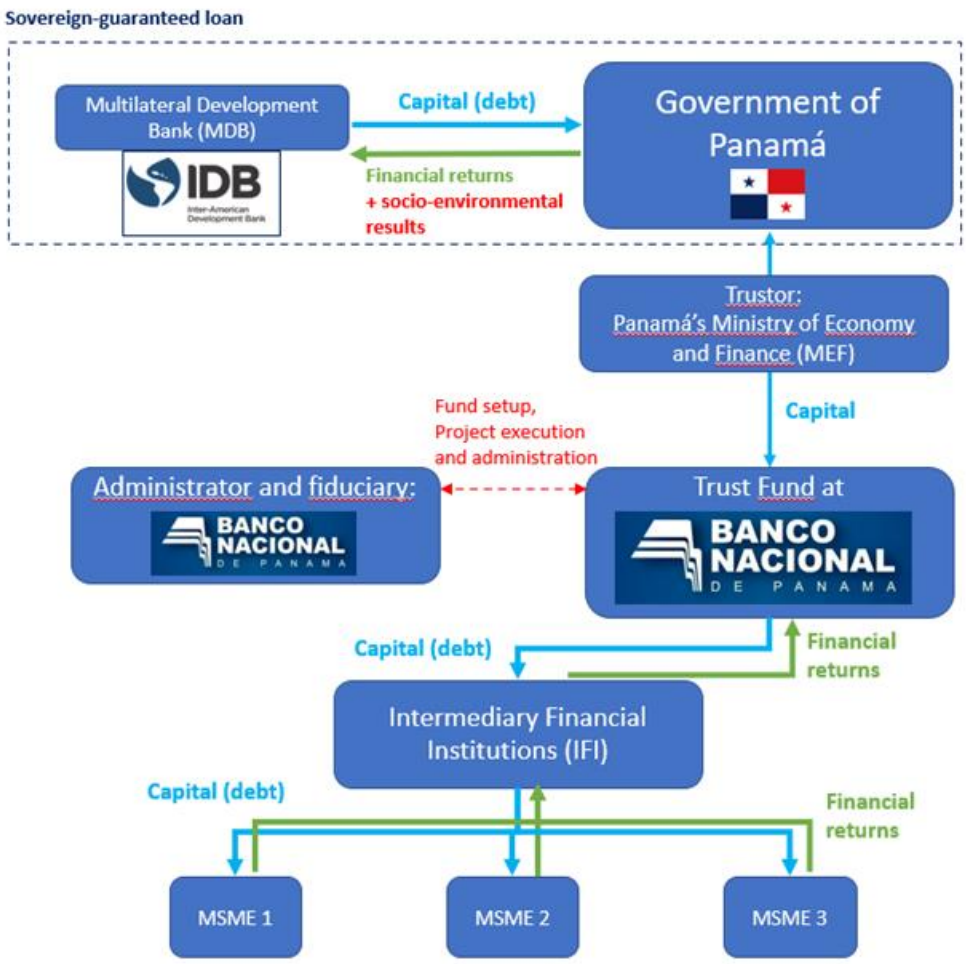
Financial instrument description

The general objective of the Global Credit Program for Sustainable Economic Recovery is to foster a sustainable post-COVID economic recovery in Panama, by supporting investments to increase the productivity and sustainability of Panama's productive fabric, especially in micro, small and medium-sized enterprises (MSMEs). The total programme size is USD 160 million and it is currently under

implementation. Project preparation was performed during the second half of 2022 and the Loan agreement was signed in April 2023 (IDB, 2023[76]).

This credit line, structured by the Inter-American Development Bank (IDB), helps to increase financing alternatives to Panamanian MSMEs through medium- and long-term financial products that contribute to a sustainable economic recovery while incorporating a gender perspective. This programme complements the Global Credit Program for Promoting the Sustainability and Economic Recovery of Panama (5251/OC-PN), approved in March 2021 for USD150 million and already disbursed, which was intended to provide short- and medium-term lines of credit to help businesses recover from the worst effects of COVID-19.

Figure 4.10. Structure of the loan



Source: IDB

Global Credit Loans (GCL) are public sector, sovereign-guaranteed loans from the IDB that provide financial resources to MSMEs or subnational entities (such as cities and states) to finance projects in strategic sectors to promote economic and social development. The funding is indirect: the IDB extends funding to a first-tier private or public intermediary financial institution, which in turn provides funding to a second-tier public financial institutions, such as private commercial banks and microfinance institutions, which then lends to MSMEs or subnational entities. In this case, the borrower is the Republic of Panama. The Ministry of Economy and Finance (MEF) acts as trustor, and the executing agency is Banco Nacional

de Panamá (BNP), which executes the programme via a trust fund. BNP is also in charge of the administration and monitoring of the programme's results.

The USD 160-million financing facility, funded 100% by the IDB through ordinary capital, has a disbursement period of 3 years structured via a procurement plan, which is agreed by the IDB, the MEF and BNP. The grace period is 3.5 years, and the amortisation period is 20 years. The loan is nominated in USD and the interest rate is SOFR-based. Under the flexible repayment options of the facility, changes to the grace period are permitted if it does not entail any extension of the original weighted average life of the loan, or the last payment date as documented in the loan contract. Sovereign-guaranteed loans by multilateral development banks (MDB) are usually beneficial in terms of interest rates, tenors and collaterals, compared with traditional loans made by commercial financial institutions.

Supported project(s) description

This credit line is intended to develop innovative, low-cost lending instruments to MSMEs to specifically focus on sustainability projects. These instruments will be designed and commercialised by different first-tier financial institutions, mainly commercial banks. For example, these instruments may provide funding to:

- increase production capacity and efficiency in the manufacturing sector
- incorporate sustainable practices in agriculture and food production processes, including circular economy initiatives
- promote energy efficiency and the utilisation of renewable energy in the services and commercial sectors.

According to the IDB's funding proposal, priority will be given to MSMEs in the agriculture, commerce and service sectors, as they are key to the country's economy and directly contribute to carbon emissions. There is huge potential for decarbonisation in these sectors in Panama. The country has an estimated 85,000 MSMEs, accounting for 95% of all businesses and 51% of all formal-sector jobs. Microenterprises account for 59% of Panama's businesses and employ 15% of the workforce; small enterprises for 35% of all businesses and 30% of the workforce; and medium-sized enterprises for 2.1% of all businesses and 6% of the workforce. In 2016, MSMEs grossed some USD 6.5 billion in revenues (17% of GDP).

In terms of project size, the average loan amount is estimated at USD 40 thousand, and the maximum loan amount has been established in USD 500 thousand. Specific conditions for eligibility and other details are structured through particular credit regulations, agreed in advance by the IDB and the Government of Panamá.

The IDB has been actively collaborating with Panama's financial and industrial sector development through other programmes, such as the Sustainable and Inclusive Agricultural Innovation, whose objective is to help smallholder farmers make their farms more sustainable and profitable. The private arm of the IDB Group (IDB Invest) has also active financing and guarantee programmes in Panama. One of the most relevant is a risk-sharing facility for the tourism sector.[20]

Founded in 1904, BNP is an autonomous state-owned financial institution with administrative and budgetary autonomy. It is subject to the oversight of Panama's executive branch and supervisory bodies. BNP is Panama's financial agency and supplies first- and second-tier financial products. With a network of 42 branches, BNP covers every department in Panama, mainly serving the agriculture, service and commerce sectors. As of 31 March 2022, the agriculture, commerce and industrial sectors (specifically in operations with MSMEs) jointly account for 47% of the total portfolio.

[20] IDB Invest, Panama Support Tourism Recovery with Financial Guarantees.

Due to its geographical location, its condition as a second-tier bank and its presence among the MSME sector, BNP is a very relevant stakeholder to increase chances for successful project implementation.

Impact of the solution on the project(s)

While investment opportunities in decarbonisation and energy efficiency are available for most Panamanian enterprises, smaller businesses have special potential due to the crucial role they play in growth, diversification of production and job creation. However, currently, Panama's MSMEs are constrained in their ability to make sustainable production-related investments. These constraints include: (i) limited access to long-term financing for upgrading production processes; (ii) highly limited financial products aimed specifically at sustainable investment projects with improved financial conditions; and (iii) a gender gap that particularly hinders access to financing for women-owned or -led MSMEs. Given the objective, characteristics and the defined prioritised recipients, this funding facility will help to tackle these constraints and provide financing with improved conditions for relevant stakeholders.

Other challenges that are currently contributing to a low penetration of financing activities for decarbonisation projects in MSMEs are a lack of financial education and access to the required information especially for microenterprises. Furthermore, and despite the fact that Panama's banking system has remained liquid and well capitalised during the pandemic-related shock,[21] traditional financing resources for smaller enterprises has remained low, especially without targeted interventions by the national government and MDBs. This can be related to credit requirements that are difficult to meet for MSMEs, especially guarantees, and high transaction costs for loan provision of smaller amounts.

The improvement of certain conditions could complement this and other financing resources and accelerate its implementation, such as strengthening regulations in terms of financial contracts, particularly recovery processes in terms of insolvency, and helping second-tier financial institutions to increase technical and financial expertise for risk assessment in decarbonisation projects.

Lessons learnt and replicability

This financing programme is in the early stages of implementation. However, the IDB has wide expertise and experience in designing sovereign-guaranteed loan programs to enhance access to financing for MSMEs through financial intermediaries. The Global Credit Program for Promoting the Sustainability and Economic Recovery of Panama, which is the predecessor programme, provided very positive results and this second programme is intended to strengthen its outcomes. According to the IDB, as of mid- 2022, this programme has benefited more than 4,100 MSMEs (of which 61% are microenterprises, 25% are small enterprises, and 14% are medium-sized enterprises) in various areas of Panama through 31 financial intermediaries (banks, co-operatives and finance institutions) while restoring more than 16,500 jobs. These enterprises are concentrated mainly in agriculture (sale of grains, fruits, vegetables, and food processing), retail commerce (grocery stores, sale of cleaning products), and services (lodging and restaurants). Currently, BNP is offering 10-year loans specifically targeted to purchase solar photovoltaic systems for MSMEs and individuals,[22], with more flexible guarantees. Other initiatives that are currently in place in Panama for investments in sustainability measures have been established by commercial banks, such as Banco General[23] and Banistmo (Bancolombia group).

In Panama and other countries in LAC, co-ordination with private sector associations is key for accurate prospecting and analysis of proposed financing programmes. In Panama, institutions such as the ABP

[21] Article IV Consultation. International Monetary Fund (IMF). 2021.

[22] https://www.banconal.com.pa/prestamos/paneles-solares.html.

[23] https://www.bgeneral.com/empresas/financiamiento-paneles-solares/.

