Climate Club

Accelerating global industry decarbonisation through stronger international collaboration

Paper prepared by the Interim Secretariat of the Climate Club

Background on the Climate Club

The Climate Club is an open, co-operative and inclusive forum of climate-ambitious countries with the goal of supporting the effective implementation of the Paris Agreement and decisions thereunder. It aims to support accelerating climate action and increasing ambition to achieve global net zero GHG emissions by or around mid-century, with a particular focus on decarbonising industry.

Launched at COP 28 in 2023, the Climate Club currently has over 30 government members. The full list can be found at www.climate-club.org.

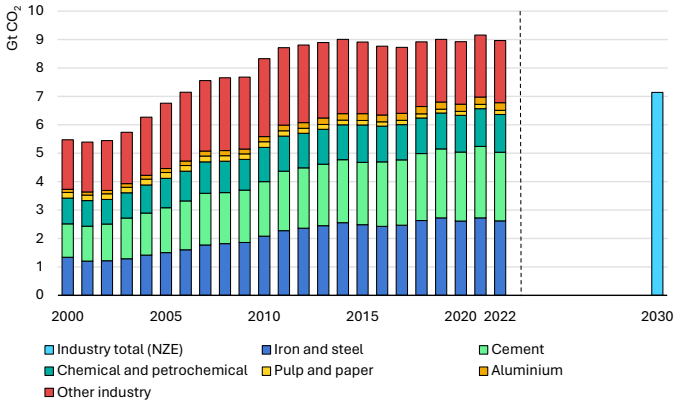
Why is there a need for a greater focus on industry decarbonisation?

The industry sector accounts for almost half of total energy system emissions

In 2022, the industry sector was responsible for 9 gigatonnes (Gt) of direct CO_2 emissions, accounting for a quarter of total energy system CO_2 emissions (including both energy-related and industrial process emissions). When indirect emissions from electricity and imported heat generation are included, this increases to around 16 Gt CO_2, or around 45% of total energy system emissions. Three industry sectors – steel, cement and chemicals – account for around 70% of direct CO_2 emissions from industry.

Direct industrial emissions have been broadly flat since 2013, but now need to fall to about 7 Gt CO_2 by 2030 – or by around 3% per year on average – to align with the IEA's Net Zero Emissions by 2050 Scenario (NZE Scenario).

Figure 1: Direct CO2 emissions from industry in the Net Zero Emissions by 2050 Scenario, 2000-2030



Note: NZE = Net Zero Emissions by 2050 Scenario.
Source: IEA (2023), Tracking Clean Energy Progress: Industry.

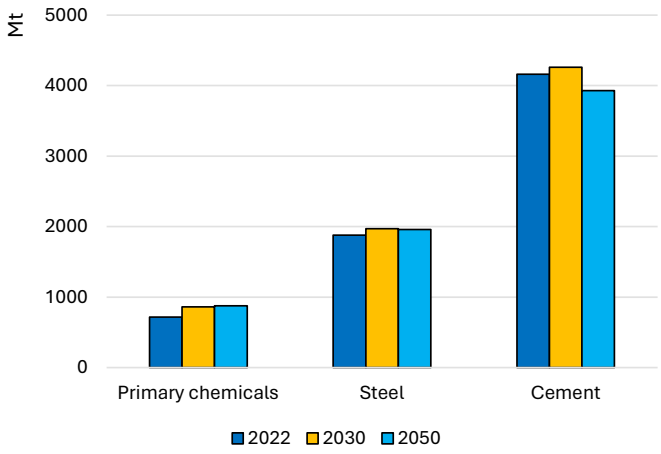
Demand for industrial materials will grow rapidly in developing countries

Over the past two decades, as the global population has grown by 25% and global GDP has doubled, demand for materials produced by heavy industries has grown considerably – by about 110% for steel, 120% for cement and 80% for primary chemicals.[1]

Looking out to 2050, at a global level, demand for these materials will remain high under current policies. Demand reduction in advanced economies is largely offset by rapid growth in developing and emerging economies, as they expand the infrastructure and services required for development.

