TASK FORCE
WORKING GROUP
REPORT

EUROPEAN GREEN DEAL

Towards a Resilient and Sustainable Post-Pandemic Recovery

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Task Force Working Group Report

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1. INTRODUCTION

The economic growth that the low-carbon transition could bring, in parallel with the digital transition, is an integral part of the European Green Deal. It is critical that this twin transition successfully transforms Europe's manufacturing base and carbon-intensive industries towards climate neutrality and increased circularity. The first important steps need to be taken now and continued throughout the rest of the decade to 2030.

At the moment, carbon-intensive industries mostly overlap with energy-intensive industries, but in a future dominated by low-carbon energy the two will diverge. Together, these industries are currently responsible for just under a quarter of greenhouse gas (GHG) emissions in the EU, and account for half of the emissions in the EU emissions trading system (ETS). They include some of the most 'hard-to-abate'[i] sectors, such as (petro)chemicals, steelmaking and other basic materials production. The emissions in these sectors are hard to abate because of their high-energy intensity, in both electricity and heat, as well as non-energy-process emissions.

While the Green Deal addresses all emissions-intensive areas of society, in addition to a slew of other environmental objectives, this chapter focuses on industrial transformation of carbon-intensive industrial sectors. There are nevertheless important linkages to other areas. Electrification and massive deployment of low-carbon power will be needed throughout the economy. Improving resource efficiency through increased circularity is a common challenge that goes beyond the manufacturing economy. Digitalisation – the other half of the twin transition – can support both resource and energy efficiency improvements. In recent years, biodiversity has become both a complementary and competing 'green' priority which may impact agriculture, but the role of land and forests in climate change mitigation and adaptation has also risen (which may affect several UN Sustainable Development Goals (SDGs)). Through substitution, biomaterials can also contribute to emissions reductions.

The importance of clusters, and the associated regional dimension, is a defining characteristic of carbon-intensive industries. Industrial hubs such as the *Ruhrgebiet* in North-Rhine Westphalia, Lombardy, the North Sea ports and Silesia are home to a great many of the EU's carbon-intensive industries. EU policy focus on these clusters is both wise and inevitable, particularly when clusters cross borders, such as in the Low Countries. Not all emissions can be covered in this way, however. Some sectors are dispersed throughout the EU but still require decarbonisation, cement being one example (this is the third-largest industrial emitter – heavy and unattractive to transport over great distance) or ceramics production, which tends towards many small production sites.

There is a general economic imperative for the EU to engage in the low-carbon industrial transformation, not least to position European industry competitively for the future. Politically, this will require an answer to the question of how the EU can build on its leadership role, whereby it can continue to offer solutions for emissions reductions and underpin growth in future low-carbon industries in Europe and globally while supporting increased resource efficiency. From a climate perspective, it does not matter where technologies are developed and deployed. From an economic and political acceptability perspective, however, the EU and other countries are keen to reap economic benefits by playing a leading role in this transition. There is likely to be both competition and cooperation between companies and economic blocs. Finally, the EU's choices in the energy transition will also affect the sustainable development pathways in the Global South.

2. RECOMMENDATIONS

R1. Identify revenue streams to invest in climate-neutral production.

Climate-neutral technologies exist, but companies need revenue streams to invest in climate-neutral production. The EU industrial strategy should identify possible revenue streams for (i) EU-level funding, (ii) member state funding, and (iii) the boundaries for member state funding to ensure the integrity of the internal market. Public support should be time-limited and aim to reduce costs and scale while being compatible with low-carbon and circular business models.

Technological solutions for industrial decarbonisation certainly exist, for example direct electrification of energy including heat, hydrogen, and carbon capture.[2,3,4,5,6,7,8,9]

Industrial decarbonisation policies generally consist of three elements:

- *Installation-based regulation*: for example, upstream production processes including energy and materials feedstock. This can be done through electrification, or more generally a switch to low-carbon energy such as green hydrogen or biomethane, and a shift in feedstock to biomass or recycled materials (Fossil Free Sweden, 2020).
- *Innovation finance and support for new breakthrough low-carbon production techniques and technologies*: this includes the transformation of industry processes, for example, use of direct reduced iron (DRI) with hydrogen or carbon capture, utilisation and storage (CCUS)[10] (e.g. Wyns et al, 2018). CCUS could be important for emissions' abatement in many sectors but particularly for cement.
- Substitution of high carbon for low carbon and circular products, for example by using incentives for material efficiency and product substitution, through market or policy-induced demand.

To date, EU policies have mainly concentrated on installation-based regulation (through the ETS and the renewables policy) and innovation support (through innovation funding by the EU and member states). The next step is to go beyond marginal energy or carbon improvements and replace these with new breakthrough technologies.

Bringing technologies into the market

Governments are investing in new breakthrough low-carbon technologies with the support of first-of-a-kind projects. Once the technologies are proven, their risks decline, but market risks remain. Analyses find that industrial low-carbon solutions often achieve abatement close to or more than €100 per tonne of CO2. Temporary support for early deployment will be needed to bring new breakthrough technologies into the market and reduce the costs of learning curves and economies of scale. Later, a combination of carbon pricing (which will have a greater impact due to cost reductions) and product standards will re-establish a competitive market for low-carbon materials, either through decarbonisation or substitution of one material for a lower carbon one with the same functionality.

In many cases, the costs of the end products increase very modestly and remain below 2% or 3%, even if the cost for material production increases by 50-60% (Rootzén, J. and F. Johnsson, 2016,[11] 2017[12]).

Competitiveness

Measures to protect competitiveness, and therefore low-carbon products, may be needed during a transition period, in addition to temporary demand-creation support. In many cases materials are globally traded commodities. Cost increases immediately raise concerns about competition and competitiveness. This is why the EU has continued with free allocation for industries at risk of carbon leakage and other support measures such as exemptions from renewables' levies or grid fees and compensation for indirect carbon costs for electro-intensive industries.

Options to support deployment of low-carbon and circular products

One option is the combination of a 'carbon contribution' (a carbon-related excise duty imposed at consumption level on materials) and a Carbon Contract for Difference (CCfD)[13] to cover the costs gap with high-carbon 'like' products. The main function of carbon contributions would be to generate revenues to finance CCfDs for low-carbon breakthrough technology investment, thereby assisting the passing on of the carbon price. Competitiveness would still be supported by free allocation under the ETS (e.g. Neuhoff et al, 2019).[14]

Acceptability of this model depends partly on whether CCfDs, combined with free allocation, would survive a possible challenge under WTO. It also depends on whether and how budgetary rules in both the EU and member states can be amended so that governments can guarantee ex ante future commitments that are still uncertain. Politically, carbon contributions are likely to fall under EU unanimity requirements, meaning that all member states need to agree.

A broader political question is whether consumers can be charged and the money distributed to industry while free allocation continues. Considering the polluter-pays-principle and the need to pass on carbon costs, would this be politically acceptable?

R2. Reward innovators under the EU ETS

ETS-based solutions: While there is a need to protect the competitiveness of existing industry, a new focus should be added whereby innovators should be rewarded, possibly also under free allocation.

ETS-based solutions may be easier to get agreement for as they would most likely not require unanimity. There are two options: monetising European Union Allowances (EUA) or focusing on ETS free allocation as a source of revenue to finance CCfDs.