(Panama Microfinance Network, and National Association of Financial Institutions), has been important to validate current needs from MSMEs and the financial sector. The ABP and other private-sector led institutions have helped in the design of the financing facility. Moreover, co-ordination with the MEF and sector-specific ministries has helped to prioritise the targeted sectors, by taking into account economic activities that are most important to the national economy and have the greatest demand for this type of financing.

The lessons learned by BNP as the executing agency of previous financing programmes (5040/OC-PN and 5251/OC-PN) contribute to ensure efficient execution of this operation and fulfillment of its objectives. BNP's ability and expertise in interagency co-ordination with the Ministry of Economy and Finance (MEF) and other ministries and government entities has been key to accelerate approval and signature of loan contracts, as well as approvals of changes to the Credit Regulations to streamline execution and reach more MSMEs more quickly.

Credit lines and guarantee funds backed by public institutions, especially with sovereign-guaranteed loans from MDBs, are widely utilised in different countries of the region to accelerate national development targets, and provide support to MSMEs decarbonisation and best practices. Successful examples are past programmes with Bancoldex, Colombia's second-tier development bank and the Brazilian National Bank for Social and Economic Development (BNDES). This program has demonstrated that it is replicable and still has room to be implemented in other countries of the LAC region.

Case study 8: CO_2 Removal Certificates (CORCs) - Puro / NetZero

Financial instrument description

Carbon dioxide removal (CDR) is the process of removing carbon dioxide (CO_2) from the atmosphere and storing it durably in geological, terrestrial or ocean reservoirs, or in products.[24]

Implementing CDR can provide a source of revenue through CO_2 Removal Certificates, which can be sold in carbon markets or bilaterally. High-quality CDR sell as carbon credits at a price range of EUR 150-200 per ton of CO_2. CDR solutions have various storage timescales, financial costs, trade-offs, risks and co-benefits, all of which can influence the value of CO_2 Removal Certificates.

CO_2 Removal suppliers need to follow four main steps to obtain and sell CO_2 Removal Certificates (CORCs), as per the Puro Standard process (see Figure 4.11):

1. A supplier provides a Lifecycle Assessment (LCA) or Environmental Product Declaration (EPD) attesting that its product has absorbed more CO_2 that it has emitted.
2. Based on this evidence, independent assessors[25] verify compliance to Puro Standard methodology requirements. This includes a visit of the production facility, data validation and issuing an audit statement.[26]

[24] This can be achieved through natural and technological solutions. Nature-based solutions include afforestation, soil carbon sequestration and wetland restoration. Technological solutions include carbon storage in products and materials (e.g. wood construction), CO_2 capture from a biogenic source, or directly from the atmosphere and transport of the carbon to a long-term storage location. All pathways that limit global warming to 1.5°C with limited or no overshoot require the use of CDR on the order of 100–1000 billion tonnes (Gt) of CO_2 over the 21st century (IPCC), given that even with massive efforts to reduce emissions at the source, humanity will continue to emit at least 5 to 10 Gt CO_2 equivalent every year by 2050, from agriculture, transport, and some industrial processes.

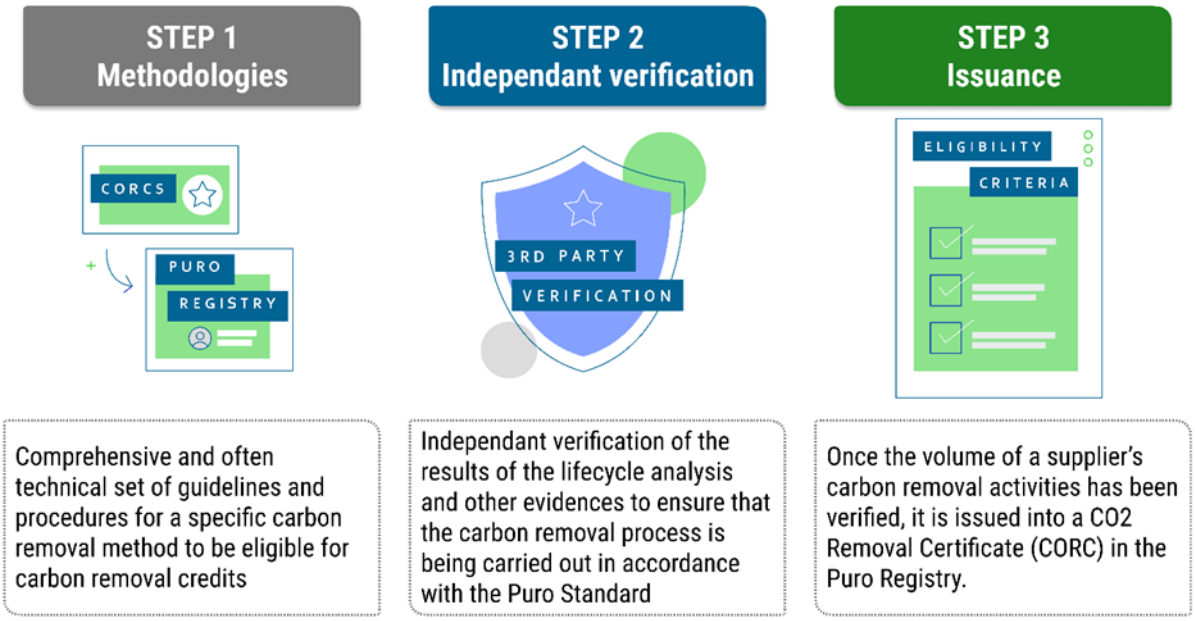
[25] Such as DNV GL, Bio Inspecta and Energy Link Services.

[26] Puro.earth covers the costs of verification.

3. A CORC is issued for every verified metric tonne of CO_2 removed and stored durably.
4. Accredited CORC suppliers can sell their CORCs through bilateral agreements or a third-party marketplace.

Buyers of the CORCs, also called beneficiaries, can claim the carbon removals to support their sustainability or net zero pledges, once the CORCs are retired. The CORCs that have been retired and the projects that issued them are available on the publicly available Puro Registry to ensure transparency and avoid double counting.

Figure 4.11. Puro Standard – Carbon Crediting Certification Process description



Source: Authors; based on Puro's communication document.

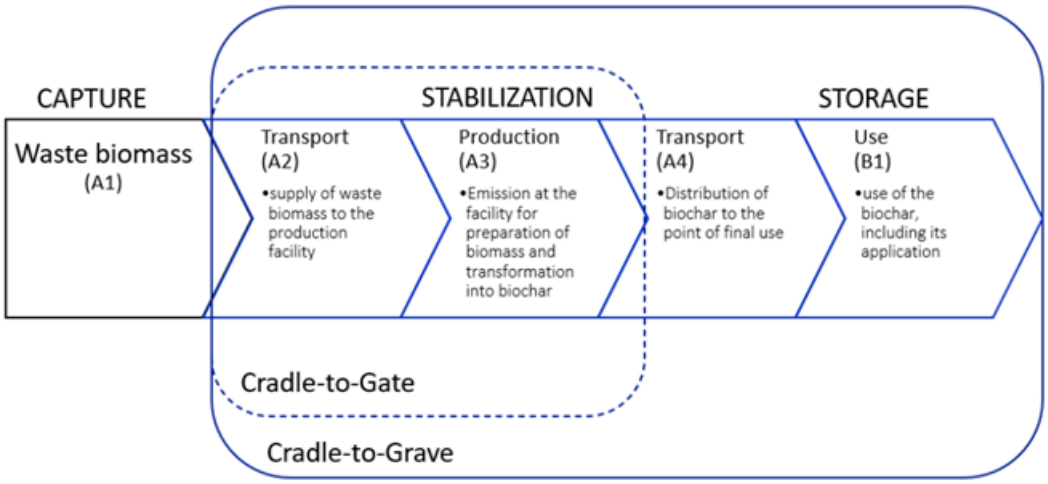
Supported project(s) description

Puro.earth is a carbon-crediting platform for engineered carbon removal solutions, developed in 2018 as an intrapreneurship project by Fortum, a Finnish state-owned energy company. Nasdaq acquired a majority share of the company in 2021. Puro.earth certifies projects from CO_2 Removal suppliers based on an in-house standard,[27] created by a working group of scientific and industry experts together with an external advisory board.

Puro.earth ensures alignment with the Intergovernmental Panel on Climate Change (IPCC) definition of CDR. Currently, its removal methodologies are limited to Biochar, Carbonated Building Elements, Geologically Stored Carbon, Enhanced Rock Weathering and Woody Biomass Burial. The certification methodology notably ensures that the feedstock is sourced sustainably, that only the stable share of carbon (100+ year lifetime) is accounted for and that all the value chain emissions are deducted (see Figure 4.12). For instance, the Biochar Methodology released in 2022 states that the biochar must only be used for non-combustion purposes, to guarantee that the carbon that was captured stays out the atmosphere.

[27] Accredited by the International Carbon Reduction and Offset Alliance (ICROA).

Figure 4.12. Overall System Boundary for life cycle assessment of a biochar activity produced from waste biomass



Source: Puro's communication document.

NetZero is a French company founded in 2021 and is one of the 38 carbon removal suppliers today identified in Puro.earth's CORC suppliers listing. The company extracts the carbon contained in agricultural residues to produce biochar, also generating electricity surplus in the process. The biochar is sold to local farmers and agricultural companies as a soil amendment that durably improves water and nutrient retention, thus reducing the need for fertilisers while increasing crop yields. The generated electricity is dispatchable and renewable and is sold locally. In April 2022, NetZero was selected by the Musk Foundation in the 15 milestone winners in the XPRIZE Carbon Removal competition.

The company develops projects in emerging and developing economies, pursuing both climate and social objectives. Tropical zones represent a key market for its biochar, given the large amount of non-valorised agricultural residues and the soil acidity. Its full-scale pilot plant was built in Nkongsamba (Cameroon), next to Synergie Nord Sud (SNS), a large coffee-processing plant. This location gives NetZero a direct access to coffee husks, an abundant waste product of coffee transformation, and facilitates the distribution of the biochar to small coffee growers that supply SNS. Its production capacity can reach two thousand tonnes (kt) of biochar per year. The company's second production plant was inaugurated in 2023 in Lajinha (Minas Gerais, Brazil) and will also use waste products of coffee to produce up to 4.5 kt of biochar per year.

