NET-ZERO INDUSTRIES
MISSION

Accelerating industrial decarbonisation through technology transfer, knowledge sharing and learning with emerging economies

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Abstract

Countries worldwide face the challenge of reducing the CO_2 emissions from industry. Both highly industrialised and emerging economies encounter numerous similar obstacles, but also have some specific challenges to overcome. The **Net-Zero Industries Mission** (NIM) and its collaboration partners acknowledge that technology transfer, knowledge sharing and learning are strategies of mutual interest to reach climate neutrality. This White Paper presents an overview of barriers and challenges as well as strategies and measures to facilitate an accelerate industrial decarbonisation. These issues go beyond technological innovation and include strategies for energy and resources, financing mechanisms, regulatory measures and market incentives, as well as social issues. NIM is committed to advancing industrial decarbonisation through collaboration between developed and emerging economies, in particular by supporting the establishment of knowledge-sharing hubs and extending the network to the global south.

Introduction

In July 2023, Mission Innovation NetZero Industries and its partners Breakthrough Steel, UNIDO CEM-Industrial Deep Decarbonization Initiative (CEM-IDDI), LeadIT, and the Alliance for Industry Decarbonization of IRENA, brought together participants from industry, academia, and policy to discuss how technology transfer to and from emerging economies could be facilitated and accelerated to achieve deep decarbonisation of industry.

Countries worldwide face the challenge of reducing the CO_2 emissions from industry. Both highly industrialised countries and emerging economies face a number of similar obstacles, but also have some specific challenges to overcome. However, better mechanisms for technology transfer, knowledge sharing and learning are a strategy to jointly address some challenges that are of mutual interest. We have a broad understanding of the potential to accelerate technology transfer. This includes encompassing the diffusion of knowledge, technology and technology collaboration across and within organisations, sectors and countries, and creating opportunities for shared learning.

To this end, the partners involved organised a first workshop during the MI-8 ministerial in Goa, India, in July 2023 to discuss common issues and ways to improve technology transfer between different countries. More than 60 participants discussed Financing Mechanisms, Technology Innovation, Market Incentives and Regulatory Measures that should interlink to reach the collaborative goal of climate neutrality by the mid of the century. This workshop made it explicit that close coordination and a joint program management approach between global initiatives such as NIM and its collaboration partners is essential to efficiently progress towards the common goals. A further workshop was organised as a side event of the COP 28 in Dubai at the Heriot-Watt University in collaboration with IDRIC in December 2023.

This White Paper presents the results of the workshop discussions, complemented by an overview of the specific challenges faced by emerging economies and current technology transfer practices. The paper will firstly give an overview of challenges and barriers for the decarbonisation of industry focussing also on the specifics of developing and emerging countries. Although the context and situation vary from one emerging market to another, some challenges and barriers are common to many. Then some strategies, measures and enabling factors will be presented that indicate important areas for further actions. Finally, the paper

summarises the main recommendations for improving knowledge transfer between countries of the West and East, and North and South.

The discussion paper identifies several actions to be taken by MI members and collaboration partners to further improve and accelerate technology transfer and learning in emerging economies.

Barriers and Challenges

A number of different strategies and technologies for industrial decarbonisation have been proposed by various studies, expert groups and international organisations. Often these strategies are defined as pathways, with electrification, carbon capture, storage and use, hydrogen use, use of alternative fuels and feedstocks identified as key pathways for industrial decarbonisation. The concept of industrial symbiosis in the form of waste heat or resource sharing between industrial companies, but also with other users at regional level, also has potential. However, there is no silver bullet and the decarbonisation strategy needs to take into account sectoral and regional specificities, local resource conditions and the infrastructure. While a number of strategies and technological solutions can be identified to reduce greenhouse gas emissions, there are several barriers to successful implementation. These barriers address different dimensions and go beyond just performing R&D and mastering technological challenges. Among other things, higher levels of electrification, whether to provide energy for end use or to produce renewable energy such as hydrogen, will require significantly higher amounts of electrical energy. In addition, the industry will have to substantially consider the substitution of raw material and intermediate products and increase the use of recycled materials. The realisation of such innovations will also require, among other things, adapted regulatory frameworks, substantial investments, sufficient human resources and new forms of industrial cooperation, all of which represent major efforts and challenges. Overcoming these challenges and reducing major barriers is a prerequisite for successful technology transfer and cooperation between different countries.