The first option would mean monetising a part of EUAs that are currently allocated for free to industry and using the receipts to temporarily support deployment of low-carbon products. A very strong role for EU competition policy, through the *State Aid Guidelines on Environmental Protection and Energy,* would be a likely outcome. An alternative would be to split free allocation into (i) an instrument to protect the competitiveness of existing installations while providing incentives to innovate, as is done at the moment, and (ii) a mechanism to incentivise low-carbon investment of frontrunners.

Free allocation is available to both incumbents and innovative new entrants. In principle, the benchmark system of free allocation should ensure that the most carbon-efficient receive the most allowances for free, therefore creating an incentive to invest in more carbon-efficient technologies. However, benchmarks are relative: the most efficient 10% can still be carbon-intensive in an absolute sense. The exact volumes a company[15] receives depends on the exact production process they use (which determines the applicable benchmark) as well as historical production levels.

The benchmark definitions may lead to perverse outcomes, where a more efficient producer ultimately receives fewer allowances for free, thereby undermining its competitiveness. This could happen when a producer uses a more efficient production process that has its own benchmark but which nevertheless competes with less efficient production processes, such as in steelmaking.[16] Over time, when fully carbon-neutral production is deployed, a more fundamental problem arises with free allocation; if there are no emissions (or very few), the compliance obligation – and inclusion into the system – of the ETS disappears altogether, as would any potential free allocation.

If industrial decarbonisation were to be achieved by a succession of incremental efficiency improvements, free allocation could support emissions reductions. Similarly, if emissions reductions were to be limited to, say, 40 or 60%, free allocation could incentivise reductions, as there would always be a market for allowances in the long term, from companies who choose to pay the compliance costs rather than abate their emissions. In reality, emissions will need to reach net-zero in just three decades, in other words, be virtually eliminated. This requires carbon-neutral production to be scaled up, and carbon-intensive production to be phased out over time – just as renewables replace fossil fuel electricity generation. In that light, a carbon leakage system that benefits frontrunners who deploy climate-neutral technologies and goods is needed. This should not lead to comparatively high-carbon companies no longer being protected against carbon leakage risk, but where possible, this protection should incentivise investments in climate-neutral production.

One way to do this would be to move to a carbon border adjustment mechanism (CBAM) and auction all allowances. The auction revenues could then fund industrial policy measures that support the expansion of climate-neutral production. Another option worth examining is a radical overhaul of free allocation, with a part of allocation based on an aspirational benchmark that is very close to zero-carbon production. The more a company is able to produce climate-neutral products, the more allowances it would receive for free.

There are, however, some inherent weaknesses to using free allocation (or even the ETS in general) to fund transformational innovation. Today's methodology of free allocation is to mitigate carbon leakage risk first, and only support innovation (through efficiency benchmarks) after this. As carbon leakage risk is assessed on the basis of trade and emissions intensity, there is an intrinsic link to some accounting conventions applicable to international trade. In practice, this means that sectors are defined by their NACE code. These NACE codes overlap with (sub)sectors, but do not perfectly correspond with them, let alone with value chains. For example, the steel industry comprises not only steel manufacture, but also coke production, iron ore mining, and even the power sector in the case of electric arc furnaces. Fundamental problems also arise when considering substitutes that are carbon neutral and which may therefore fall outside the ETS boundaries altogether. In these cases, free allocation would also disappear. This is particularly problematic for sectors wanting to shift from a carbon-intensive ETS activity eligible for free allocation to a carbon-neutral activity outside the ETS. In addition, multiple product benchmarks – which affect allocation volumes – can apply to single sectors. This level of specificity works well for carbon leakage protection, but less so for supporting innovation, where moving to new production processes is desirable. An approach like the one taken in the sustainable finance taxonomy – which also aims to support investment flows to greener activities – where various subsectors and activities are aggregated, could work for deployment support.[17]

Distortions inherent in the system of free allocation have therefore created path dependencies (e.g. the product boundaries of benchmarks) and unintended departures from technology neutrality. This makes it a challenge to support breakthrough innovation using mechanisms such as free allocation. An additional challenge is the relationship between the size of investments needed and the financing that could be generated by monetising allowances in different sectors. While the volume of emissions is correlated to investment needs, this correlation is not perfect, especially for smaller sectors. This creates a bias in favour of larger sectors.

To illustrate, the five largest industrial ETS sectors are responsible for roughly 75% of industrial ETS emissions. The remaining quarter of emissions is caused by over a hundred smaller industries, whose emissions often do not exceed the tens or hundreds of thousands. By moving away from free allocation, a different distribution between sectors becomes possible; one that is more targeted at specific investment needs.

Nevertheless, the potential of the ETS remains by virtue of the amount of funding that could be generated through auctions. This would require either member states to fund industrial decarbonisation more, for example through CCfDs, or for the EU to acquire a share of the proceeds of auctions. The member state option would not be legally binding, although member states could target investment to sectors most important to their competitiveness. The EU option could involve own resources, but do not have to per se. A far larger innovation fund could also be an option, especially if allowances were monetised on an ongoing basis (to lower the chances of random price fluctuations affecting the size of the fund).

R3. Focus EU climate diplomacy on industrial decarbonisation partnerships

For COP26, the EU should back up its emissions reduction pathway of at least -55% net by an accompanying set of industrial policy tools that are credible enough to interest other countries in industrial decarbonisation. In its climate diplomacy the EU should develop partnerships on industrial decarbonisation with a focus on deployment of low-carbon industrial products. Japan, which has taken a similar approach, is a natural starting point with other countries such as Canada or New Zealand to follow (and the US under President Biden).

With the focus on its global role in the European Green Deal, the EU has elevated climate diplomacy to the forefront of its policy.[18] However, the effectiveness of diplomacy depends on credibility. If the EU wishes to drive commitments and actions forward at COP26, the credibility of the pathway to -55% and climate neutrality by 2050 matters. Will the EU be able to put sectors where emissions have so far been stagnant on a trajectory towards climate neutrality? Here, EU industrial policy plays a crucial role. A successful industrial strategy should be able to showcase a set of policy tools that demonstrate a credible pathway for emissions reductions in the traded sector, as well as in expanding global low-carbon markets.

There are two ways in which partnerships and cooperation with countries that are taking a similar approach could also provide benefits. First, they could help support the development, deployment and scale of industrial decarbonisation globally and thus benefit the overall goal of mitigating climate change. Depending on the nature of the partnerships, larger markets for decarbonised industrial products, opportunities for joint funding and R&D, among other things, could help drive and accelerate industrial decarbonisation. Second, they could ensure compatibility of approaches and contribute to EU competitiveness. The EU is at the forefront of green industrial innovation, but other countries are also forging ahead with climate investments.[19] To remain competitive, it will be important for EU actors to be part of new value chains as they develop and gain access to strategic raw materials. Partnerships can play an important role in facilitating this. A larger joint market share may also improve the ability to influence global standards through cooperation on common standards with like-minded partners. This is a similar idea to that of a climate club, although such clubs could also focus on taxing the carbon contents of imports.[20] A more formalised environment for cooperation on decarbonisation could make it easier for other countries to join.