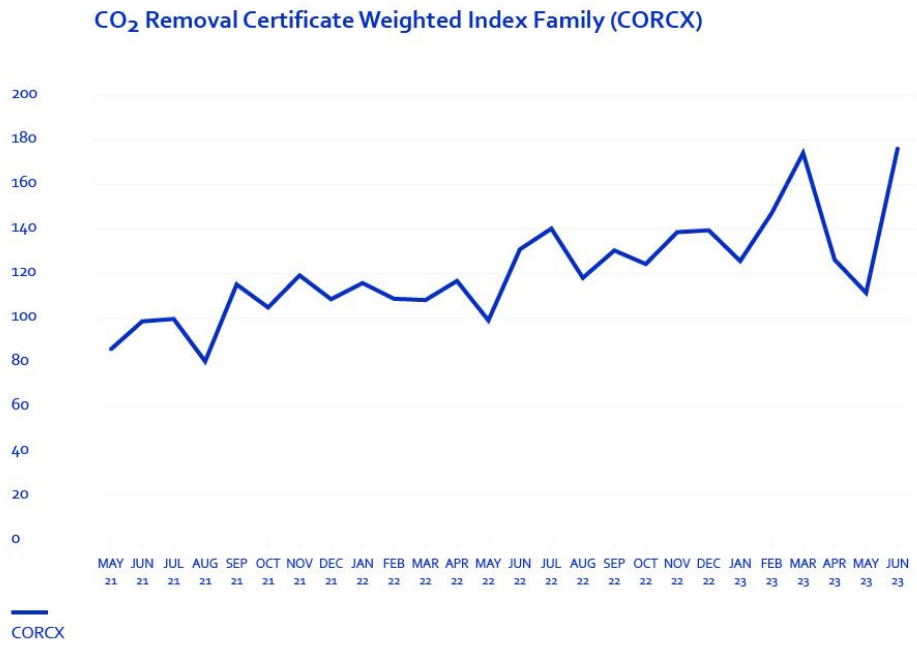
Impact of the solution on the project(s)

Since the sale of biochar and electricity is insufficient to build a robust economic model, the company relies on carbon credits to reach profitability, through CORC sales that represent roughly 50% of the projects' revenues, primarily supplied to corporates in Europe and North America. While the corporates' priority should always be to reduce their own emissions at the source, they can use CORCs to neutralise residual emissions and support their net-zero claims. Thus, NetZero's policy is to provide CORCs only to companies with credible net-zero roadmaps, for instance meeting the criteria set by the Science Based Targets initiative (SBTi). Higher CORC prices also gives the opportunity for NetZero to subsidise the selling price of biochar for farmers, whose purchasing power is often limited in the geographies where NetZero operates.

NetZero relies on the recognition of its high-quality CDR to sell carbon credits at a price range of EUR 150-200 per ton of CO_2.[28] While this value is higher than the prices observed in most carbon markets, it is comparable to the weighted average of transactions for CORC obtained by biochar projects and certified by Puro.earth (see Figure 4.13).[29] Puro.earth covers the certification costs, and gets a fee on transaction fees when volumes are exchanged.

Figure 4.13. CORC Carbon Removal Price Index evolution

Volume-weighted average price of transactions between June 2021 and May 2023



Source: Puro's communication document.

Lessons learnt and replicability

NetZero completed the Lifecycle Assessment (LCA) of its first facility in two months and obtained certification in October 2022, after a 5-month process. The certification process takes places after the plant is fully constructed and operational, with an audit to check calculated LCA parameters against reality.

The CORCs were negotiated on a bilateral basis with a few companies taking long-term purchase commitments, including Boston Consulting Group (BCG) and Rothschild & Co. While a buyer raised a minor concern because Puro was a new certification standard with limited tracking record, it still proceeded with the transaction, after confirming the robustness of the certification methodology of high-permanence carbon removal projects with measurable processes. Since then, the ICROA endorsement of the Puro standard in 2023 has increased buyers' confidence.

[28] Indicative range mid-2023.

[29] The higher price also reflects the fact that the carbon is removed from the atmosphere for a guaranteed minimum of 100 years.

NetZero's second plant in Brazil should be certified by the end of 2023. The company has already started the construction of a third plant, also in Brazil, and has a pipeline for more plants to be built in 2023 and 2024, replicating a similar business model as for the Cameroon plant.

Based on NetZero's first projects, one tonne of biochar sequesters between 1.5 and 3 metric tons of CO_2 equivalent over a 100-year period. The first two plants of NetZero having a total capacity of 6.5 kt per year, this corresponds to 9.75-13 kt of sequestered CO_2, i.e. less than 0.001% of the projected residual emissions of 5-10 Gt CO_2-eq by 2050. As the global CDR potential of biochar is estimated at a few Gt of CO_2-eq, the market potential for scalability is significant.[30]

Enabling conditions are needed to foster a rapid scale-up of high-quality CDR solutions in the next decades. First, liquid markets for carbon credits would provide more transparent pricing information to the various grades of CDRs, and a range of price-management instruments (such as forwards or derivatives) could emerge, leading to better visibility and risk management for buyers. Second, visibility on tax and regulations help investors in establishing viable business plans, enabling more capital to flow into the industry, thus building scale. Lastly, clear roadmaps from governments, including sectoral emissions and compensation targets would provide a long-term view on the demand side. For instance, in France, the Climate and Resilience law issued in 2021 requires carbon emissions offsetting for domestic flights.

Case study 9: CAPEX grants - EBRD

Financial instrument description

FINTECC (Finance and Technology Transfer Centre for Climate Change) is a multi-scope support programme created by the European Bank for Reconstruction and Development (EBRD) that helps governments and companies to implement innovative climate technologies through different mechanisms. It has been created as part of a global initiative, as the 2010 United Nations Framework Convention on Climate Change Conference of the Parties mandated Multilateral Development Banks (MDBs) to establish regional technology transfer centres. It benefitted from initial funding from the Global Environment Facility's Long-Term Program on Technology Transfer.[31] As the EBRD's regional technology transfer centre, FINTECC supports businesses in implementing climate technologies and supporting climate technology transfer across different regions and sectors.

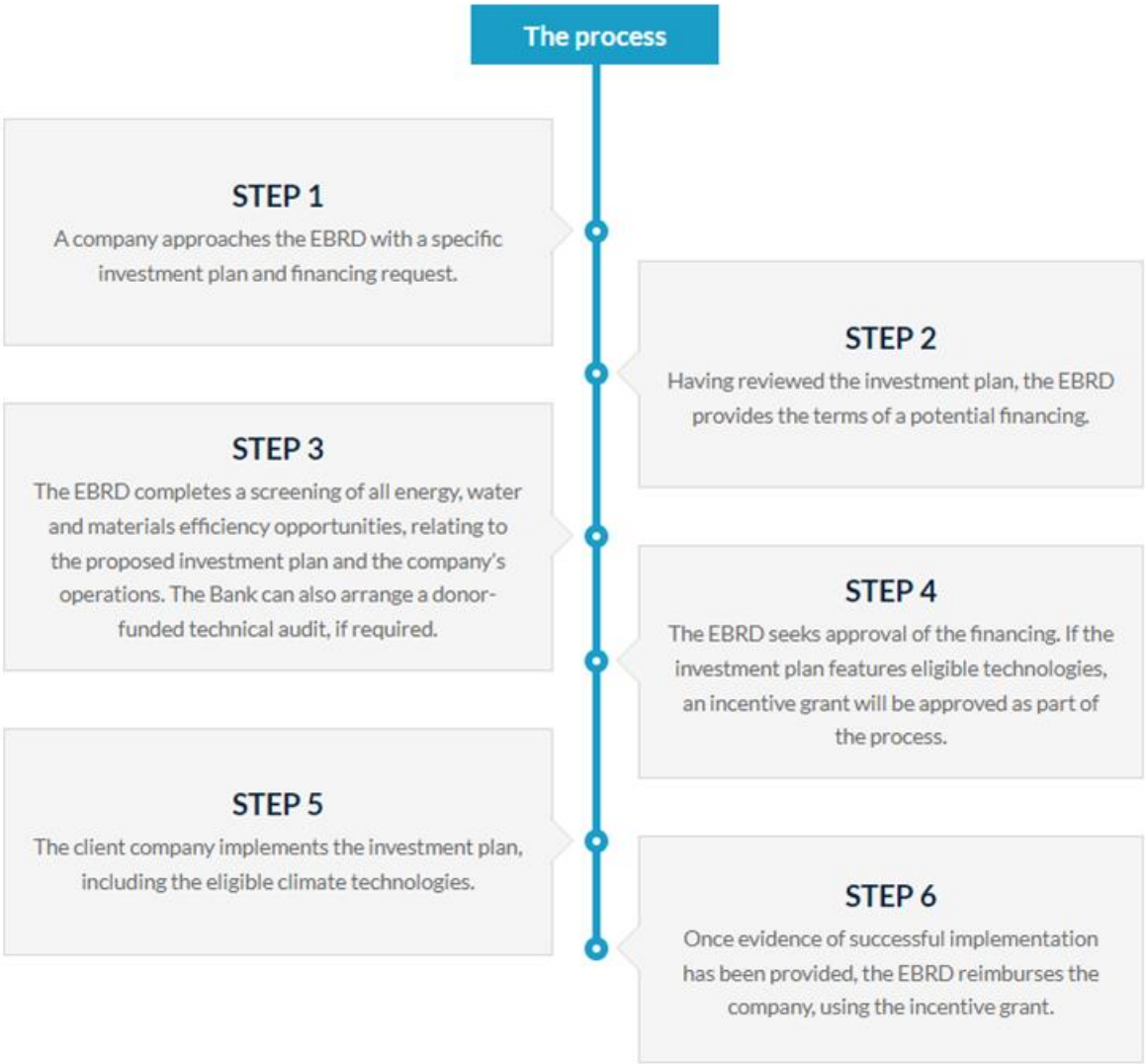
EBRD customers can apply for FINTECC support to complement traditional EBRD financing. Incentives provided by FINTECC aim to strengthen the project's business case and improve economics. FINTECC provides investment, policy and technical support. Through the investment support, customers benefit from direct CAPEX grants to implement climate technologies in countries where significant implementation risks are present, such as the lack of regulatory frameworks, markets and supply chain risks or technology risks. These grants support demonstration projects that implement the best available climate technologies, within a specific sector and country. EBRD provides a preliminary assessment of a project's eligibility upon customer's application. Whilst this is determined on a case-by-case basis, eligible climate technologies are defined by low market penetration and good replicability potential.

[30] The global CDR potential of biochar is estimated to vary between 0.65 and 35 Gt CO_2-eq per year, a wide range explained by different assumptions on the biomass resources available for biochar production (Azzi, Karltun and Sundberg, 2021[85]) (Tisserant and Cherubini, 2019[86]). Most reports present a range of 1-3 Gt CO_2-eq per year, e.g. "annual net emissions of carbon dioxide (CO(2)), methane and nitrous oxide could be reduced by a maximum of 1.8 Pg CO(2)-C equivalent (CO(2)-C(e)) per year" (Woolf et al., 2010[87]).