Some of the key barriers described along six dimensions, which provide a common starting point for discussion, can be summarised as follows:

Research, development and technological innovation

The development and dissemination of new technological solutions and innovations is key for mastering industrial decarbonisation. Currently, many breakthrough technologies are already in high development stage and are currently in the stage of transferring to industrial scale, i.e., implemented in pilot or demonstration plants. Concerning the well-known Technology Readiness Level (TRL), these projects and technologies can be positioned on the TRL stages 7-9. Thus, the design and construction of large-scale pilot or demonstration plants are currently one of the major challenges for the implementation of many decarbonisation technologies in highly industrialised countries and pioneering

organisations. It often requires collaboration between different industries and partners at a regional level and across borders. Yet the return on investment is uncertain and there is still a risk of technological lock-in and stranded investment. Moreover, there is a significant dependency on the availability of feedstock and green energy as well as uncertainty concerning potential revenues from emerging demand markets.[1]
In addition to the development of major new technologies, there is also a huge potential for technological solutions that are already well known but require specific adaptation to the specific sector and the company. These include measures to increase energy efficiency, the electrification of processes that can be easily adapted, or the use of heat pumps.

The availability and acceptance of various new technologies in individual countries also represent an obstacle. It is therefore necessary to create an attractive market for the technology but also to create the proper enabling framework conditions (see also below).

In general, both major and incremental innovations require R&D, and even efficiency measures require some degree of absorptive capacity and readiness. Development efforts are essential for successful technology adoption, even when technologies are proven in other sectors and countries. In general, uncertainty over the performance of new technologies without a track record and wide demonstration at a global level is a common barrier to investing in new technologies in emerging economies.[2]

While in highly industrialised countries, building R&D capacity and establishing demonstration and pilot plants is a major effort that requires cooperation between different countries and public support, the challenge for emerging economies is even greater. This applies to both university and public research R&D and business R&D. Emerging economies often lack specialised research departments and R&D facilities, while universities do not provide enough trained scientists and engineers for both academia and industry. In addition, addressing technological challenges often requires cooperation between academia and industry, and in some emerging economies there is a lack of collaboration between academia and industry and a tradition of conducting joint R&D.

[1] See e.g. Energy Industrial Energy Accelerator (2022).
[2] See IEA (2021).

Many emerging economies also lack public support measures and R&D policies to promote industrial decarbonisation, and without such a public strategy to promote and build a certain level of R&D capacity, technology transfer is unlikely to be successful.

Provision of renewable energy

In order to decarbonise the industry, efficiency increases, direct use of energy from renewable energy sources, electrification, the use of green hydrogen and bioenergy, as well as carbon capture and storage (CCS) and carbon capture and utilisation (CCU) are necessary measures. An increased use of renewable energy sources is unavoidable in the future. In general, renewable energy potential varies widely across countries. In a report by ESMAP from 2020, for example, the PV power potential of the different countries is determined (see Figure 1).[3] In Indonesia, for instance, the renewable energy potential is estimated at over 400 GW, with only 10.8 GW in use in 2021.[4]

Solar production has increased significantly in recent years. To further support and accelerate this expansion, investments are planned to increase capacity from 640 GW (2022) to 1,200 GW in the medium term.[5]

Renewable energy sources can only be properly exploited if the appropriate transmission infrastructure (electricity, hydrogen, CO_2) is in place to transport the energy to where it is needed. The use of renewable energy also means that fluctuations in availability are to be expected, so greater flexibility is needed, for example in the form of storage in the supply network. The use of renewable energies also means that fluctuations in availability must be expected, which is why increased flexibility is needed, for example in the form of storages in the supply network. For using CCS technologies, the availability of geological storage of CO_2 is required, too.

[3] See ESMAP (2020).
[4] See World Economic Forum (2022).
[5] See IEA (2023).