When developing such partnerships, focus should be on deployment of low-carbon industrial products. There are several options: the inclusion of industrial sectors in carbon pricing (or regulatory equivalent policies); joint approaches to carbon leakage risk mitigation and carbon content standards; or cooperative approaches on climate neutral technology diffusion in trade agreements. A natural starting point would be to cooperate with countries that are taking a similar approach to industrial decarbonisation. Japan's recent industrial policy that aims to achieve carbon neutrality by 2050[21] may provide one opportunity to further expand EU-Japanese cooperation. Canada and New Zealand could be other candidates for enhanced cooperation, as well as the US with its recent reversal on climate policy. However, while such partnerships could play an important role, cooperation with developing countries should not be forgotten. An industrial strategy that also recognises the need for investment in low-carbon technologies in developing countries could provide a positive signal and contribute to financing transition in them.

Notably, partnerships and cooperation may also influence the need for and design of a CBAM, and, even more importantly, its acceptability to partners. In this respect, the objections to an EU CBAM raised recently by both developing and industrialised countries show the importance of treading carefully with instruments that can adversely impact trade partners' economies. Here, partnerships on industrial decarbonisation could play a mitigating role.

R4. A strong EU ETS price signal is important

A strong ETS price signal is important and a revised Market Stability Reserve (MSR) is essential for this. A withdrawal rate of at least 24% should be continued, and ideally increased. A hybrid design with price triggers is also possible. A uniform, economy-wide carbon price signal is desirable even when industrial and lead market policies interact with the ETS. The long-term role of the EU ETS should be considered; how will the ETS relate to carbon dioxide removals (CDR)? When considering extension of the ETS scope, the benefits of a single cap as well as the impact on all ETS sectors should be considered, not just on the sector to be included.

The role of carbon pricing and the ETS in the EU's climate policy mix remains important, even with a strengthened industrial strategy. The Fit-for-55 package will contain a proposal for revising the ETS. In theory, this revision could be limited to a simple update of the cap to reflect the new -55% target for 2030. The ETS revision completed in 2018 (though not taking effect until January 2021) already made more comprehensive changes.

The ETS revision will, however, be affected by two additional reforms linked to separate processes: a review of the MSR operation and the potential introduction of a CBAM (see the chapter on Trade). The MSR was also reformed through the 2018 ETS revision by doubling the withdrawal rate of the mechanism. Without further intervention, the MSR would revert to the 12% withdrawal rate as originally agreed in 2015. However, the supply shock induced by the Covid-19 pandemic shows the importance of flexibility for the supply side of the ETS. While the carbon price dropped significantly at the start of the pandemic, it has recently set new all-time highs. A weaker MSR than we have seen since 2019 would risk increasing supply-demand imbalances, which could undermine the ETS price signal.

With an increased 2030 climate target, the number of policies that interact with the ETS – including some based on the industrial strategy that may be introduced – may also rise. For that reason, the current MSR design should be at least maintained and ideally revised. A simple option to strengthen the MSR is to further increase the withdrawal rate. Another is to allow withdrawals at lower 'surplus' levels than currently defined, or its design could be adjusted so that withdrawals are linked to predefined price levels rather than to the 'total number of allowances in circulation' (i.e. surplus).

The final option is more similar to a carbon price floor. While this could be seen as a reasonable alternative to the MSR it is not worth the political capital needed to agree on a price level and to move away from a purely volume-based policy. Furthermore, many commentators also link a price floor to the need for a price ceiling (i.e. a price collar), with the argument that this would increase certainty. This makes considering replacing the MSR even less attractive; ultimately, it is hard to look at the performance of the ETS since the pandemic started and argue that it (or the MSR) is wholly unfit for purpose.

Although it is a separate legal proposal, the CBAM could nevertheless lead to changes for the EU ETS as a whole, insofar as the new mechanism would replace free allocation. If the application of a CBAM was limited at first (see Recommendation 6), the approach to free allocation for sectors not (yet) included in the CBAM may be revised. One option would be to no longer treat all sectors as being at the same risk of carbon leakage (or not at all) but to have different gradations of risk, with higher-risk sectors receiving more allowances for free.

There are also a number of long-term questions about the role of the ETS in the EU climate policy mix.

The most critical question is that of sectoral scope. The share of EU GHG emissions covered by the ETS is declining as power sector emissions rapidly reduce. In some non-ETS sectors such as road transport and buildings, emissions have been more stable, as is the case for heavy industry emissions under the ETS. As already announced by the Commission, some sectors might be included in the ETS in the future (although separate systems may exist in a transitional period). Doing so would bring the vast majority of the EU's emissions under a single cap. There are benefits to this from a value chain and substitution perspective.

With ongoing electrification in heating and road transport, there is already a gradual indirect shift of buildings and transport emissions to the power sector, and therefore to the ETS. Ensuring a uniform carbon price signal across 'old' and 'new' (i.e. low carbon) heating and transport would be desirable. Longer term, the benefit of ETS inclusion is to ensure that a large share of emissions is capped, and that this cap moves towards zero. Allowances becoming increasingly scarce ensures that emissions will only continue where no alternatives are available. Within some value chains (especially material-intensive ones such as construction), it would also be desirable to have a common carbon price signal between materials and energy consumption as well as for carbon price signals to be harmonised across major energy carriers.

It is unlikely that eliminating all emissions will be feasible; some residual emissions will remain. This implies that the ETS needs to continue, as there would still be emissions to be covered. This is possible, and compatible with a net-zero climate target, but requires a political choice: what amount of emissions should be allowed to be offset by 'carbon removal' credits? The answer could be a specific volume expressed in an absolute number, or as a share of the EU's 1990 emissions. Another option is to keep the ETS cap at zero but allow an indefinite number of removals credits. This increases flexibility but may have the effect of incentivising investment in carbon removal over emissions reductions. The costs of carbon dioxide removal could also become a determinant of carbon prices, thereby affecting regular emissions reductions.

An additional reason to make political choices about carbon removals under the ETS sooner rather than later is the interaction with carbon capture and storage (CCS) technology. Two potential technological routes for carbon removal use CCS: bioenergy with CCS (BECCS) and direct air capture with CCS (DACCS). If a choice is made in favour of more carbon removal, the need to develop CCS infrastructure (especially for storage) increases. Conversely, increased use of CCS in industry could also lower the costs of carbon removal.

R5. Slowly develop a CBAM and engage with international partners

The CBAM is conceptually and economically attractive but difficult to implement. The European Commission should take time to develop it further, for example by publishing a White Paper, which could be used to engage its international partners. To keep the CBAM as a climate diplomacy tool (a 'sleeping gun'), its initial application should remain limited to those homogeneous sectors facing strong pressure from carbon-intensive imports (cement, electricity, refineries etc.). A CBAM and free allocation should ideally not be combined, for political as well as legal (WTO) reasons. However, a compromise could be to link free allocation just to export competitiveness. This could be done by focusing on export intensity rather than on overall trade intensity.

While the EU's climate diplomacy should be focused on expanding global low-carbon markets, a level playing field in terms of carbon costs would support private low-carbon investments into such a market. Carbon leakage risk mitigation therefore plays a role in the investment case, and the proposed CBAM would be a radical new approach compared with the current practice of free allocation. The CBAM concept is intuitively attractive: EU industrial producers have to pay for ETS allowances to cover their emissions, but importers of the same products do not. By levying a charge on the border – linked to the ETS price – the competitive disadvantage to the EU producer is alleviated.

The precise design,[22] however, is intrinsically political, and this will also affect the EU's climate diplomacy. EU trade partners no doubt have strong views (sometimes publicly expressed[23]) on the prospect of their imports facing new charges. A CBAM can also be perceived as unduly protectionist. Whether intended or not, a CBAM is therefore inevitably one of the most powerful tools the EU has at its disposal in its climate diplomacy. The mere prospect of its introduction has already led trade partners to examine the potential impacts and ways to mitigate a CBAM – which may include changes to their own domestic climate policies (or to consider a CBAM themselves, such as in Canada[24]).