[31] More information about the Poznan strategic and long-term programme for technology transfers can be found at: https://www.thegef.org/sites/default/files/publications/GEF_PoznanTT_lowres_final_2.pdf.

The proportion of grants within the overall capital costs of a technology is usually calculated using set calibration criteria. Grants are normally also subject to an absolute cap that can vary slightly between regions. For example, repayable grants in Southern and Eastern Mediterranean countries are targeted to technology improvement projects that would achieve energy, water or materials efficiency. These grants could sponsor up to 25% of the total technology CAPEX, with a cap of EUR 400,000.[32]

Figure 4.14. FINTECC process for investment support



Source: EBRD-FINTECC documentation

[32] https://fintecc.ebrd.com/region/semed.html

In addition, the scope of FINTECC's technical and policy programme is defined for each country or group of countries and based on their specific needs:

- Technical support is generally provided to companies working in high-risk sectors with significant climate mitigation potential. Pre-feasibility and feasibility studies, sectorial market assessments, and early-stage project development activities are provided to improve conditions for project implementation. In general, these activities are performed by highly skilled sectorial specialists and experienced companies in more mature markets, boosting technology transfer and capacity building.
- Policy support is provided to identified countries which show high potential to transform a specific sector, but where country or regulatory risks are present. This can include country-wide sectorial assessments to quantify climate mitigation potential, preparing or upgrading regulatory frameworks for climate, such as energy efficiency standards. Furthermore, in some countries the programme has participated with technical support to establish climate and carbon emissions targets and mandates.

Supported project(s) description

The FINTECC programme is active in 17 countries: Early Transition Countries (Armenia, Azerbaijan, Georgia, Kyrgyz Republic, Moldova, Mongolia, Tajikistan, Turkmenistan and Uzbekistan), Southern and Eastern Mediterranean countries (Egypt, Jordan, Lebanon, Morocco and Tunisia), and Kazakhstan and Ukraine. The beneficiary countries cover various areas within the overall EBRD region of operations.

Eligible projects must seek to implement technology with significant impact in carbon emission reductions or resource efficiency. There is no list of specific subsectors that are targeted by the programme, but technologies in demonstration phase, which are in early stages of market adoption, and with potential for replicability and scale-up are prioritised. Eligible climate technologies include Greywater recycling and rainwater harvesting, on-site renewable energy, cogeneration and trigeneration systems, advanced heat recovery systems in industrial applications or LED lighting and advanced energy management systems.

Impact of the solution on the project(s)

Along with conventional project financing, EBRD's FINTECC provides financial and technical resources to investors to improve manufacturing efficiency and lower implementation and operational costs, while lowering carbon emissions. During the project financing process, the EBRD's in-house energy and water efficiency specialists review the energy, water and material efficiency potential of the clients' operations and assist in identifying the best way to support them in implementing investment opportunities.

Water scarcity is a major concern in several FINTECC countries, impacting operations in sectors such as agriculture and manufacturing. Including water scarcity risk assessments at an early stage of the project can provide relevant information to lower perceived risks. FINTECC grants, concessional loans and technical assistance, facilitates feasibility studies, including water use efficiency and resiliency.

FINTECC also works as a knowledge-sharing platform between different sectors in countries where EBRD is active. Communication of success cases, best manufacturing practices and demonstration of innovative climate technologies have improved access to finance for projects in countries where there is still a lack of understanding and knowledge about different resource-efficient technologies.

Lessons learnt and replicability

The FINTECC programme has been under implementation since the early 2010s, with numerous success cases. FINTECC grants and technical assistance allowed companies in different sectors, such as food, materials, pharma and others, to improve manufacturing investment projects on a climate perspective.

Assistance in the project preparation phase, especially with resource efficiency assessments, has been a proven tool to better direct EBRD loans to climate-positive projects, achieving high impact at relatively low cost for the bank.

The FINTECC programme has also contributed to de-risk innovative climate technology through demonstration projects. It has been proven that the lack of understanding of new technologies and its associated profitability and risk is one of the main barriers for successful implementation of innovative climate projects.

Policy support to prepare and upgrade adequate regulatory frameworks in several countries has also been paramount to boost technology transfer and project implementation. Regulation such as energy performance standards, energy efficiency action plans, and environmental monitoring, verification and enforcement processes, has paved the way to increase climate project pipelines and improve project economics.

Training programmes are helping local consultants learn more about climate technologies, notably in the industrial sector. This is instrumental for these consultants to provide more effective support for local clients and projects.

Case study 10: (Concessional) loans and grants - Green Climate Fund / EBRD

Financial instrument description

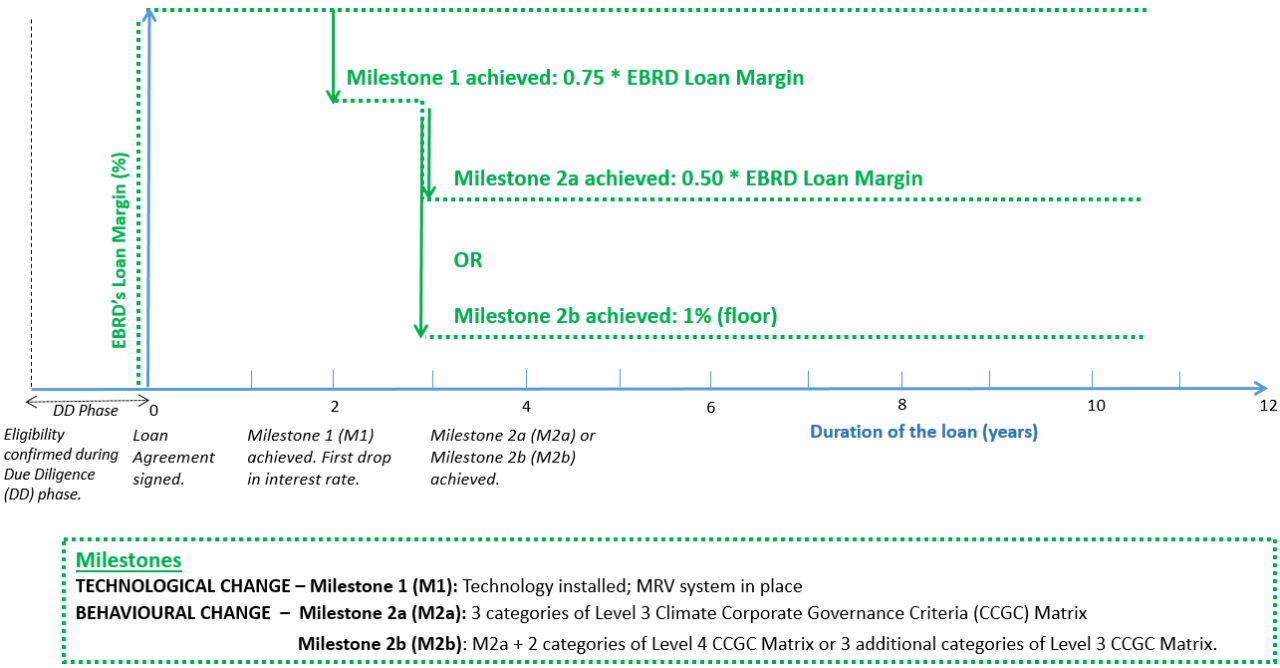
The objective of the High Impact Programme for the Corporate Sector (HIP) is to collaborate in the implementation of climate change mitigation projects, by fostering the uptake of low-carbon technologies in the corporate sector of seven selected countries (Armenia, Kazakhstan, Jordan, Morocco, Serbia, Tunisia and Uzbekistan) with the provision of technical co-operation and access to sustainability linked loans. In addition, the programme is helping countries to adopt country and sector-level roadmaps, providing proven approaches to address specific challenges that corporates are facing to establish and implement decarbonisation projects. HIP aims to reduce emissions by 17 million tonnes of carbon dioxide equivalent in 20 years. The total programme size is approximately USD 1 billion, and it is currently under implementation. The partnership agreement between the Green Climate Fund (GCF) and the European Bank for Reconstruction and Development (EBRD) was signed in May 2021 (GCF, 2023[77]).

This programme was GCF and EBRD's first at-scale investment to promote the uptake of low-carbon technologies in the industrial sector. It promotes the uptake of high climate impact technologies and stimulating behavioural change at the corporate governance and management level. This includes integrating climate change considerations into strategic, financial and technological decision making. The programme is structured into three different components:

1. USD 5.42 million in grants to develop low-carbon strategies and prepare investments through the identification of high climate impact technologies and the development of corporate low-carbon gender-responsive strategies.
2. USD 1.01 billion investment programme for high climate impact projects in targeted industrial sectors.
3. USD 1.45 million in grants to develop low-carbon sectorial roadmaps and knowledge sharing.

The main financing component of the programme (Component 2) was funded by GCF (USD 252.5 million, through concessional finance) and EBRD (USD 757.5 million) and is structured as a performance-based climate financing. This financing is tied to climate and corporate governance performance through specific, previously defined milestones. A discount on the interest rate is provided if these milestones are met. Discounts on the GCF margin range between 25% to 100%, with an interest rate floor of 1% (GCF, 2020[78]).

Figure 4.15. Illustrative impact of sustainability-linked interest rate (loan margin) by milestone



Source: GCF

The disbursement period of the facility is 6 years, with a repayment period of 12 years, which is the maximum tenor for loans under the programme. The final interest rate of the loans ultimately depends on the market rate provided by EBRD, which is determined based on the market conditions at the date of loan agreement signature with each financed project, and the discount applied according to the accomplishment of previously defined milestones.

Supported project(s) description

The programme targets the manufacturing industry, mining companies (except for the extraction of fossil fuels) and agribusinesses in seven participating countries: Armenia, Jordan, Kazakhstan, Morocco, Serbia, Tunisia and Uzbekistan. Corporates and projects must comply with eligibility criteria related to sector, behavioural change, technology and impact potential.

Table 4.4. List of eligible sectors and indicative sub-sectors of the High Impact Programme for the Corporate Sector

Manufacturing industries	Agribusiness and agriculture value chains	(non-fossil energy) Mining
• Construction materials: cement, lime, ceramic • Fertilizer • Chemicals • Iron and Steel • Aluminum • Pulp and paper • Glass	• Food retail/distribution and logistics • Dairy production/processing • Juice and beverage production • Packaging and food industry • Other food-processing industries	• Metals and Minerals mining (from exploration phase to closure)

Source: GCF

In these sectors and countries, key barriers need to be overcome to unlock potentials to deliver climate benefits. Critical financial barriers to the uptake of climate technologies across industrial, agribusiness and mining sectors contribute to the higher costs that early adopters of technologies face due to a lack of access to suitable financial products with adequate pricing. In addition, companies face a range of capacity barriers related to identifying, prioritising, developing, implementing and monitoring low-carbon projects and the respective climate governance procedures. HIP targets technologies with a level of at least TRL 7; technologies with TRL < 7 are only supported on selective basis.