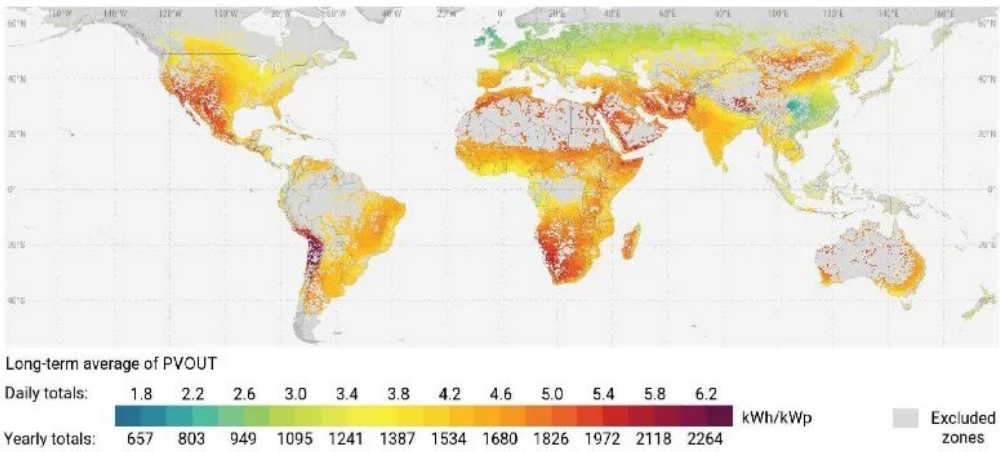

Figure 1: Practical solar energy potential excluding areas based on physical, environmental and other factors (ESMAP, 2020).

It is important to keep in mind that the demand for energy in emerging countries will increase significantly in the coming years. An IEA report points out that about 785 million people worldwide lack access to electricity and indicates that decarbonisation should also go together with efforts to provide all people with access to electricity by 2030. [6]

Another IEA report mentions that the IEA climate-driven scenario needs at least a threefold increase in annual investments in clean energy, grids, efficiency, and other consumer applications in emerging markets and developing economies.[7] It is therefore clear that significant investment is needed in the use and distribution of renewable energy and other decarbonisation measures.

However, it is important to ensure an efficient and sustainable use of renewable energy sources. A global perspective should play a role here, as it can provide opportunities for new business models, for example through the export of hydrogen or electricity, especially in countries with high renewable energy potential. Furthermore, the possibility to store CO_2 can be of great importance not only locally but also globally.

[6] See IEA (2021a).
[7] See IEA (2021b).

However, in some countries, current energy policies and regulations continue to promote coal use and hinder the easy growth of renewables.[8] And there are vested interests of state-owned electricity, coal and oil enterprises. Moreover, there are continued government subsidies for fossil fuel consumption, making coal the cheapest energy source. In addition, in some countries value chains are highly concentrated on a few key players that control the entire market which can hamper any change. Joint efforts are needed to ensure that, on the one hand, energy producers provide sufficient renewable energy and the corresponding infrastructure, and that, on the other hand, industry can adopt business models that allow it to compensate for higher energy prices.

Finally, to take the most efficient measures in decarbonisation, a holistic view or decarbonisation roadmap is necessary. The creation of such national industrial decarbonisation roadmaps is a complex process, but also an opportunity to bring together key stakeholders who can collectively shape development, mitigate risks and reduce barriers. Here, a lot of experience from industrialised countries can already be exchanged.[9]

Materials and feedstock supply

In the decarbonisation process, attention will also have to be paid to the efficient use of raw materials. In general, the technologies that will be used to decarbonise the energy system require more minerals than their fossil fuel equivalents.[10] In total, however (materials, fossil fuels, and critical minerals), the energy system consumes two-thirds less in the Net Zero Emission scenario.[11]

The expected sharp increase in demand for critical minerals may lead to price volatility and supply disruptions around the globe. In addition, the production of many of the required minerals is strongly concentrated in individual countries. Combined with complex supply chains, this increases the risk of securing the minerals needed for decarbonisation technologies. There are also concerns about the quality of the raw material. Low quality of the raw material can lead to higher energy consumption and thus to higher greenhouse gas emissions in the extraction of the required material. In addition, the extraction and processing of mineral resources must be carried out in an environmentally friendly manner and