Given the importance of climate diplomacy in the eventual success of a CBAM, there are advantages to developing the proposal in close coordination with trade partners. At the same time, the mechanism needs to be credible. A more limited initial application – leaving open the prospect of a wider one in the future – would be desirable for that purpose. The more homogeneous a sector is, the more attractive it would be for early inclusion. Cement, which is mostly traded over short distances in the EU neighbourhood, would be a good candidate. The cement sector is also one of the largest recipients of free allowances today.[25] Electricity would be another sector only affecting the EU neighbourhood (and one that is generally not brought up as part of carbon leakage debates). Refineries – or rather imported fuels – could be another relatively homogeneous sector, but one part of an extensive global supply chain.

Two other design issues are of political and diplomatic importance: what happens to free allocation for sectors included in the CBAM, and what happens to exports. The Commission has presented the CBAM as an alternative to replace free allocation, but in both the Council of Ministers and the European Parliament, opinions diverge on whether the two should coexist. In a legal sense, combining CBAM with free allocation is likely to be possible, provided that the levy is adjusted for the level of free allocation. Nevertheless, compared with the current situation, this would lead to an expanded level of protection against carbon leakage risk.

Ideally, free allocation would be discontinued when a CBAM applies. Doing so would eliminate the (unavoidable) complexities and distortions associated with the free allocation system. It would also allow for more allowances to be auctioned, thereby raising revenues that can be used for financing climate action domestically and abroad.

Like ETS revenues, CBAM revenues could contribute to climate action or public budgets (although the revenues may be limited so long as the CBAM is applied only to limited sectors or products). While they are indeed important, there are many competing interests in how to spend revenues. Some uses may run into legal difficulty. A specific example is the WTO compatibility of a CBAM, which may require that revenues are used to compensate developing countries, or provide climate finance.

An immediate change from free allocation to a CBAM may be politically unfeasible. It would leave companies under the ETS with a sudden change in compliance rules and carbon costs. For that reason, a gradual phasing out may be more desirable. An alternative could be to link free allocation to export intensity and competitiveness. This is a dimension of industrial competitiveness that is in any case more difficult to tackle through a CBAM, but for many companies is as important, if not more so, than competitiveness vis-à-vis imports. While it is not impossible to design a CBAM to apply to exports by rebating ETS costs, the legality of such an approach is much more tenuous than a regular CBAM. Export subsidies are very hard to justify under the WTO, let alone politically.[26]

The introduction of a CBAM may still raise eyebrows in countries' whose imports (into the EU) are affected. Free allocation for just exports might, however, be easier to justify as the case can be made that it facilitates more investment in climate mitigation technology by addressing carbon leakage risk. Furthermore, free allocation to industry has existed in some form since 2005; limiting it to export competitiveness would only imply a reduction compared with the past. Practically, the volume of free allowances could be calculated by comparing the volume of exports to the total production volume while using a historical baseline to prevent gaming behaviour to maximise allocation volumes. It can be based on the same trade data that is used for free allocation today.[27]

The distributional implications of carbon leakage risk mitigation policies are also part of the 'just transition' – measures enabling a more effective transformation of an industry support long-term economic and social sustainability. Yet for industries already benefiting from subsidies and public investments, it may not be appropriate to also allocate a large share of ETS allowances for free. In fact, the revenues raised by auctions may be necessary to fund the new industrial policies in the first place. The ongoing debate about what to do with free allowances if a CBAM is introduced for a sector also feed into this equity dimension of the Green Deal.

The idea of a consumption charge on certain industrial goods has also been raised as an alternative to a CBAM. This charge could take the form of a levy on final goods to account for the embedded carbon of the materials used in the goods. Such a levy could incentivise customers of industrial products to substitute carbon-intensive products for low-carbon alternatives. It could apply both to domestic products and imports alike. A consumption charge, however, still depends on the continuation of free allocation to provide for carbon leakage risk mitigation. It is therefore a useful addition to an industrial decarbonisation policy mix, but does not address existing unattractive features inherent to free allocation. Moreover, a consumption charge may not incentivise changes (whether policy or production) in third countries.

R6. ETS revenues can contribute to industrial transformation

EU-level policies are most effective when their funding is structural rather than ad hoc. Both current and future carbon-pricing policies in the EU can contribute to industrial decarbonisation efforts.

The EU faces harder budget constraints than member states. Although the EU's financial capacity is set to grow significantly with the Recovery and Resilience Facility, it remains relatively limited when expressed as a share of GDP. Nevertheless, EU policies do contribute to public finances: hundreds of millions of ETS allowances are auctioned every year, raising billions in revenues for member state coffers, or given to industry to mitigate carbon leakage risk.

In 2021, the ETS cap is set at 1.57 billion allowances, of which around 700 million will be allocated for free. Just over 300 million allowances are withheld from auction and placed in the MSR. This leaves roughly half a billion in allowances to be auctioned, leading to €20 billion in revenues for member states if carbon prices maintain an average of €40 per tonne. The allowances allocated for free then have a market value of well over €25 billion.

Neither of these revenue streams are currently available to the EU. Instead, several 'funds'[28] have been created through the ETS Directive, of which the Innovation Fund is the most important for financing up to 60% of demonstration projects in industrial decarbonisation. The funds are created by selling a predetermined amount of ETS allowances and polling the revenues. The size of the Innovation Fund is 450 million allowances for the entire ten years of the fourth ETS trading phase, which amounts to €18 billion at a carbon price of €40.

While the Innovation Fund could therefore play a role in supporting industrial decarbonisation on a project basis, other revenue streams may be more suited for longer-running schemes supporting the increased capital investments and higher operating costs of low-carbon production. Redirecting a part of the ETS auction volumes would be one option; this would amount to a decision to expand the EU's own resources. Redirecting free allocation volumes is another option. This has consequences for carbon leakage risk.

A question is whether subsidies to expand low-carbon production also mitigate carbon leakage risk. Is it legitimate or efficient to publicly fund low-carbon investments if the same industries are already compensated for their carbon costs? The answer depends on political judgement and will affect what combination of free allowances, industrial policy support, and CBAM to pursue.

Using ETS revenues to fund low-carbon production is a form of revenue recycling. In principle this is a common recommendation for carbon pricing mechanisms.[29]

Not all sectors that benefit from free allocation under the EU ETS would necessarily benefit from instruments such as CCfDs or similar measures. From 2021 onward, 63 sectors or subsectors are eligible for free allocation because they are considered at significant risk of carbon leakage.[30] This includes the large industrial sectors such as cement and chemicals, which receive (tens of) millions of free allowances, but also smaller sectors receiving only thousands of allowances. While not every sector may require unique technological solutions to transition to climate neutrality, it should be ensured that public support measures benefit all sectors, not just the largest. It also requires revisiting the political choice on whether to support frontrunners separately, or to support all incumbents (see the previous Recommendation).