EBRD is the implementing agency of the programme, providing loans from its own capital resource. The EBRD has extensive experience working with industrial, agribusiness and mining corporates and has offices in the participating countries. Support from the GCF enables the introduction of an innovative funding mechanism that is currently unavailable to private companies in the participating countries, thus enabling energy-intensive industrial sectors to shift to a low-carbon pathway.

The HIP Programme is complementary to another GCF-funded and EBRD-led programme, called Sustainable Energy Financing Facilities (SEFF), approved in 2016. The SEFF programme focused on the scale-up of private sector climate finance through local financial institutions, also providing an innovative combination of financial support, capacity building and technology transfer. SEFF focuses on MSMEs, and the HIP programme complements its offer by targeting bigger corporates and thus larger emissions reduction programmes.

Impact of the solution on the project(s)

HIP is intended to act as a role model in showing how it is possible to boost the commercial viability of low-carbon investments in industry. The programme incorporates an innovative approach by directly linking the accomplishment of climate-related metrics with financial benefits for the sponsor of the project. While some instruments, such as Sustainability-linked loans (SLL), are being developed in advanced markets, they are underdeveloped for the industrial, agriculture and mining sectors in many regions such as Asia, Latin America, or Africa.

Through its three components, HIP links climate considerations at a project level with the uptake of long-term climate corporate governance performance that is supported by the adoption of sectoral low-carbon trajectories. Under Component 1 of the HIP facility, different stakeholders of the corporate sector receive capacity building to enhance their understanding and capacity to strategically adapt to the climate change agenda. These activities include technical assistance to address the lack of corporate capacity to identify low-carbon projects across industries, and the development of corporate low-carbon strategies. This enables corporates to integrate risk analysis and to include climate change considerations into strategic decision making and investment planning.

Lessons learnt and replicability

HIP is still in early stages of implementation. However, the previous experience by GCF, as a designer of climate-specific financing products and structures, and by EBRD ,as a financial institution specifically active in industrial development, contribute to ensure efficient execution of this programme and the achievement of project- and industry-wide objectives. By setting climate change mitigation targets by 2030 through low carbon investment planning and incorporating climate governance principles into decision-making, corporates can contribute to sectoral and country-specific low-carbon pathways.

The programme has been designed to ensure the possibility of replicating and scaling up financing in the targeted sectors and participating countries, as well as replicating in other countries and sectors matching EBRD's experience. It is expected that the abilities acquired by different companies in the corporate sector to seek and invest in high-climate impact technologies will encourage the entire sector to pursue long-term behavioural change to address innovation. Furthermore, the projects financed by HIP will be showcased

as success stories, encouraging more investments in climate technologies in other companies and industry sub-sectors. Additionally, sectoral roadmaps developed or rolled-out under this programme will improve the conditions for climate-related investments beyond the targeted sectors, countries and timeline of the programme. Lastly, HIP offers opportunities for learning and knowledge transfer across industries and local financial institutions both within the participating countries and across the region.

Case study 11: Energy Savings Insurance - Green Climate Fund / XacBank

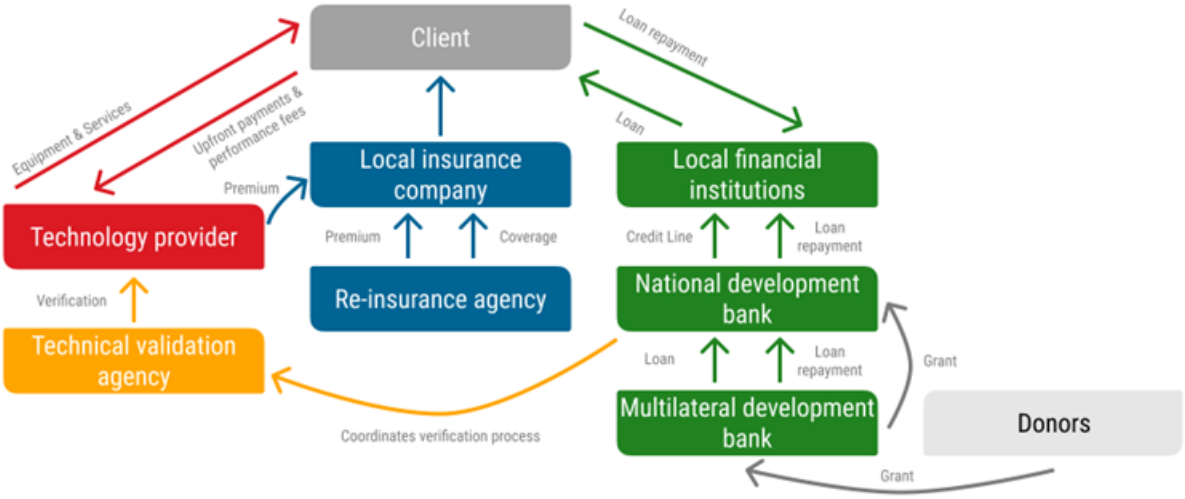
Financial instrument description

The Energy Savings Insurance (ESI) model was first developed by the Inter-American Development Bank (IDB) in 2014, with the support of the Basel Agency for Sustainable Energy Foundation (BASE Foundation), to drive investments in energy efficiency projects. It has since been implemented in eight Latin American countries in several sectors, notably healthcare, hospitality, agriculture, and is especially targeted towards micro, small and medium enterprises (MSMEs).

The ESI model is a de-risking package consisting of both financial and non-financial elements designed to build investor confidence in energy efficiency projects. It has four building blocks that support the identification and structuring of technically robust and bankable projects:

1. The **standard contract** establishes the responsibilities of the supplier in terms of supply and installation of equipment, corresponding guarantees and the promised energy savings relative to a benchmark (established by the supplier using standardised methodologies). It also commits the customer to timely payments, access to facilities and adequate maintenance of the equipment.
2. The **technical validation** is carried out by an independent agency who evaluates and confirms the project's technical potential to achieve the promised savings and verifies on site that the project has been built according to specifications. This actor also determines which party is entitled to compensation in case of disagreement on the achieved performance and actual savings generated by the project. The validator's roles are defined in the standard contract and its decisions are binding for both parties.
3. The **energy savings insurance** is a performance warranty provided by the supplier to the customer for the committed savings over the contract duration. If at any point in time, the project does not achieve the pledged savings, the insurance agency will financially compensate the client. The energy savings insurance is activated upon technical validation of the project and is further backed by a reinsurance agency.
4. Insured projects are financed with **concessional credit lines** and preferential terms by lenders such as preferential interest rates, grace periods and extended tenure.

Figure 4.16. Conceptual design of ESI



Source: (Micale, Stadelmann and Boni, 2015[60])

The ESI programme in Mongolia is being implemented by XacBank, a Mongolian commercial bank, since December 2020, with support from the BASE Foundation. The total amount committed to this program is USD 49.7 million, including a USD 20 million contribution by GCF (senior + syndicated loans), USD 23 million in co-financing commitments (Government of Mongolia), and USD 2 million in grants.[33] As part of the grant and technical assistance package, XacBank received a USD 300 thousand grant to implement the program, by tailoring and developing the ESI model elements for the Mongolian context.

This programme complements an existing USD 60 million credit line, operated by XacBank and co-funded by GCF, known as the Micro, Small, and Medium Enterprises (MSME) Business Loan Programme for Greenhouse Gas (GHG) Emissions Reduction,[34] which aims to promote the use of energy efficient and renewable energy solutions in the Mongolian MSME market. The credit line has been operational since 2017, providing access to over 240 MSMEs, and the ongoing development of the ESI programme is expected to reduce investment barriers and contribute to its success.

In March 2023, a USD 25-million additional funding programme by the European Bank of Reconstruction and Finance (BERD) and GCF (XacBank II) was approved to help accelerate renewable energy and energy efficiency technology adoption.

Supported project(s) description

From 2010 to 2018 Mongolia experienced a rising trend in energy consumption, leading to policies like the 2015 Energy Conservation Law, aimed at enhancing energy efficiency and advance energy-efficient technology deployment. The 2018–2022 National Energy Conservation Programme was aimed at speeding up law implementation, boost industry competitiveness, and save costs for businesses and homes. Despite this favourable legal framework, relevant barriers remain for energy efficiency projects, such as lack of awareness, challenging financing conditions and lack of trust in technology providers.

[33] According to project documentation for Project GCF-FP153. Available at: https://www.greenclimate.fund/document/mongolian-green-finance-corporation.

[34] GCF Funding Project FP208. Project documents available at: https://www.greenclimate.fund/sites/default/files/document/gcf-b15-13-add01.pdf.

The ESI initiative in Mongolia is therefore implemented to further stimulate the energy efficiency and renewable energy sector while enhancing lending support for such projects through their MSME Business Loan Program. The primary beneficiaries envisioned for the ESI initiative are more than 60 thousand MSMEs in Mongolia, especially the ones with substantial energy consumption. Of them, 22 thousand are registered at XacBank and more than 3,400 MSMEs are active customers.[35] The ESI programme was conceived as a strategy to make energy efficiency investment opportunities a priority for businesses, to build trust and credibility among key actors, and to improve the risk-return trade-off perception.

Examples of supported projects are: the substitution of electrical and mechanical industrial process equipment (for their energy-efficient alternatives); the substitution of heating, ventilation, and air conditioning (HVAC) equipment; and energy efficiency in buildings such as lighting and thermal insulation, electromechanical process efficiency improvement for good manufacturing, among others.

The total investment of the projects financed under the ESI programme are not limited, however XacBank usually finances projects with a value of more than USD 20 thousand, in order to keep transaction costs low, which ideally should not exceed 3-4% of the project value. XacBank's Eco Banking Department is the lead implementing unit for the ESI programme in Mongolia, responsible for the overall co-ordination, oversight, monitoring, reporting and management of the credit line and grant funding.

Impact of the solution on the project

The ESI programme is aimed to tackle some of the current barriers for the additional adoption of energy efficiency in Mongolia: these investments are not prioritised by private companies due to a mismatch between risk and return on investments. The lack of expertise and experience in energy efficiency projects (from both companies and financial institutions) as well as the complexity of the projects is causing this mismatch. In this scenario, an energy efficiency performance insurance product, combined with technical assistance for project design, is important to tackle all of the above-mentioned barriers.

In Mongolia, there was no specific regulation allowing the type of insurance that normally complements the ESI model, i.e. surety bonds. The regulator agreed for Tenger Insurance to develop a new product that, without being a surety bond, would work in a similar way.