[8] See Shawoo et al. (2020).
[9] See Leitner et al. (2023).
[10] See IEA (2022).
[11] See IEA (2023).

in accordance with good social standards. Another challenge at mining facilities is the increase in climate risks. One example of this is water stress for resources with high water requirements, such as lithium.[12]

In 2022, investments for critical minerals development have increased by 30% and for expansion by 20%. However, for the Net Zero Emission scenario in 2030 these increases and the announced mining projects are not enough.[13] The IEA report therefore points to the need for a strong focus on investment in mining, processing, refining, recycling and technological innovation, highlighting the multiple challenges for emerging economies.

In general, industry will rely more and more on recycled materials as raw materials. For most basic materials, enhanced circularity will become even more critical over the next decades. More circular material and energy flows will reduce emissions, reduce energy use, and maintain supply security while reducing costs. Of course, there are limits to recycling as well determined also by the regional and national industry structure as well as transportation costs. For example, steel cannot be recycled endlessly because nickel or copper impurities can creep in, making the steel less durable. Nevertheless, more than a quarter of steel is made from scrap metal in electric arc furnaces.[14]

Financial barriers

According to an IEA report[15], two-thirds of the world's population lived in emerging and developing countries in 2021 and they only accounted for 20% of global investment in clean energy technologies.

The development and integration of new technologies into a full production system is a key technological and organisational challenge and requires huge investments. Even if the decarbonisation technologies reach maturity, their market uptake will depend on the operational costs and relative prices. Furthermore, in many cases, major brownfield conversions of existing sites will be required, which will be frequently more expensive than greenfield investments. In addition, the

[12] See IEA (2022).
[13] See IEA (2023).
[14] See Niranjan (2022).
[15] See IEA (2021b).

accelerated transition may require the rebuilding of assets that will still provide a return on investment even after full depreciation. However, currently, capital is significantly more expensive in emerging economies than in advanced economies. In addition, there is limited capacity of local banks to conduct due diligence and value projects (underdeveloped local capital markets).[16] Hence, reducing the cost and improving the availability of capital is crucial.

There is a need for adequate incentives for innovations and investments, in particular, to offset any cost/price disadvantages compared to state-of-the-art technology and the use of fossil fuels, taking into account also market competition on global markets. In this case, incentives for companies and private investors for their investments (Capital Expenditures - CAPEX) are needed which allows to reduce the investment risks. In addition, in some areas, public support measures for higher operation costs (Operating Expenditures – OPEX) are needed. The lack of public policies to support CAPEX and OPEX is currently seen as an obstacle in many highly industrialised countries and is, for example, a major issue in recent European policy debates.[17] However, the challenge is even greater for emerging economies.

Another way to support decarbonisation is the carbon pricing already in use in many countries. According to the Word Energy Outlook 2023[18], around 23% of energy-related emissions are included in some kind of carbon pricing. Furthermore, a lot is being done or planned regarding carbon pricing, but most prices are too low to achieve the goals of the Paris Agreement[18]. Carbon pricing can help to reduce the hurdle for electrification, for example, as the high electricity prices compared to the conventional fossil fuels used are an obstacle. Furthermore, a global solution should be aimed at preventing the emigration of some production sites to countries without carbon pricing and thus a local shift of carbon emissions and no reduction of these.

Policy and regulatory barriers

The transformation of production processes is currently often hampered by the regulatory framework in place. In addition, as already mentioned above, a stable and predictive regulatory framework is important for private investors. Topics such as operating licences, trade regulations, norms, and standardisation are of

[16] IEA (2021).
[17] EC (2022).
[18] See IEA (2023).

importance. For example, in some regions, the existing regulatory framework conditions make it almost impossible to exploit new critical minerals. As a consequence, long lead times or unclear processes for obtaining project licences and operating permits prevent investors from making investment decisions.