[1] Ethylene, propylene, benzene, toluene, mixed xylenes, methanol and ammonia.

Figure 2: Demand for primary chemicals, steel and cement under the Net Zero Emissions by 2050 Scenario, 2022-2050



Source: IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach.

Moreover, these materials are an important component of the global net zero transition, being vital for the manufacture of clean energy technologies and infrastructure, such as wind farms, transmission lines and electric vehicles.

Supply is dominated by conventional, high-emissions capacity

To meet this demand, supply is rapidly expanding globally, though most of this continues to rely on conventional, emissions-intensive processes. For example, in the iron and steel sector, around 160 million tonnes of capacity is under construction or announced (or 7% of the global total), at least half of which will use emissions-intensive processes for ironmaking, notably blast furnaces with basic oxygen furnaces. Given that facilities have a typical lifetime of 40 years, this expansion of capacity will result in a significant emissions lock-in. Often, the underlying cause for the growth in emissions-intensive supply is not market-driven, but results from policy settings that favour high-emissions capacity growth of this kind.

There are early signs of growth in low-emissions production from heavy industries, with around 60 low-emissions steel projects announced worldwide as of the end of 2022, with the project pipeline expanding rapidly over the past 2 years. However, many of these projects are at the pilot or demonstration stage, while conventional steelmaking capacity continues to grow at the same time.

Challenges for achieving net zero industry

There are four main challenges for achieving net zero in industry, including: (i) a lack of commercially available technologies for near zero emission production of materials; (ii) the high cost of near zero emission production routes compared to conventional processes; (iii) many of the materials produced by heavy industries are highly traded and pricing is competitive; and (iv) heavy industry facilities are long-lived and capital-intensive, potentially locking in emissions.

Lack of commercially available technologies for near zero emissions production of materials

While there has been considerable progress on clean energy innovation in the past few years, around 35% of the emissions reductions under the NZE Scenario are from technologies that are still at either demonstration or prototype stage, i.e. not yet available on the market. Many of these technologies are concentrated in industry sectors, and are yet to achieve commercial-scale deployment. Further efforts are needed to develop, demonstrate and deploy low-emissions technologies, in particular in emerging market and developing economies (EMDEs), where the majority of industry investments are set to take place to respond to growing demand.

Figure 3: Technology Readiness Level for selected technologies relative to technology maturity targets under the Net Zero Emissions by 2050 Scenario

Notes: H_2 = hydrogen; CCS = carbon capture and storage; DRI = direct reduced iron.

Source: IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5C Goal in Reach.

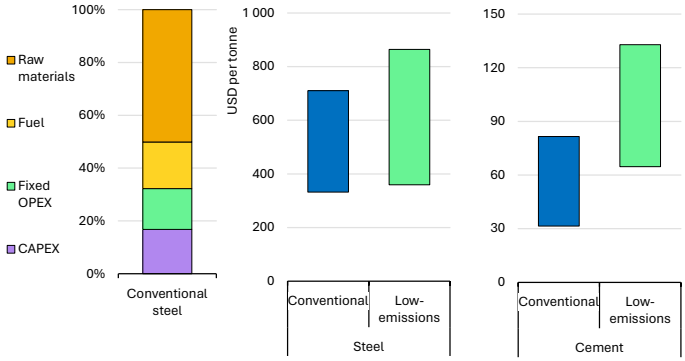
High cost of near zero emission production routes versus conventional processes

Cost premiums for low-emission alternatives today vary depending on the different technologies involved and local conditions, with some likely to achieve near cost equivalence in the most favourable locations, while others are likely to command a significant premium. Cost estimates warrant further analysis as the first set of plants are built over the 2020s.