Moreover, the financial characteristics of the credit line is favourable and better than traditional loans offered to small enterprises, both in tenor and in cost (interest rate), compared to a range between 14 and 17% lending rate in Mongolia between 2020 and 2023 (CEIC, 2023[79]). Additionally, the ESI programme permitted the development of various non-financial tools to adapt credit line conditions to the Mongolian market and needs of local MSMEs. The development of a standard energy performance contract, standard insurance policy and the technology validation process, has a strong impact in increasing access to financing and lowering transaction costs of energy efficiency projects.

The ESI model has had a positive impact in broadening the market potential of energy efficiency projects, by making it possible for SMEs to create longer-term, capital-intensive projects. Currently, most SME investments in energy efficiency (EE) are mostly limited to those with very short payback periods, such as lighting upgrades, rather than more capital-intensive measures such as mechanical and electrical equipment retrofits and process efficiency improvement projects, which are more complex and, in most cases, require expensive technical expertise. The combination of technical validation, insurance and lower-cost financing is attracting more companies to assess and implement larger energy efficiency projects in the countries in which ESI was implemented, such as in Mexico, Colombia and Brazil.

In addition, the ESI programme in Mongolia is trying to detect and identify technology providers that could be interested in implementing energy efficiency projects. Also, the BASE Foundation and XacBank aim to identify locally reputable first mover SMEs to engage in the pilot phase of the programme. These first

[35] At the time of project funding proposal (2017).

movers will then become an important part of the promotion and communication activities of the programme, with the goal of expanding its reach.

The effective engagement of multilateral and national development banks (MDBs, NDBs) at the country level can increase the likeliness of success of the ESI models over the long term, given the comprehensive package of financial and non-financial instruments to be designed and implemented. Additionally, implementation and technical validation agencies have already gained experience in other countries, and therefore the program could benefit from these institutions' experience to identify business model adjustments and apply lessons learned in Mongolia.

Enabling and supporting regulatory framework could enhance the impact and speed up the implementation of the instrument, but the ESI model may also provide valuable input to national regulators in developing tools to support the development of an energy efficiency market in Mongolia and other developing countries.

Lessons learnt and replicability

The ESI programme in Mongolia is still at early stages. However, it is aimed to deliver huge impact in the energy efficiency sector. An initial market assessment conducted by the BASE Foundation estimated that the programme could mobilise USD 36 million in energy efficiency investments within the next five years, and contribute to energy savings of 39 GWh, while reducing carbon footprint of the electricity sector by 234 thousand tonnes of CO_2 equivalent. The ESI programme in Mongolia is now nearing the end of its development stage activities and a pilot project is expected by the end of 2023.

This programme is unprecedented for the ESI model, because it is being implemented by a commercial bank, rather than a national development bank, as in many countries in Latin America. This could untap an opportunity to broaden the implementation potential in other countries around the globe, where NDBs are not available or are not prioritising this type of programme or industry. Additionally, XacBank is currently the only Mongolian bank with a green lending alternative and is playing a pioneering role in setting up demonstration projects that reduce the risk perception of energy efficiency in the country. This could bring more commercial banks in Mongolia attracted to offer specific products for climate change mitigation and adaptation projects.

To increase interest and sustain demand for the programme, and to decrease project implementation timelines, this programme used innovative strategies such as embedding the ESI insurance product into the XacBank financing scheme (credit line). The programme is trying new strategies to make the product simpler and more attractive, as well as to improve credit conditions offered. Interested donors, including development banks, international financial institutions and governments could provide strategic, complementary support to the program by fast-tracking pilot investments in different regions and demonstrating the effectiveness of the mechanism.

Case study 12: Partial Risk Sharing Facility - World Bank, SIDBI, EESL

Financial instrument description

World Bank partnered with the Small Industries Development Bank of India (SIDBI) to set up the Partial Risk Sharing Facility for Energy Efficiency (PRSF) programme in 2015. It is a risk mitigation model to support the Government of India's efforts to transform the energy efficiency market by promoting investments through Energy Service Companies (ESCOs). The programme is designed to minimise the perceived risk of lenders in providing financial assistance to ESCOs and end users for energy efficiency projects. It supports the loans granted by various Participating Financial Institutions (PFIs)[36] and by SIDBI as lender to either ESCOs or companies who are implementing energy saving projects.

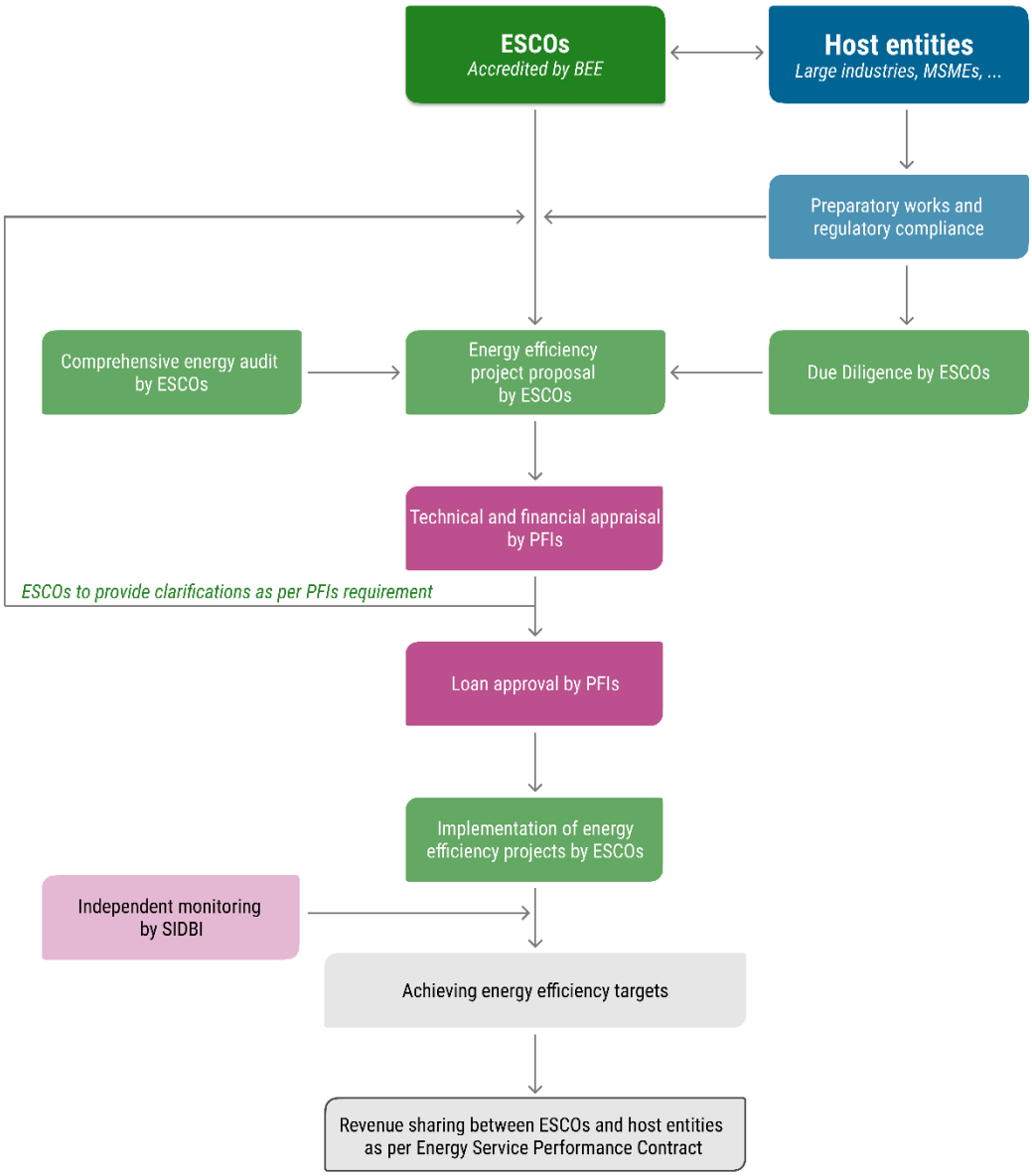
The PRSF aims to pro-actively address vulnerabilities of the MSME ecosystem to climate change. Financing green investments is considered to be a riskier proposition by lending institutions due notably to the techno-commercial viability of the project, the non-availability of security and collateral, or inadequate capacity of the credit officer to understand and evaluate the proposal. India faces specific risks such as the lack of standardised assessment criteria and documentation, limited awareness, and non-availability or low accessibility to assets. ESCOs often struggle to secure funding as lending institutions find it challenging to evaluate the long-term benefits and performance of energy efficiency projects. Banks also face challenges in grasping the technical aspects of such projects, leading to cautious practices seeking the high reliability of collaterals. Yet, adequate and timely credit support by the lending ecosystem is key to support MSMEs transformation towards greener processes.

The PRSF scheme primarily addresses the barrier of a lack of requisite collateral or guarantees to apply for project finance. It provides coverage for repayment of energy efficiency loans through its Risk Sharing Facility component. The partial credit guarantees are provided to cover a share of default risk faced by PFIs in extending loans to eligible energy efficiency projects implemented through ESCOs after entering energy savings performance contracts. To date, PRSF has provided partial default risk coverage to 15 participating financial institutions on loans to energy efficiency projects implemented by 40 ESCOs,[37] which are either empanelled by the Bureau of Energy Efficiency (BEE) or graded by rating agencies. The programme also provides technical assistance and capacity building to ESCOs.

[36] Including commercial banks and non-banking financial companies (NBFCs).

[37] In total, there are around 40 energy service companies who have availed the PRSF facility.

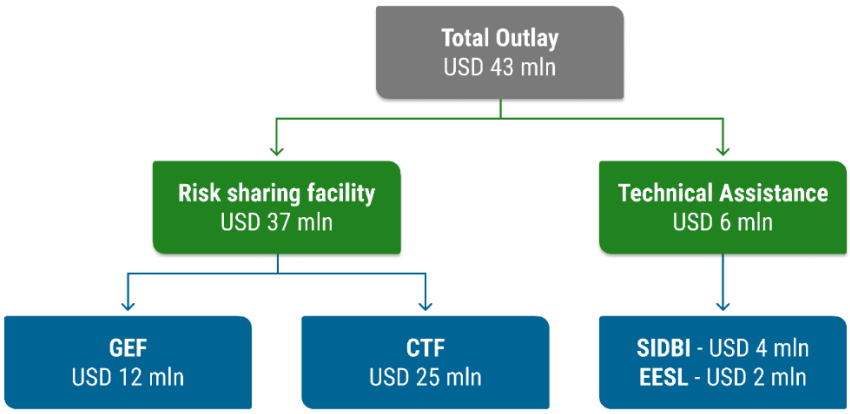
Figure 4.17. Flowchart of project-level roles and responsibilities



Source: Authors, adapted from SIDBI

PRSF total funding amounts to USD 43 million. The risk-sharing corpus funds come from GEF (USD 12 million) and are backstopped by a Clean Technology Fund (CTF) Guarantee, in the form of contingent finance, of USD 25 million. This "Risk Sharing Facility" component of USD 37 million is managed by SIDBI. The programme has also earmarked funding for technical assistance, capacity building initiatives and other development and operational support for the project (see Figure 4.18).