These regulatory framework conditions are often defined and implemented by policy and in some cases in cooperation with interest groups. Thus, the political will to shape the development is key. However, a big challenge in many emerging countries remains vested interests at all levels, with short-term economic motivations in the governments but also the state-owned companies and the business elite which hinders progress. And even if a country has a conducive regulatory framework in place, there appears to be a lack of political commitment and leadership, intensified through strong opposition from fossil fuel-intensive companies.[19] Poor collaboration and knowledge transfer between key stakeholders, particularly industry and government is a dominant weakness in many emerging economies, too. In addition, there is sometimes limited capacity of local governments to deal with transition challenges. In general, it is difficult to solve the short-term trade-offs between economic development, securing value chains, income equality and employment with decarbonisation and mitigation.

Social dimension

The industrial decarbonisation has huge social implications and is driven by society. It can only be managed if the possible negative impacts are mitigated and if society plays an active role in helping to shape its development. Lack of societal acceptance of new technologies and scepticism about some technologies can block local planning processes for critical infrastructure or site development in general, and can influence government support for these technologies.[20]

At the same time, technological change and huge investments in infrastructure require new capabilities from the workforce and demand for skilled labour. For example, concerning the above-mentioned challenges of mining critical minerals, currently, one of the key barriers is the shortage of workforce. In addition, the population has also the power to shape the development as its role of users and customers and hence the demand for more climate-friendly products.

[19] Shawoo et al. (2020).
[20] Lai et al. (2024).

However, there are major concerns and barriers to the different forms of change and the consequences of change. Thus, there is a need to tackle the transition alongside poverty and inequality reduction.[21] For instance, jobs in coal mines are not directly transferable to jobs in the renewables sector, which would require a major reskilling.

As a result, industry and policymakers need to take action and raise awareness of the need to decarbonise industry as a key strategy to preserve our planet's resources in the long term. But without a clear political will, such an endeavour is doomed to failure. And many countries continue to prioritise economic growth and other development goals over climate goals. Thus, there is a challenge of ensuring a "just transition" due to high unemployment, large proportion of marginalised workers and an ambivalent role of labour unions. Thus, barriers concerning knowledge and capacity make a just transition difficult.

[21] Shawoo et al. (2020).

Strategies and measures to facilitate and accelerate industrial decarbonisation

In order to address the challenges and barriers described above, several actions can be presented that should guide key stakeholders at national and international levels.

Technology Innovation

A number of actions are needed to facilitate the development:

- **Technological co-development** at medium to late TRL between highly industrialised and emerging economies is essential to accelerate implementation and diffusion of technologies. R&D frameworks and joint R&D with emerging economies need to be established. Here public support and funding are required. A holistic technology adaptation readiness discussion is required to increase the speed of technology development. Artificial intelligence methods will improve the agility of technology development and help to pursue a non-linear approach.
- **Collaboration.** In general, promotion of intra- and cross-sectoral collaboration and along the value chain (with energy suppliers, technology providers, universities, SMEs, etc.) is important for the introduction of major as well as incremental innovation.
- **Promotion of digitalisation.** Digitalisation is a key technology and enabler for many decarbonisation solutions, and any R&D&I programme should address digitalisation, including the provision of digital infrastructure.
- **Promoting science-industry relationships.** In some emerging economies, the culture and tradition of collaboration between academia and industry is weak and specific actions should promote transfer mechanisms and activities (e.g., by establishing joint competence centers, university technology transfer units).
- **Establishment of a network of laboratories and research institutes** between different countries focussing on low-carbon technologies (R&D, infrastructure, technology transfer etc.) to support industrial decarbonisation in emerging economies.
- **Demonstration projects and plants** are essential to prove the feasibility of new major breakthrough technologies. The demonstration phase is critical to

provide the information required for decision on investment in full scale commercial production plants. Publicly available information about demonstration projects is important to promote learning and knowledge exchange.

- **Support technology providers** to test and adapt innovative technologies to the specifics in emerging economies. In this context, specific regulatory framework conditions (see below) are important as well to promote the **market development**.
- **Development of national strategies and roadmaps**: Many countries have decarbonisation roadmaps for different hard-to-abate sectors, however, this is often not the case for emerging economies. Such technology roadmaps are a key element of a formal industrial and R&D strategy in a country that formulates climate targets and defines the role of technological innovation and R&D (technology pathways) in achieving the targets.
- If a roadmap or strategy already exists, it is important to **track progress** to ensure that the goals are achieved and, if necessary, to take measures to support implementation.