There are three main factors that impact the final production cost of bulk materials, including (i) capital costs, (ii) operational costs and (iii) financing costs. Initially, capital costs for near zero emissions production technologies will be higher than for their conventional counterparts. However, we can expect these to fall as more facilities are built, in many cases achieving cost parity. Operational costs will vary significantly between sector and location, but are likely to be higher in the near- to medium-term, particularly if using fuels such as low-emissions hydrogen or methanol. Near zero emission production technologies at an early stage of development are also likely to face higher financing costs due to the higher risk associated with their deployment. These can be mitigated in the near-term via a range of de-risking measures and should dissipate over the medium- to long-term, as the technologies mature.

Although the cost of producing bulk materials using near zero emissions production technologies is generally significantly higher than using conventional ones, the estimated impact on final prices for clean energy products is typically small, as bulk material costs represent a relatively small share of their final production cost. As an example, the final costs of key clean energy products, such as electric cars, heat pumps, offshore wind turbines and solar PV, are estimated to increase to just 0.5-2.0% more than if produced using conventional, high-emissions materials.

Figure 4: Indicative levelised cost of production for selected industrial materials



Source: IEA (2023), Energy Technology Perspectives 2023.

Nonetheless, these additional costs are significant at the production or facility level, requiring a combination of policies and financial support to incentivise first movers.

Many of the materials produced by heavy industries are highly traded, where pricing is competitive

Steel is the most traded of the main heavy industry outputs, with an export share of global production of more than 20%, according to worldsteel. The figure for ammonia is around 10%, methanol around 30%, and for ethylene, propylene and cement it is around or below 5%, according to the International Fertilizer Association and the United Nations Comtrade database.

Differences in climate policy can adversely affect trade between countries. Production cost differences can lead to increased imports from regions with less stringent climate policy and/or difficulties in exporting to regions with more stringent policy. As a result, countries could be penalised for taking early action, without additional measures to limit the import of higher-emissions materials and/or support exports of lower-emissions materials. This can lead to trade tensions and additional costs, slowing the pace of the transition.

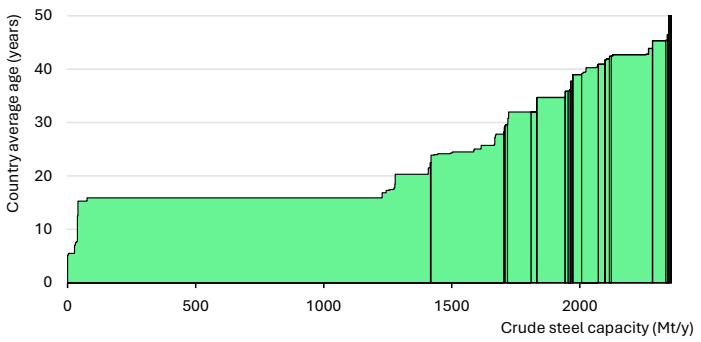
Heavy industry facilities are long-lived and capital-intensive, potentially locking in emissions

Given the long technical lifetimes and high capital requirements of the industrial assets used in these sectors, the year 2050 is just one investment cycle away. Once facilities have reached a final investment decision, it is unlikely that the asset would be decommissioned until it reaches the end of its lifetime.

Global average lifetimes of assets such as blast furnaces and cement kilns are around 40 years. However, after about 20-25 years of operation, plants often undergo a major refurbishment to extend their lifetimes, with associated investment costs of the same order of magnitude as a new-build plant (e.g. the relining of a blast furnace).

The scale of the opportunity should not be underestimated: if all existing plants were retrofitted or replaced with near zero emission technologies at the end of the current investment cycle, this could reduce projected cumulative emissions from existing assets in heavy industry sectors by around 50%. At the same time, further increases in new high-emissions industrial capacity represent a major challenge, as these plants will be operating for decades to come.

Figure 5: Average age and size of key emissions-intensive assets in the steel industry



Source: IEA (2022), Achieving Net Zero Heavy Industry Sectors in G7 Members.