Figure 4.18. Structure of PRSF total outlay



Note: CTF: Clean Technology Fund; EESL: Energy Efficiency Services Limited; GEF: Global Environment Facility
Source: SIDBI

PRSF covers up to 75% of an energy efficiency loan, with a threshold of USD 3.6 million (INR 30 crores) per project and maximum exposure to a single ESCO of USD 10.8 million (INR 90 crores). The non-refundable annual guarantee fee amounts to 0.5-1%, depending on the guarantee loan amount or exposure and the grading of ESCO.

Supported project(s) description

SIDBI has defined a list of eligible sectors that could benefit from PRSF. This includes: (i) large industries, such as cement, steel, paper or chemical plants (10 projects), but excluding thermal power plants; (ii) industrial MSMEs are eligible including retrofits, expansion with reduction of specific energy consumption and greenfield projects (39 projects); and (iii) non-industrial actors, such as municipalities (e.g. for street lighting), commercial buildings such as hotels, hospitals or office buildings, and power distribution companies (26 projects).

Energy efficiency projects covered under PRSF include a wide array of technologies, in particular for industry actors. LED Lighting and Variable Frequency Drives have been installed at multiple industrial locations. The programme enabled the replacement of old inefficient equipment such as motors, furnaces and air compressors with modern machines, and the installation of new boilers and waste recuperation technologies. Energy Management Systems and Internet of Things-based solutions to optimise operations of equipment have also benefited several industrial sites.

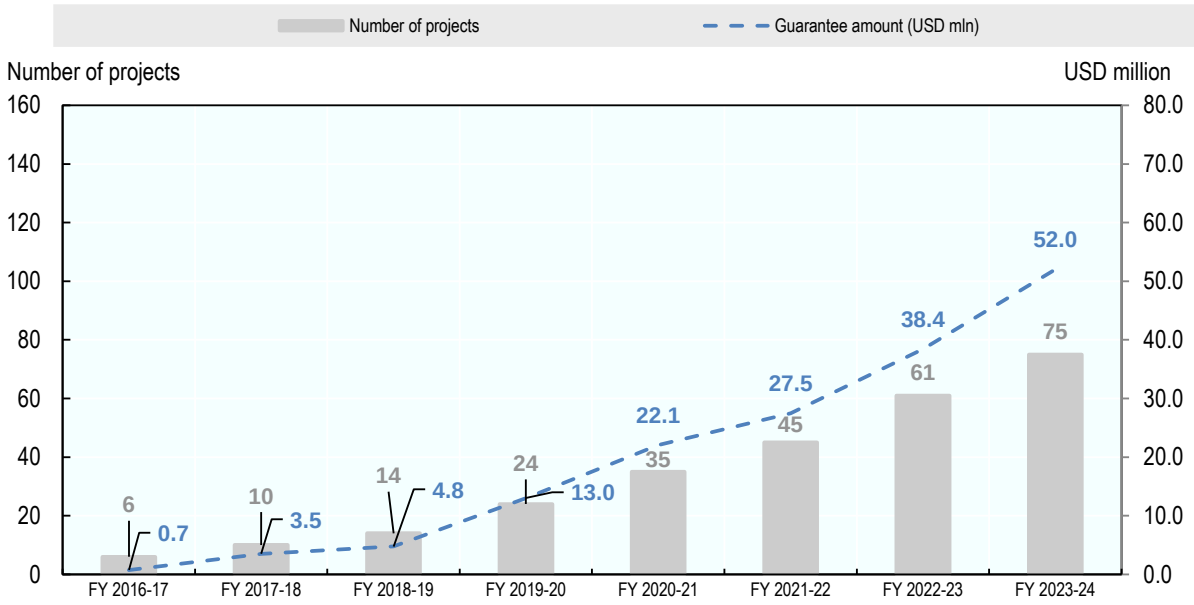
Some of the innovative and impactful projects which are being supported under the PRSF programme which otherwise were finding it difficult to get adequate finance includes:

- Energy as Service, managing the utilities at commercial buildings.
- Municipal Solid Waste Treatment & Green Hydrogen generation, using plasma gasification technology to treat municipal solid waste and generating green hydrogen.
- Resource optimisation, using artificial intelligence and digitalisation towards higher throughput and lower wastage in manufacturing.
- Material Recovery, using waste heat recovery and solar energy.

Overall, PRSF supported 75 energy efficiency projects between financial year 2016-17 and September 2023, providing a total guarantee amount of USD 52 million (see Figure 4.19). This corresponds to a loan

amount guaranteed of USD 69 million, for a total project cost of USD 120 million, including USD 50 million for industrial applications.

Figure 4.19. Progress of PRSF implementation between financial years 2016-17 and 2023-24



Note: FY: Financial Year
Source: SIDBI

In addition to projects already implemented, PRSF currently has a pipeline of more than 20 projects representing a cumulative guarantee amount of USD 28 million (INR 226 Crore). Out of this pipeline, 13 projects are led by SIDBI with a guarantee amount of USD 16 million (INR 130 crores), and eight projects belong to other PFIs with a guarantee amount of USD 12 million (INR 96 crores).

Impact of the solution on the project

The energy efficiency projects developed and supported under the programme contribute to annual energy savings of 371 GWh, including 100 GWh for industrial projects. This corresponds to a yearly emission reduction of 0.3 Mt of CO_2.

The programme facilitated access to financing for a range of energy efficient technologies, providing support to companies or projects that would not avail financing otherwise. The guarantee amount enabled companies to leverage private finance to the tune of USD 120 million.

Many industrial companies established their baseline energy consumption and identified areas of improvement with ESCOs under the PRSF. It led industrial actors to identify the low-hanging fruit to improve their energy efficiency, but also encouraged them to look for implementation of other technologies such as heat pumps.

Table 4.5. Example of projects supported by PRSF

Company	Type	Sector	Project / Equipment	ESCO	Model	Loan provider	Investment	Annual energy Savings	Annual emissions reduction
SunPharma	Large industry	Pharmaceutical	Boiler replacement	Punjab Renewable Energy Systems	ESPC[1)] under deemed saving model with guaranteed energy savings of 22% on annual basis.	HDFC Bank	USD 1.2 million (INR 987 lakh)	18 820 MWh	13.0 kt CO_2
Kamachi Group	Large industry	Steel Manufacturing and processing	Medium voltage variable speed drives	Yantra Harvest Energy	ESPC under shared saving model with annual energy savings of 5,920 MWh.[2)]	SIDBI	USD 1.0 million (INR 869 lakh)	5 920 MWh	10.3 kt CO_2
Shanker Forge	MSME	Forging products manufacturing	Controllers, fans, LED lights, replacement of lathe machines...	Katyani Energy	ESPC under Guaranteed saving model with minimum energy savings of 20% on annual basis.	SIDBI	USD 0.8 million (INR 670 lakh)	2 341 MWh	1.9 kt CO_2
Echo Plast India	MSME	Plastic bottles manufacturing	Automatic extrusion machine and plastic injection moulding machine	Geostat Technologies	ESPC under Guaranteed saving model with minimum energy savings of 19% on annual basis.	SIDBI	USD 0.08 million (INR 64 lakh)	83 MWh	0.07 kt CO_2

Note: 1) ESPC: Energy Savings Performance Contract; 2) The ESCO followed a standard measurement and verification protocol to establish the monthly energy savings.
Source: SIDBI

Under PRSF, ESCOs have carried out the Environmental Safeguards Due Diligence of industrial companies during the preparation of proposals for energy efficiency projects. ESCOs have also explored energy efficiency measures, which can lead to emission reduction and improvement in operational efficiencies, thus expanding into wider environmental co-benefits.

Lessons learnt and replicability

PRSF has been able to minimise the perceived risk of the lending institutions by way of (i) technical screening of the proposals by experts; (ii) enhanced awareness and upskilling of the credit officers, and (iii) standardised documents for Energy Saving Performance Contract and environmental safeguards due diligence. By doing so, PRSF could trigger investment in areas where a traditional approach by lending institutions was insufficient.

Multilateral and national partners have introduced good practices and helped the PRSF to meet its objectives. BEE, the lead policy body of the country for energy efficiency, guided the project. Energy Efficiency Services Limited (EESL), the Indian super ESCO[38] has shed light on the nuances of the demand aggregation model. The World Bank accompanied the programme's evolution and consolidation, by sharing best practices gained through experience in various countries. SIDBI has demonstrated the efficiency of the model, which crowded in 15 lending institutions and incentivised many actors in the ecosystem. The programme has been able to demonstrate the techno-commercial viability of energy efficiency projects being implemented by ESCOs: no project has observed non-performing status of the asset.

Capacity building, both on the demand and supply side, has been instrumental to this initiative. It included awareness programs, visits to successful projects, and multi-stakeholder workshops to brainstorm and find customised solutions. More than 100 ESCOs, 5 000 energy professionals and 10 000 MSMEs have received information or have benefitted directly from the programme. Consulting companies have been engaged to help generate pipelines of projects through holding workshops, showcasing similar successful projects and being in continuous touch with all stakeholders. A key lesson learned is the necessity of having technical assistance along with financial incentives.

Each sector under PRSF had its own preference among the models that have been implemented to distribute the savings generated by the projects. While "shared savings" is prevalent for projects for municipals and buildings, "deemed savings" were prominent for large industries, and MSMEs often opted for a "guaranteed savings" model.

The PRSF risk mitigation model allows for the enhancement of private finance mobilisation. The guarantee amount has increased year after year, and the last two years represent almost half of the total amount that has been issued to energy efficiency projects implemented by ESCOs. SIDBI (as lender to ESCOs) has been provided with nearly half of the guarantee amount (46%), followed by Union Bank of India, State Bank of India, HDFC Bank, and others. The PRSF programme had positive repercussions on the energy efficiency ecosystem in India. Today, several ESCOs who have been supported under PRSF are implementing varied projects of national importance.

The PRSF programme is being replicated by the World Bank in other countries. SIDBI has also used the learnings of PRSF to launch Risk Sharing Facility in emerging priority areas, such as electric vehicles and solid waste management. Furthermore, SIDBI is in the process of designing similar focused schemes to address strategic technologies and sectors. Following the results achieved by the PRSF programme, SIDBI, along-with the World Bank, is now designing another financing facility specifically targeting industrial decarbonisation.