The divergent fiscal capacities of member states are an additional consideration, particularly in the wake of the pandemic. State aid expenditure has always differed considerably from one member state to the next and this trend has been exacerbated by the economic crisis caused by the pandemic.[31] While member state spending will play an important role in supporting industrial transformation, the EU should do more than just coordinate national investments through governance provisions and state aid control. Coordination nevertheless is important to ensure coherence between the Recovery and Resilience Facility and the twin transitions. There are intrinsic limits to what can be achieved with recovery spending, however: the recovery is aimed at the short term while the energy transition requires more structural long-term transformations.

By moving a share of the ETS revenues to the EU's own resources, the EU can act more efficiently with a view to ensuring convergence in the internal market. The EU could focus its industrial policy efforts more on sectors and regions where investment runs the risk of lagging behind, which would undermine cohesion but also the attainment of the Green Deal goals in general. A limited transfer of ETS revenues to own resources would be in line with the subsidiarity principle if focused on cohesion and cost-effectively meeting climate and energy goals. As the EU ETS cap is inherently (but also legally) required to move to zero, this own resource would not be a permanent addition to the EU budget, but rather one that delivers most precisely in the period when Green Deal investments are needed most.

The EU-level funding instruments that would be made possible by EU own resources would also avoid fragmentation of the internal market from a finance perspective. Uniform conditions across member states can make it easier to attract and gather in private capital.

R7. Treat domestic production and imports alike?

Product carbon content requirements can be a tool to ensure that domestic and imported products are treated the same, thus mitigating carbon leakage risk. The industrial strategy could accelerate efforts to establish embedded carbon content requirements of industrial goods. Such requirements could be expressed as limits to the amount of kg of CO2 per tonne of product. An open question is whether to apply such product carbon content requirements to intermediate goods or final goods and how to take into account technological developments and sectoral investment cycles.

The European Green Deal seeks to achieve a rapid deployment of low-carbon technologies while securing Europe's security of supply and competitiveness, irrespective of whether other countries are willing to act.[32] To achieve this objective, effective mechanisms must be put in place to ensure that Europe's products compete on an equal footing with products produced elsewhere. Besides CBAM, introducing requirements on the carbon content of products based on a standardised methodology could contribute to safeguarding domestic industrial production. In addition to supporting the competitiveness of domestic products, such requirements can also provide a reference point regarding what is a green product through standardised CO_2 information, thereby supporting the development of well-functioning markets for green products.

A prerequisite for developing product requirements on carbon content requirements is having reliable information about the actual CO_2 embedded in goods. Therefore, the development of credible and standardised methods for assessing carbon content should be prioritised. Such requirements will also need to be sector-specific since different products, such as cement, steel and aluminium, exhibit large variations in low-carbon technological readiness and investment cycles. Product requirements on carbon content can be incorporated in other policy tools for creating demand for low-carbon products such as public procurement and help avoid creating a fragmented single market for clean innovation.

R8. Identify skills to support rapid deployment of low-carbon technologies

In its skills agenda, the industrial strategy should identify which labour market policies can support more rapid deployment of low-carbon technologies. Skills are important not only from a just transition and wealth creation perspective, but also to accelerate emissions reductions. Skills can support knowledge dissemination about low-carbon solutions throughout value chains. Identifying which skills are needed to accelerate emissions reductions should be part of the Covid-19 recovery plans.

A fundamental reason to critically consider the skills dimension in climate and industrial policies is that some skills are needed to accelerate the deployment of low-carbon technologies. This may be particularly important in complex value chains involving many different actors of different sizes, such as construction and buildings. In this value chain, several of the most energy-intensive industries (basic material producers) are combined with energy production and consumers. Although new skills are not essential to construct a building with low carbon, rather than conventional cement and steel, the same is not necessarily true when it comes to resource efficiency or ensuring that other circularity practices are adhered to. Low-carbon materials may also behave differently, which may need to be accounted for during construction.

Moreover, knowledge about low-carbon materials – and potential substitutes – is important so that the default choice in procurement isn't necessarily the conventional (and often the cheapest) material. Using fewer materials, recycled materials, or materials such as wood, can be a way to reduce embedded emissions in buildings, but doing so requires specific expertise and practices. Skills for industrial deconstruction – which enables material reuse – and retrofitting buildings become more important to improve circularity. A specific challenge in the construction industry is the cyclical nature of the industry, which may drive loss of expertise and knowledge. During economic downturns, the most experienced employees are often the ones at risk of losing their jobs owing to their higher salaries and the need for cost cutting.[33]

Both the Covid recovery plans and the national energy and climate plans (NECPs) could serve as appropriate avenues for member states to identify what type of skills would be needed to accelerate emissions reductions. Member states could then describe in more detail the changes in the demand for certain skills across different sectors, the type of profiles needed, and the level of jobs in the low-carbon sectors. In the context of the Covid recovery, however, the transformational potential of any recovery activity is long- rather than short term. Hence, while recovery investments can support structural reforms benefiting the 'twin transitions', they should not be relied on to achieve immediate emissions reductions. A focus on skills fits with this more structural, long-term transition perspective.

From an energy and resource efficiency perspective, digitalisation and associated skills can play an important role in optimising resource use. Digitalisation can also play a role in improving collaboration between different actors in a value chain, especially where information and data is concerned. Artificial Intelligence (AI) adds a further element to the digital sphere: it can be a driver of automation and thereby contribute to shifts in job profiles. Additionally, sectors making increased use of AI may need specific skills to adjust to its use. The mining sector is one example of a sector intertwined with industrial value chains for which AI provides opportunities to increase efficiencies and lower the environmental footprint.[34]

A final element in the jobs and skills dimension is the need for active labour market policies. The shifts in skills demand both between sectors (those at the front of the transition towards climate neutrality and circularity) and within them (towards low carbon production), and between regions, make it desirable and necessary that people seek jobs in sectors contributing to the EU's climate and circularity objectives.[35] They should also receive sufficient support –such as training – to allow them succeed in those sectors. Hence, 'just transition' policies should support the transition of a supply of workers in carbon-intensive industries to sectors driving (or otherwise benefiting) from the energy transition and Green Deal.

In the wake of the pandemic, the EU has also acquired more means to support member state efforts to mitigate unemployment through the SURE instrument and bonds.[36] As the pandemic moves to its recovery phase, the use of part of the SURE funds could be tied to retraining purposes in line with the energy and digital transitions. This would strengthen coherence between the recovery and the long-term priorities of the twin transitions.

R9. Strengthen public procurement and boost demand for low-carbon goods

The current legislative framework for green public procurement (GPP) needs to be strengthened with compulsory criteria and targets. Such a move will need to be supported by actions to increase the competence of public buyers and other relevant actors. Examples include training activities targeted at specific sectors, online toolkits, national competence centres, information initiatives and guidelines for the full supply chain. It will also require the development of reliable tools and data to support public buyers in assessing the carbon content and/or resource efficiency of the products and services they procure.

The present EU legal framework for public procurement is underpinned by two EU directives[37] that open the way for the inclusion of environmental and social objectives in government tender requirements, although they do not include any mandatory provisions on GHG emissions or resource efficiency/circularity. The decision to use GPP requirements is up to the member states and local authorities, while the European Commission has developed a set of voluntary GPP criteria for a number of product and service groups. It is generally acknowledged that although GPP is often regarded as an instrument with potential to be a fundamental lever in driving market uptake of 'greener' products and services, the current EU system has not been effective in utilising its full potential.