How to accelerate the decarbonisation of industry

Accelerating the decarbonisation of industry will require action across multiple enabling conditions, both at a national and international level.

Setting clear timelines for emissions reduction

This includes roadmaps, plans and targets that are supported by policies and measures that will deliver emissions reductions in line with the Paris Agreement. Providing certainty and stability on the trajectory of industrial decarbonisation can help mobilise investment, particularly when aligned internationally.

Standards and definitions

It will be important for countries and companies to have a shared understanding of methodologies for measuring emissions from industrial materials and products, to enable like-for-like comparison and trade across borders. There should also be a common understanding on defining what constitutes near and low-emissions, to avoid fragmentation and confusion for customers.

Creating early markets for low-emissions materials and products

Signalling early demand for low-emissions materials, across the public and private sectors, can help accelerate industry decarbonisation by providing greater certainty on the size of market for producers and

manufacturers. This can include procurement policies, advance market commitments, quotas and end-use product regulations.

Developing novel emissions reduction technologies

Given that near zero emission production processes for most heavy industries have not yet been demonstrated at full scale, government support to accelerate innovation and share learning will be crucial. This can include national and international research programmes, in collaboration with the private sector.

Supply-side policies to support commercial-scale low-emissions production and limit growth of high-emissions production

For as long as costs of producing low and near zero emissions materials and products remain higher than the costs from conventional, high-emissions routes, it is likely that some degree of support will be necessary. Early examples of support include direct government subsidy on capital or operational costs or carbon contracts for difference. There will also need to be action to limit the growth and enable the exit of new high-emissions production capacity. This is particularly important since the growth of such capacity is often the result of government support lowering costs for high-emissions production and raising barriers to exit for such production routes.

Mobilising finance and investment

Strong policies and measures can help mobilise much-needed private capital, which will account for the majority of investments in the industry sector on the path to net zero. For first movers to invest in high-risk technologies, public finance can be used strategically for de-risking initial projects. De-risking instruments for lowering the cost of capital in EMDEs will be vital, as they face a combination of risks when investing in near zero emission technologies.

Accelerating material efficiency and circularity

Enabling the mainstreaming of material efficiency considerations will require the development of policies and regulations to motivate more intelligent use of materials along various supply chains. This will be vital in limiting the growth in demand for new materials, thereby helping to accelerate the decarbonisation of material supply.

Ensuring a just and inclusive transition for workers and communities

Decarbonisation of industry can only be sustainable if it considers the people and communities involved. This includes communities affected by new industrial sites or by the shutdown of high-emissions facilities. It may also include training workers to operate new technologies within industrial plants, or to work in new areas (e.g. operating CO_2 transport and storage networks).

How the Climate Club can accelerate global industrial decarbonisation

The Climate Club provides a much-needed opportunity for governments to collaborate more closely on industry decarbonisation, enabling co-ordination and joint action on key challenges. In doing so, members of the Climate Club can make the transition of industry faster, easier and cheaper for all.

Share best practice on industry decarbonisation policies and support work on standards and definitions

Decarbonising industry in line with net zero emissions will require new policies, which can be complex to deliver. No country has successfully decarbonised a significant portion of its heavy industries today, although there are early signs of policies that are having a positive impact.

By sharing best practice on such policies and instruments, countries can learn from successful

examples being implemented around the world. To seize the full potential of such policies for global decarbonisation efforts, improved collaboration among countries, including on standards and definitions, can unlock significant co-ordination benefits, including stronger investment signals, reduced administrative burden for companies operating across borders and larger, shared markets. Best practice examples can include policies and measures covering technology development and innovation, commercial-scale project support, public procurement and the use of public finance to mobilise private capital.

The Climate Club will draw on the work of existing initiatives, signalling to its members where forums for such collaboration may already exist (see landscape map in the Annex).