Lessons learnt from case studies

Instruments characteristics

There is a growing momentum for industrial corporates to release climate transition plans and finance decarbonisation projects through project and corporate financing. This is, for instance, illustrated by the increasing issuance of sustainability-linked instruments. Several examples have been reviewed in an earlier study by the OECD from sectors that represent the energy-intensive industries in emerging and developing economies (OECD, 2022[33]). The development of these instruments is motivated notably by the improvement of second-party frameworks such as ICMA's Principles on Sustainability-linked Bonds, the Loan Market Association's (LMA), and the Loan Syndications and Tradition Association's (LSTA),

[38] Super ESCOs are governmental entities created to serve the public sector, develop the capacity of private ESCOs, and facilitate project financing.

under which companies report on their decarbonisation performance based on validated, measurable targets and KPIs. The credibility of sustainability targets, metrics and second party opinions, builds investors' confidence and enables corporates to issue such instruments.

Direct public support and concessional finance have a key role to play, as many decarbonisation projects do not immediately offer quick returns on investment for private investors. For industry corporates, a few years is the maximum for a return on investments. In less mature industry decarbonisation technologies, this can take up to a decade. Financial incentives, such as tax rebates and market-based instruments, for example (carbon) contracts for difference, are being developed by the public sector to support first-movers in investing in strategic decarbonisation technologies. In this context, there is a growing interest in blended finance structures and other facilities that can help de-risk and lower the cost of financing projects, for instance in the hydrogen sector (Lee and Saygin, 2023[40]). Below-market loan rates and longer loan tenures nudge more risk-averse players, such as private equity and institutional investors, especially for capital-intensive projects that are technologically mature but with high uncertainties on revenues. Yet, this market is at a very early stage of development and more attention will need to be brought to it.

Similarly, de-risking instruments can optimise the leverage of public resources. De-risking instruments such as credit guarantees and energy savings insurance, can support both early-stage technologies with limited track record, as well as more mature technologies such as energy efficiency that are being implemented in regions or by actors with higher risk profiles. De-risking facilities are also needed where the offtake risk is high, as it may affect the capability of companies to repay debt.

Financial instruments for industry decarbonisation are tailored across several dimensions:

- ***Country type***. While financing facilities for industry decarbonisation are more mature in advanced economies, the case studies highlight available instruments provided to EMDEs, both from domestic and international actors. They showcase both programmes that primarily aim to support the local development of the industry (such as GCF's High Impact Programme for the Corporate Sector) and programmes that offer opportunities for EMDEs to export their industrial products to advanced economies which are early-adopters of low-carbon manufacturing goods (e.g. H2Global).
- ***Technology and commercial maturity***. The case studies show that most examples of support to early-stage technology are being conducted in economies where country and regulatory risks are lower, or in EMDEs with very favourable conditions, and supported financially by international actors. For more mature technologies, grants and financing instruments focus on the acceleration of technology adoption and try to minimise recourse to public finance. For instance, instruments for energy efficiency aim to improve financing access and financing conditions, notably through guarantees to secure revenues derived from energy savings. For low-carbon energy and feedstock projects, programmes are targeted to level market conditions (i.e. prices, volumes, revenues) compared to their traditional, business-as-usual alternatives, such as contracts for differences and favourable offtake agreements.
- ***Project phase***. Grants from development banks or philanthropic sources are common instruments to provide technical assistance across the industry value chain and project development. They typically aim to lower the cost of feasibility studies, which can be expensive and constitute a barrier especially for MSMES which have limited capital availability for such purposes. In EMDEs, studies, monitoring and verification carried out and supervised by internationally recognised institutions also provide higher confidence to investors, given the complexity of emissions and decarbonisation in the manufacturing sector (see Box 2.1). As projects enter the contracting and financing phase, instruments become more diverse and are designed depending on specific techno-economic assessments.
- ***Steps in the industry value chain***. Financing instruments among surveyed case studies tend to primarily focus on a single step in the industry value chain, such as the manufacturing production

process or the technology development, to address a specific barrier to investment. For instance, grants and concessional loans are supporting the development of capital-intensive technologies, while contracts for difference can address offtake risks in nascent markets such as renewable hydrogen. While these financing instruments and incentives are not mutually exclusive, prioritising instruments for a given technology or market enables support to be channelled to actors that face the highest challenges. These instruments should be selected and used carefully to maximise the impact of public financing and avoid crowding out private finance.

- ***Company type***. The case studies show that several financing instruments target MSMEs, notably because (i) MSMEs are an important part of developing economies' productive fabric in terms of GDP and job creation; (ii) they have room to improve energy and material efficiency; and (iii) they are especially affected by the lack of access to capital and poor financing conditions. Large companies, notably in hard-to-abate sectors, also benefit from facilities to improve their financing conditions, especially for specific pilot projects of high-risk, early-stage technologies and to put in place financing programmes for large-scale, capital-intensive projects, for which scale would be difficult to achieve with traditional financing.

Governance and implementation

Several case studies highlight the use of a multi-stakeholder approach to structure, design, implement and co-ordinate de-risking and financing facilities, such as the PRSF which involves international and domestic finance institutions, policymakers, ESCOs and manufacturing companies. Governance needs to build on the operational experience from industry actors, the enforcement of regulatory packages from national and subnational governments, concessional and low-cost finance provided by DFIs and direct support from donors to fast-track pilot investments. This is particularly important as a sound collaboration can minimise investment risks. Some programmes and organisations are also building on the learnings of governance models gained in other areas, such as the power sector.

The role of the public sector is paramount to define an effective governance framework. Indeed, it is paramount to align financial flows with national net-zero pathways (Noels et al., 2023[80]), and more broadly with country-wide industrial strategies. International organisations can support national governments in co-ordinating initiatives, especially in industrial subsectors exposed to global value chains and trade that would require international alignment.

Knowledge-sharing platforms can be instrumental in synchronising actions of finance providers and recipients, and scaling up investments. They can notably address the lack of co-ordination between technical and financial assistance partners. Exchange of best practices among relevant stakeholders and implementing agencies can help accelerate the deployment of decarbonisation technologies and policies. MDBs have prior experience with similar programme structures in other countries and regions and can provide capacity building to financial institutions that lack experience in industry decarbonisation.

Enabling conditions to prioritise countries/technologies/projects.

Policymakers can provide a long-term vision and outline industrial plans through the development of national and sectoral decarbonisation roadmaps. Setting up a credible path and clear milestones to implement low-carbon technologies and projects reduces uncertainties for investors. Public sector interventions may also include other areas, such as support to research and development (notably to reduce capital costs of technologies), skills development and effective regulatory environment to streamline permitting and licensing processes.

Taxonomies of sustainable activities (including transition activities), complemented with reporting obligations for corporates, will be key to help investors classify and prioritise industrial projects. There is still uncertainty on the definition of environmental sustainability of different types of investments and

economic activities, notably in the manufacturing sector. While a number of sustainable finance taxonomies have already been prepared, international collaboration is further needed to align the scope of industrial activities, work on standards and definitions and make them interoperable. Aligning taxonomies with sectoral roadmaps and funding programmes can help to speed up decision-making and accelerate deployment of low-carbon technologies. Reporting obligations based on these taxonomies will facilitate the tracking of progress and reduce the risk of greenwashing.

Case studies and interviews highlighted the importance of access to raw materials, water, renewable energy, land and basic infrastructure as key prerequisites to select a project location. Identifying suitable areas with all these resources could attract project developers and, consequently, financing. This is particularly challenging in emerging and developing economies, which may be endowed with excellent natural resources but have limited energy or logistic infrastructures.

Capacity building is required in many EMDEs to improve institutional readiness and the maturity of the domestic industry's regulatory frameworks in certain countries and regions. These conditions are, in some cases, not considered a prerequisite, but instead are embedded in the offer of technical assistance and financing facilities, e.g. in results-based loans. Availability and cost of human capital is also a characteristic that is considered important to prioritise countries or regions.

Replicability & scale-up

International organisations have a key role to play in collecting data from real projects and consolidating learnings in evidence-based analysis. Tracking progress and defining sustainability metrics among financial institutions and implementation agencies, to evaluate project and programme outcomes and results, will be highly beneficial to correctly analyse the efficiency of each instrument, in terms of investment needed and decarbonisation results. This would inform policymakers and financial institutions in their efforts to optimise their resources while achieving decarbonisation objectives. This is particularly important in emerging and developing economies, where stakeholders require more information on the available technologies and success factors of flagship decarbonisation projects. International organisations can provide a safe space for multilateral dialogue and peer-learning.

Project preparation pipelines are a critical aspect for the success of financial instruments. Domestic and international development finance institutions (DFIs) have a key role to play to identify and source bankable projects in emerging and developing economies. "Deep" project pipelines are especially needed in the industry sector, where projects might require several years for implementation.

While most of the identified financing programmes are relatively new, the experience gained in the last few years already enabled ways to replicate and scale up some financing instruments. For instance, energy savings insurance has primarily been developed in Latin America, but then expanded to several other regions and industrial subsectors. De-risking tools such as Buyer Credit Guarantees are highly replicable and can be implemented in different geographies, notably when they are developed by institutions in advanced economies with outreach in many EMDEs. Sustainability-linked instruments are expected to continue growing in the coming years, especially as they enable corporates to access lower-cost financing, provided that the companies meet the pre-defined sustainability objectives.

Given the size of the challenge to decarbonise the industry sector, several new facilities are being designed with the idea to enhance their replicability potential. For instance, H2Global offers a modular approach and flexibility to replicate the scheme to multiple financing windows and products. However, most of the financing instruments developed by public finance institutions are meant to support nascent or immature technologies and markets in a transition phase, until they are bankable and can be financed by private sources. Further analysis on the replicability and scale-up of these instruments should also encompass assessment of the requirements to achieve commercial sustainability.

Conclusions

The growing number of net-zero pledges reflect the imperative to decarbonise the industry sector in order to achieve net-zero emissions. Decarbonising industry sector which accounts for around a third of all GHG emissions worldwide is critical to realise these pledges. That requires deploying the entire suite of low-carbon technology options. The challenge is present in emerging and developing economies, where most of the industrial output growth will take place in the next decade.

As this working paper shows, the development of innovative financing instruments and models for derisking and mobilising private capital will be urgently needed, as depicted in the case studies. While public resources that can be allocated to industry decarbonisation are scarce, especially in emerging and developing economies, public finance will play a key role in strategically mobilising private capital.

This paper identified several financing instruments and models that are already available to spur industry decarbonisation projects. It described how programmes and financing mechanisms are being implemented, notably to support emerging and developing economies. This paper can serve as a basis for understanding how these instruments can be scaled up to mobilise private finance for industry decarbonisation. Further, the paper provided evidence to enrich dialogue and foster collaboration between policymakers of developed countries, emerging and developing economies, industry actors and financial institutions.

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