Energy and resources

The supply of energy, resources and feedstock is crucial, hence, supporting the access and availability of climate neutral energy is a priority. Specific measures encompass:

- **Development of adequate infrastructures** for supplying and storing electricity (electricity grid capacity), hydrogen and CO_2 at globally competitive prices is a further topic that deserves attention and immediate action.
- **Securing access to and availability of feedstock sources** at globally competitive prices through supportive measures is required, Resource availability of reg. biomass/waste; Having separated streams of materials to repurpose.
- The development and **implementation of a regional approach** to industrial decarbonisation, based on regionally available resources (e.g., access to renewables, or CO_2 transport and storage networks) is an adequate strategy to be promoted. The role of Industrial clusters can be mentioned in this context.

- **Corporate power purchase agreements** from utility-scale renewables are important and should be enabled by the proper framework conditions (see also below).
- **Promotion of industrial symbiosis and a circular economy** through the effective combination of energy recovery and recycling which encourages the symbiosis of heat, hydrogen and other energy and material flows. In this context, fossil carbon carriers/materials should be regulated in their new use so that the use of secondary raw materials is promoted.

Financing mechanisms

The development and deployment of technologies across and beyond all TRLs require large investments, predictable legal framework conditions, and, respectively, significant public co-financing to share the risk and to bridge the funding gap between early stages of development and full commercialisation and diffusion, often also called the "valley of death". Although emerging countries started to establish specific support programs, there is a lack of funding schemes to support the development of technologies for the different development stages from the development to diffusion in different sectors. Information and training can also foster the uptake and implementation of measures.

The following specific measures are relevant:

- **Risk-sharing measures** through suitable instruments are particularly critical to support investment in new technologies at the plant level (Subsidies for renewables, co-funding green investment funds, transition taxonomies etc.). In addition, policy has a strong signalling role for investors by providing predictable and supporting framework conditions (see also below). Such de-risking measures are important to incentivise first movers.
- Facilitating the **capital market and the access to private capital** at affordable cost, including providing de-risking instruments that attract private investments at competitive conditions. Specific funding mechanisms for start-ups are important as well.
- **Blended finance mechanisms** which combine public and private funds should be particularly fostered to leverage additional resources for sustainable development in emerging countries. It attracts commercial capital to projects that contribute to greening of the industry, while providing financial returns to investors.

- **Bilateral and multilateral funding mechanisms** for RD&D projects, pre-feasibility and feasibility studies are key for technological co-development.

Regulatory measures and market incentives

Existing standards often hamper the introduction of new solutions on the market and might be proactively applied to facilitate access to the market by also considering environmental aspects. The elimination of regulatory barriers that prevent the timely scaling up of technological solutions is hence important. The promotion of voluntary standards, labelling and certifications can also set incentives for the creation of markets for low-CO_2 products and promotes the demand for green products (demand-side instruments). For adapting or implementing such measures emerging economies can learn from other countries. More specifically, the following measures are of importance:

- **Enabling policy frameworks**, methodologies, targets and policies that are consistent so that trade is not disrupted. A common framework for climate targets, CO_2 pricing and carbon footprinting is needed. The establishment of standards for what constitutes e.g., green steel, cement, and chemicals can be mentioned as well. **Carbon pricing instruments** are mechanisms to provide investment signals and support the creation of those markets that are necessary for long-term climate objectives. There is also a need for the **harmonisation of global standards as well as measurement and monitoring** frameworks for embodied carbon.
- National goals have to be broken down to the **industry sector level**.
- **Carbon Accounting:** Common definitions about near-zero steel and other products are needed: thresholds are currently agreed as a starting point (e.g. IDA process / IEA Report); Transparency and carbon accounting need to be established globally; Methods for quantification and tracking of greenhouse gas emissions must be established and need to be supported by governments.
- **Regulation for energy and material supply:**
    - Development of regulatory frame for hydrogen applications, enforcing regulation to make use of recycled feedstocks a reality, electricity grid regulation: Regulatory framework for introduction/commercialisation of renewable electricity and removing obstacles of permissions allows to make new energy source conveniently available.