Set a joint vision for the pace of decarbonisation across multiple countries, including demand-side and supply-side action

Under the Climate Club, countries can set a clearer joint vision for the pace of decarbonisation across multiple countries, providing much greater certainty on the transition than any one country can do alone. In doing so, they can create stronger signals for investment to the private sector, stimulating innovation and helping lower the costs of the transition for all.

On the demand-side, several joint commitments of this nature already exist, including green public procurement of materials under the Clean Energy Ministerial Industrial Deep Decarbonisation Initiative (CEM IDDI), as well as similar initiatives in the private sector under the First Movers Coalition, SteelZero and ConcreteZero.

Additional work in this area could see measures such as quotas and end-use regulations supporting a wider demand signal that encompasses policies over and above procurement.

On the supply-side, collective action to move away from high emitting assets and technologies has provided powerful signals of ambition in other sectors, including power and transport. Similar pledges could also be powerful in industry, particularly given the long timelines for assets, where the earlier the signal, the better. Strengthening global dialogue to ensure that policy does not unduly support high-emissions capacity and is effective in increasing low-emissions supply is equally important. Additional work in this area will focus on improving insights on the nexus of emissions, capacity and supply developments and could contribute to effective policies and co-operation to address this, including by mapping existing decarbonisation policies.

Mapping existing decarbonisation policies to support more ambitious and better-aligned policies

The Interim Secretariat has begun an initial mapping of existing steel decarbonisation policies and the public finance and technical assistance being made available for industrial decarbonisation. This is an initial component of the Climate Club Work Programme, which will be vital in supporting members, with emerging insights covered below.

- Countries are increasingly implementing policies to accelerate industrial decarbonisation. For example, all major steel-producing countries have such policies in place, even if they currently lack the ambition required for net zero.
- Such policies include target-setting, strategies, roadmaps and a range of government-backed support programmes, in particular to encourage innovation and the deployment of low-emissions technologies. However, in many cases these are not binding, limiting the effectiveness of mitigation efforts. Policy mixes differ significantly between countries, making their impact hard to compare and assess.

- The use of subsidies for steel decarbonisation differs widely across countries, in part reflecting differences in fiscal capacity, which may contribute to risks of an uneven playing-field. Policies currently focus on supporting new low-emissions steelmaking and much less on the exit of emissions-intensive plants.
- Policies are mostly cross-sectoral, and may not be sufficiently tailored to challenges in specific sectors, such as the steel sector. A strengthened sectoral approach, focused on emissions-intensive sectors such as steel and cement, could also strengthen the impact of public finance and technical assistance efforts.
- Policy efforts are being hampered by a lack of international agreement on standards and definitions for low-emissions steel and other products.
- Platforms for knowledge-sharing and donor co-ordination can support a pipeline of low-emissions projects, via capacity building and stronger technical assistance.

Improve technical and financial assistance for industry decarbonisation, enabling a faster transition in all countries