A key challenge stems from the complexity of the public procurement landscape. This consists of a multitude of actors including policymakers designing the general procurement framework conditions, public buyers who prepare the tenders with specific requirements, and the contractors/suppliers who need to meet these requirements. There can also be different competences within these actors; for instance, in large public buyers separate departments may deal with purchasing aspects and environmental requirements and management (see Kadefors et al., 2021).[38] Aligning the interests of all these different actors to deploy the potential of GPP while avoiding creating too many administrative burdens is not an easy task.

On the part of public buyers, there is often limited awareness about the available solutions in the market or lack of internal capacities to assess them. Easily accessible tools to adequately assess the life-cycle impacts of products and services are also lacking (Núñez Ferrer, 2020).[39] To add complexity to these challenges, for sectors such as construction, reducing emissions requires action across various fronts (e.g. types of construction materials, energy efficiency of buildings, transport emissions). The long lifespan of buildings also means there are several uncertainties when assessing the life-cycle carbon gains of these measures. Further, the incentives for public buyers to prioritise reduction of carbon contents in products or higher resource efficiency may not yet be in place, with costs remaining in many cases the primary driver for purchasing decisions. While there are various high-level decarbonisation strategies and communications, they usually do not translate into explicit instructions and requirements to public clients to prioritise carbon reduction over low costs. Suppliers of products and solutions may also face difficulties such as administrative burdens or lack of capacities and technical know-how to meet certain low-carbon or resource-efficiency requirements in public tenders. This can in turn run the risk of lacking available bids for a specific tender.

The European Commission plans to propose minimum mandatory GPP criteria and targets in sectoral legislation.[40] While such stricter requirements are required, they will not automatically lead to full utilisation of this instrument alone, as discussed above. Such a move will need to be matched by concrete actions to increase the competence and capacities of relevant actors who will practically utilise this strategic policy tool. Examples include training activities, online toolkits, national competence centres, information initiatives and guidelines for the full supply chain.[41]

Private procurement

Private procurement and high-end customers can also drive demand for climate neutral industrial products. Certification, e.g. guarantees of origin and labelling,[42] along with increasing the uptake of PPAs, should be among the priorities to support private low-carbon demand.

Voluntary commitments by large corporations, cities, and other organisations and institutions committed to Scope 3[43] climate neutrality targets, increasingly drive low-carbon demand. Private procurement initiatives have the advantage of not requiring public money, while private clients can establish strategic partnerships with suppliers more easily than public buyers.

In January 2020, Microsoft declared its intention to be carbon negative by 2030, and to remove 'from the environment all the carbon the company has emitted either directly or by electrical consumption since it was founded in 1975' by 2050, including those from 'direct emissions and for … entire supply and value chain'. In July 2020 Apple committed to become 'carbon neutral for its supply chain and products by 2030', i.e. 'across its entire business, manufacturing supply chain, and product life cycle'. According to Apple, this means that 'by 2030, every Apple device sold will have net-zero climate impact.' As for materials, for example non-ferrous metals, Apple announced a joint venture in 2018 with aluminium company Alcoa Corporation and Rio Tinto Aluminum to commercialise patented technology that eliminates direct GHG emissions from the traditional smelting process – a key step in aluminium production. Similarly, companies such as Volvo or Volkswagen have committed to green procurement.

More generally, corporate carbon neutrality commitments may also give a boost to carbon accounting methods. Although it is not entirely clear how deeply industry will ultimately be able to dig into Scope 3 emissions, progress on calculating the carbon footprint should be expected. For example, ArcelorMittal is offering 'green steel certificates' with guaranteed Scope 3 emissions reductions from recycled and renewably produced products. Other certification methodologies are being developed.

R10. Do not forget about SMEs and non-ETS industry

SMEs need to be able to benefit from the EU industrial strategy because transaction costs and information asymmetry may be greater barriers for them. New policy proposals based on the industrial strategy should include SME provisions, including making dedicated support available. The same goes for non-ETS industry, which accounts for nearly 10% of total GHG emissions in the EU.

While most GHG emissions in industry are linked to larger corporations, a significant share comes from smaller companies. This includes companies both inside and outside[44] the EU ETS. Furthermore, smaller companies are linked to the supply chains of larger companies, especially in clusters. The updated 2030 impact assessment notes that SMEs are not typically active in carbon-intensive sectors.[45] However, the EU's climate neutrality objective means that virtually all emissions need to be eliminated, and all energy use be made carbon neutral. Even if energy use (or associated emissions) is limited, not addressing this share of emissions would only result in increasing the share of emissions that carbon removal will need to compensate for in the future. Some ETS sectors, such as ceramics or glass manufacturing, also have a large number of SMEs. SMEs are common in the architecture and engineering sectors, and the choices they make on the market can significantly affect the carbon contents of buildings.

Innovation in SMEs works differently from innovation in larger companies, with SMEs generally being less innovative.[46] In the context of the Green Deal, two types of innovation are required: incremental and breakthrough. The former optimises energy and resource efficiency and has always been important to underpin competitiveness. With circularity becoming more important, and with deep cuts to carbon intensity required, maximising resource efficiency becomes even more important. To reach climate neutrality, however, more radical breakthrough innovation is required. For breakthrough innovation, as well as business model innovation in circular value chains, new entrants can play a role.

The policies and mechanisms that will be developed as a result of the EU's industrial strategy should therefore also target and benefit SMEs. New legislative and regulatory proposals should have provisions tailored to the specific circumstances of SMEs. Not doing so would risk that this group of companies lag behind in reducing emissions.

Specific support for SMEs is important as they may face relatively higher transaction costs in accessing funding instruments or have less information about available policy support. In addition, SMEs may need specific technological solutions if they are operating in sectors with process emissions in addition to emissions from energy use. Finally, reskilling of the workforce – which the twin transitions make inevitable – poses a greater challenge to SMEs than to larger companies. The NECPs should therefore also provide details on the energy and resource use, as well as carbon intensity of SMEs and how these metrics can be improved.

R11. Regional dimension: focus on clusters but do not forget other areas

From a lead market and scale perspective it makes sense to focus on industrial clusters, but industries away from clusters also need solutions and low-carbon infrastructure. Some clusters may also have their own governance structures, which should be targeted by both EU and member state-level industrial policies.

Most industrial GHG emissions are concentrated not only in a relatively small number of sectors, but also across regional clusters in the EU. This is particularly the case in north-west Europe, with the port areas along the North Sea or the *Ruhrgebiet* in North-Rhine Westphalia, but also in other parts of the EU.[47] In some cases, these clusters also cross borders, or at least are connected through cross-border infrastructure, such as pipelines for energy carriers or feedstocks.

Given the need to speed up industrial decarbonisation and deploy low-carbon infrastructure (e.g. for hydrogen or CCS), a focus on clusters may be desirable. Some industrial clusters bring together a number of carbon-intensive industries such as chemicals production, oil refining, and steel production with energy conversion to satisfy the demand from these energy-intensive sectors. Technologies such as CCS infrastructure or a low-carbon hydrogen supply can potentially help deliver significant emissions reductions for multiple sectors at once. With increasing focus on circularity, CO_2 and waste streams including waste heat could be used within clusters for increased efficiency.

Not all sectors are clustered, however. Cement production is notable for being present in nearly every member state, and often in multiple regions within countries as well.[48] It may not be feasible to provide low-carbon infrastructure and energy carriers to every industrial production site in the EU. In addition, increased resource efficiency driven by the circular economy should also drive down demand for primary (e.g. virgin, not recycled materials) industrial production. These factors increase the prospects of regional shifts in industrial activity. This can in turn have knock-on effects for emissions reductions in other sectors, for example through the supply of waste heat for heating of buildings or use of energy infrastructure across different sectors.