  - **Policies for promoting the circular economy**. Regulatory change is a necessity to open up waste flows as a major, large-scale feedstock resource and optimise product design and end-of-life dismantling for high-quality recovery. Recyclability by design has to be promoted as well.
  - **Certification** for new input materials is needed, together with reducing trade barriers to incentivise carbon mitigation which is essential to achieve real circularity of materials and feedstock.

- **Regulatory experimenting zones** for testing (e.g., integration of green hydrogen into gas pipelines, elimination of grid tariffs for renewable energy storage facilities when providing energy services) should be considered on the national level.
- The **permission process** in relation to demonstration plants and for large infrastructure projects is often complex and lengthy. Speeding up **permitting procedures** is urgently needed. Share knowledge on development and environmental approval mechanisms that accelerate projects.
- **Demand side measures:** It is well known that **public procurement** can play an important role in creating a demand for specific solutions and in accelerating the creation of lead markets, a fact which should be promoted. In addition, **product information**, including product labelling, can be a useful tool to empower consumers from simple awareness to active involvement and thus help create markets for climate-neutral products.
- Showcasing **best practices** for how energy transition could work creates a pull from the demand side.

Social dimension

The wide deployment of decarbonisation technologies also requires the integration of workers, customers, and citizens and corresponding public measures. The transformation of the industry requires to support to develop and provide education and training offers for all different qualification levels.

- **Education and training:** Supporting education institutions, training providers and companies to offer specific education and training programs (reskilling, curricula at (higher) education institutions, vocational training centres, etc.)
- **Co-financing national just transition** funds which would help tackle barriers and mitigate negative short-term impacts.

- **Awareness-raising activities** on the urgency of the transformation of the industry can help to reduce barriers, empower social forces and speed up the development.

Outlook

In the final section of this White Paper, we present specific actions that NIM members and their partners have identified as highly relevant and have committed to support. The NIM partners emphasise the importance of the above-mentioned strategies and measures to advance industrial decarbonisation in cooperation between industrialised and emerging economies.

In particular, NIM aims to support to establish knowledge sharing hubs and thereby aims to expand the network to the global south. CEM-IDDI and IDRIC already have strong links with emerging economies and joining forces with NIM will be beneficial.

CEM-IDDI is particularly interested to further promoting public procurement for industrial transformation. Public procurement can strongly facilitate the creation of markets for new green products (e.g., green steel, renewable plastics, green concrete) or products made by decarbonised production processes. CEM-IDDI is currently working on an initiative to harmonise global standards and reporting frameworks for embodied carbon, and set a globally recognised target for green public procurement.

In many emerging economies, there is still a lack of data to monitor the evolution of CO_2 emissions at the organisational, sectoral and regional levels. In addition, there is little systematic data on major R&D&I activities (e.g. large demonstration projects, FOAK plants), which are the basis for monitoring progress and sharing knowledge between companies, sectors, and countries. CEM-IDDI aims to help fill this data gap in the future (e.g. by supporting the establishment of a measurement and monitoring framework).

The adoption and adaptation of technologies also depend on the specific national and regional context. The traditional TRL scheme does not take into account geographic, market, and social readiness. Therefore, a holistic discussion on TRL is needed, which both CEM-IDDI and NIM are committed to supporting.

In order to raise the large investments private and public financial resources are necessary. Public co-funding can help to reduce uncertainties and de-risk investments by private actors. All partners aim to promote that national governments increase their public funding in industrial decarbonisation and create co-financing and blended funding mechanisms.

Private and public co-financing is needed to finance large investments along the technological development stages and in particular beyond TRL 7. Public co-financing can help reduce uncertainties and de-risk investments by private actors. All MI partners aim to encourage national governments to increase their public funding for industrial decarbonisation and to create co-financing and blended funding mechanisms for R&D and deployment.

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