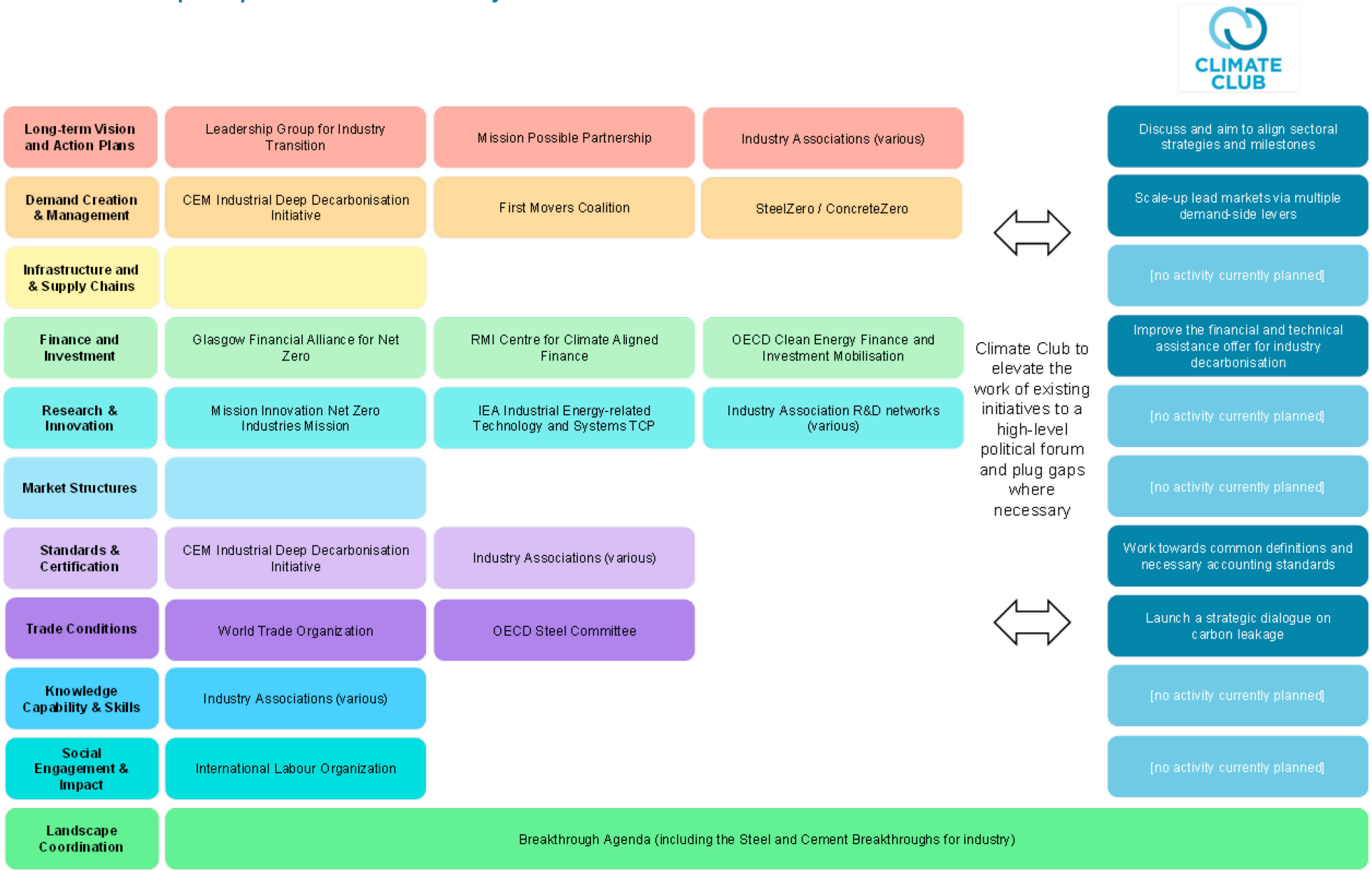
The Climate Club will support its members and the wider community with accessing financial and technical assistance through the mapping of existing resources, communication of successful projects, and the development of a new matchmaking platform, with the aim of better using public funds to mobilise private finance.

These workstreams will help tackle challenges with the existing financial and technical assistance offer for industry decarbonisation, including a lack of co-ordination among key assistance partners, a lack of expertise on deep decarbonisation projects and a lack of technical support for EMDEs, from project ideation to project delivery.

As set out above, EMDEs will be home to the vast majority of new industrial capacity in the coming decades, yet the support available for decarbonisation is insufficient. Technical assistance to support the development of policy frameworks and financial assistance to support early projects and mobilise private finance will be vital to ensure that countries can continue to industrialise, while minimising emissions.

DISCLAIMER

Annex: landscape map of international industry decarbonisation initiatives



Note: Adapted from the Breakthrough Agenda Report 2022 to cover all of industry and add Climate Club activities.