The just transition strategy of the EU should take such potential regional shifts into consideration. Geographic chance may impact the availability of decarbonisation options, but therefore also the number of workers that may need to be reskilled. It can also lead to knock-on effects for cohesion in the EU and convergence within the internal market.

While focusing on clusters can make sense to efficiently capture a comparatively large share of industrial emissions, care should also be taken that EU policies do not drive unintended agglomeration effects.

Regional clusters can also be seen as an enabling factor from the perspective of governance. Both local and regional (e.g. at the level of German *Länder*) governments are important players with regard to infrastructure development and projects with considerable impact on public space, land use, and environmental (e.g. air quality) factors. Zoning, permitting and real estate asset management are often the prerogative of lower-level government. In addition, cluster authorities, particularly in ports, can play an important role in coordinating the transition plans of their incumbent industries. The ongoing developments with CCS in, for example the Port of Rotterdam (Porthos project), show that such cluster authorities can mitigate issues such as 'cross-chain risk', where different parts of a low-carbon value chain all need to move ahead in tandem to avoid undermining the business case for the other parts.

There are also risks that regional and cluster authorities become a barrier to accelerating industrial decarbonisation. With the importance of clusters to the regional economy, and the composition of boards including local policymakers, a concentration of lobbying power could be deployed to delay climate action. Engagement and capacity building with these authorities is therefore important, also when agreeing to – and implementing – European industrial policies. For member states it is important to consider whether lower-level governments have adequate financial resources to consider the Green Deal dimension of their work.

One area where this regional dimension could be considered is in the assessment of Important Projects of Common European Interest (IPCEI). Avoiding cross-chain risk, addressing cross-border challenges, and inclusion of local and (where relevant) cluster authorities should be considered when allowing state aid. Through the NECPs, meanwhile, the European Commission should keep track of regions that may be lagging behind in Green Deal investments, so that additional actions may be proposed. This is particularly relevant for ETS installations that are not in the proximity of emerging low-carbon markets and infrastructure.

R12. Focus on the construction value chain to accelerate industrial decarbonisation

The construction industry is one of the most difficult sectors to decarbonise because it lacks an integrated value chain. Yet it offers huge abatement potential and cost increases for final products using low-carbon materials are also small. Attention should be on tools to deploy low-carbon materials across the value chain, e.g. carbon budgets, carbon obligations, or carbon-reduction contracts. This also requires credible carbon-footprint rules for buildings connecting the different parts of the value chain.

Accounting for around 30% of global extraction of resources[49] and 40% of total GHG emissions,[50] buildings and infrastructure have a key role to play in decarbonisation efforts in the EU and beyond. The Energy Performance of Buildings Directive requires new buildings to be "nearly zero energy" by the end of 2020.[51] It will be a challenge to achieve the same for the existing building stock. A multitude of options for reducing emissions exist both on the supply and demand side, including improving energy efficiency, using alternative feedstocks in the production process, utilising CCS, improving design of construction products, and reusing and recycling materials.[52] While opportunities exist, decarbonisation efforts are complicated by the multiplicity of different actors involved in the construction value chain, both on the supply and demand side.[53] Policy intervention will therefore need to span different segments of the value chain. Examples of instruments that can be applied across the whole value chain include carbon budgets,[54] carbon obligations and carbon reduction contracts.

A prerequisite for having a comprehensive set of instruments that work in a synergistic way is developing credible carbon footprint rules for buildings. Instead of having multiple methodologies that can mean inconsistent information is provided to policymakers about carbon impacts, it is important to have a common technical language based on an integrated approach that connects the different parts of the value chain. A holistic and integrated approach is also required to properly account for potential trade-offs. For instance, installing additional insulation, heat recovery ventilation systems and heat pumps can improve the energy efficiency of buildings but also increase the buildings' material requirements.[55] In a similar vein, strategies seeking to extend the lifetime of buildings can create trade-offs in terms of postponing utilisation[56] of new technological innovations.[57] In addition, given the very long lifespan of buildings, there can be many uncertainties related to climate impacts and future trade-offs, e.g. emerging technologies that cannot be easily identified at the stage of designing and constructing the building.

3. CONCLUSION AND OUTLOOK

Technologies exist but large-scale deployment is required

For most carbon-intensive sectors, low-carbon and climate neutral technologies already exist, but not at scale. Hence, the industrial policy challenge is not so much about invention and R&D as it is about mid- and later-stage innovation that is focused on deployment, scale and competitiveness of climate neutral production and processes. Only rapid deployment and innovation diffusion will guarantee emissions reduction at the scale and speed required for climate neutrality in the EU and globally. Without a big increase in global, regional or national demand for low-carbon products, one cannot expect the global low-carbon economy to develop fast enough to substantially reduce emissions and drive further cost reductions.

There is a competitive opportunity for the EU in being part of these future value chains as much as possible. The EU interest here is a competitive one and not linked to strategic autonomy per se. EU companies are at the forefront in developing climate neutral industrial goods. A wise EU industrial policy ensures that industry benefits these frontrunners, and that they grow in numbers, rather than putting up defences around carbon-intensive incumbents.

Temporary support for early deployment in the EU and elsewhere will be needed to bring new breakthrough technologies into the market and reduce their costs through learning curves and economies of scale. Later, a combination of carbon pricing and product standards should re-establish a competitive market for low-carbon materials either through decarbonisation or substitution of one material by a lower carbon one with the same functionality. A successful EU industrial strategy will ensure fair competition, based on CO_2 performance, between different low-carbon solutions.

The global low-carbon transition is creating low-carbon export opportunities, as other countries increasingly follow the EU in adopting net-zero emissions targets. Supporting the export competitiveness of low-carbon frontrunners does not only support industry in Europe but also low-carbon technology deployment. This will lead to a reduction in embedded carbon in trade as 'by-product', and can be seen as 'reverse carbon leakage'.

Building blocks

Shifting industry towards climate neutrality will require very high levels of carbon-neutral energy (e.g. renewables, nuclear, and biomass). This energy will only be available if the European Commission makes low-carbon energy production one of its most urgent priorities. Crucially, with the circular economy advancing, materials feedstocks (e.g. recycled or reused) and lower resource demand are likewise important building blocks for low-carbon industries.

A successful industrial strategy will need to strike a careful balance between the role of the market and the state (whether EU or member state). Member states face softer budget constraints, but fiscal capacities between them diverge. Coordination is possible whenever state aid is involved. Through IPCEI, significant amounts of state aid can be invested to the benefit of climate neutral industry, but it requires member states to act first and to commit their own fiscal resources.

Private sector finance is indispensable. Investment in growing markets – both sectoral and geographical – is more attractive than in staid and static ones. The circular economy is a precondition for successful industrial decarbonisation, to keep energy and resource use in check. But if primary industrial production declines, value-added will need to be found elsewhere to grow investment, i.e. in new value chains.

Private sector procurement can also drive demand for climate neutral (industrial) goods, and in fact is already doing so. A number of companies have given themselves net-zero targets for all direct and indirect emissions. To succeed, they will increasingly require low-carbon materials alongside low-carbon energy. Companies where materials represent a limited costs factor, such as in IT or consumer products, also start to demand low-carbon materials as a means of reducing their carbon footprint. A precondition for this to work is the emergence of 'life-cycle' accounting[58] methods and practices. While these are developed for voluntary systems,[59] notably for information and transparency purposes, they might give important guidance for government or standardisation efforts to create methodologies to calculate life-cycle emissions to later integrate in carbon compliance obligations and regulations.

LIST OF RECOMMENDATIONS

WORKING GROUP SESSIONS AND SPEAKERS

- Chair: Christian Egenhofer
- Rapporteurs: Vasileios Rizos and Milan Elkerbout

LOW CARBON MARKETS IN THE EU AND BEYOND

- **Carl De Maré,** VP, Head Emerging Technologies, ArcelorMittal Group
- **Gwenole Cozigou,** Director, Industrial Transformation and Advanced Value Chains, DG GROW, European Commission
- **Yan Qin,** Senior Analyst at Refinitiv
- **Gökçe Mete**, Research Fellow at Stockholm Environment Institute

TESTING THE TOOLS WITH CARBON-INTENSIVE EU INDUSTRIES

- **Oliver Sartor**, Senior Advisor AgoraEnergiewende
- **Anna Kadefors**, Professor in Real Estate Management, KTH Stockholm
- **John Cooper**, Director General, FuelsEurope
- **Rene van Sloten,** Advisor Industrial Policy, CEFIC
- **Johanna Lehne**, Senior Policy Advisor, E3G

CONSTRUCTION VALUE CHAINS IN EUROPE

- **Fulvia Raffaelli**, European Commission, Unit C1 Circular Economy and Construction DG GROW
- **Robert Lowe**, Energy Institute, UCL
- **Judith Kirton-Darlin**, IndustriALL
- **Rob van der Meer**, HeidelbergCement

EU'S CARBON BORDER ADJUSTMENT MECHANISM (CBAM) (JOINT MEETING WITH THE TRADE POLICY WORKING GROUP)

- **Gerassimos Thomas**, Director General Taxation and Customs Union, DG TAXUD, European Commission
- **Susanne Dröge**, Senior Fellow, SWP, German Institute for International and Security Affairs
- **Dominic Coppens**, Senior Associate, Sidley Austin

WORKING GROUP MEMBERS

The Working Group Members are comprised of representatives of commercial companies, trade associations, consumer interest groups and individuals from EU Institutions, policymakers, academics, regulators and supervisors. They are participating in the activities of the Task Force in a *personal* capacity.[1]
Below you can see a work-in-progress list of participants.

CORPORATE MEMBERS

- Afep
- Afore Consulting
- American Chamber of Commerce to the EU (AmCham EU)
- Apple
- Arcelor Mittal
- Assonime
- Austrian Economic Chamber (WKO)
- Austrian Mining, Steel and Non Ferrous Metals Association
- Cassa Depositi e Prestiti (CDP)
- Confindustria
- Danish Agriculture and Food Council
- Deloitte
- EDF
- European Builders Confederation
- European Cement Association (CEMBUREAU)
- European Chemical Industry Council (Cefic)
- European Federation of Pharmaceutical Industries and Associations (EFPIA)
- Fachverband Steine-Keramik
- First Solar
- FuelsEurope
- Global Cement and Concrete Association (GCCA)
- HeidelbergCement
- Huawei
- Intesa Sanpaolo
- LKAB
- Microsoft
- Norsk Hydro ASA
- Novartis
- Orange
- PJSC Acron
- Refinitiv
- Repsol
- Samsung
- Siemens
- Stora Enso
- Swedish Forest Industries Federation
- Swedish Wood
- SYSTEMIQ Ltd
- Telefonica
- Uber
- Umicore
- Wavestone Luxembourg
- Zurich Insurance Group

[1] Please refer to the “Principles and Guidelines for the Task Force and its Working Groups”.

INSTITUTIONAL MEMBERS

- European Bank for Reconstruction and Development (EBRD)
- European Commission
- European Economic and Social Committee (EESC)
- Mission of Japan to the EU
- Organisation for Economic Cooperation and Development (OECD)
- United Nations Industrial Development Organization (UNIDO)

CIVIL SOCIETY AND ACADEMIA

- Agora Energiewende
- Avans University of Applied Sciences
- Bellona Europa
- Chalmers University of Technology
- E3G
- ecoSurge
- Eindhoven University of Technology
- Energy Transitions Commission
- EnergyVille
- European Trade Union Institute (ETUI)
- European University Institute (EUI)
- EU-Japan Centre for Industrial Cooperation
- Foundation for European Progressive Studies (FEPS)
- Georgia Institute of Technology
- German Institute for International and Security Affairs (SWP)
- German Marshall Fund
- Greenpeace
- Hitotsubashi University, Japan
- Humanity of Things
- Institute for European Environmental Policy (IEEP)
- Institute of Management and Technology (IMT) Delhi, India
- King's College London
- KTH Royal Institute of Technology, Stockholm
- Stockholm Environment Institute (SEI)
- Swedish Environmental Research Institute (IVL)
- Swedish Foundation for Strategic Environmental Research (Mistra)
- Tenman Research Institute on Knowledge-based Economic Systems (RIKES)
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- Wellcome Trust

AUTHORS

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Christian EGENHOFER is a Senior Research Fellow within the Energy, Resources and Climate Change Unit at CEPS, where he heads the Energy and Climate House (ECH). He is also Visiting Professor at the College of Europe in Bruges (Belgium) and Natolin (Poland), SciencesPo (Paris/France) and LUISS University (Rome/Italy). Christian Egenhofer has more than 20 years' experience working with EU institutions on numerous policy areas. Over the last decade he has been specialising in EU energy and climate change policy, with a particular focus on the EU energy, climate and transport policies. He is currently Senior Fellow and Head of the Energy, Climate and Environment Programme at the Centre for European Policy Studies (CEPS), a Brussels-based think tank. Christian is also Visiting Professor at the College of Europe in Bruges (Belgium) and Natolin (Poland), SciencesPo (Paris/France) and LUISS University in Rome/Italy. From 1997 to 2010 he was Senior Research Fellow and Jean-Monnet Lecturer at the Centre for Energy, Petroleum and Mineral Law and Policy at the University of Dundee in Scotland/UK (part-time). Christian Egenhofer holds a Master's degree in Administration from the University of Konstanz as well as a Public Law degree.

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Julie BRYHN is a Researcher at CEPS, where she focuses on climate change policy, the sustainable use of resources and circular economy. Beyond her work at CEPS, she has experience researching and writing on sustainable development and the SDGs, and has an interest in the interlinkages between climate, resources and development policy, geopolitics, and diplomacy. Julie has a Master in International Economic Policy from Sciences Po Paris, and a BSc (Hons) in International Politics from City University London.

NOTES

[i] In practice, 'hard-to-abate' often comes down to the difficulties of electrification. Production processes based on carbon-neutral molecules (i.e. fuels and feedstock) or carbon capture may offer solutions.

[2] See for example the 2018 European Commission long-term strategy (2018a, 2018b), Wyns et al (2018) or the Energy Transition Commission (2018), Agora Energiewende (2020), Agora Energiewende and Wuppertal Institute (2020), IEA (2017) and from countries such as the sector roadmaps for fossil-free competitiveness (2020) in Sweden.

[3] European Commission (2018a), "A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy'', Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, COM(2018) 773 final.

[4] European Commission (2018b), "In-Depth Analysis in Support of the Commission Communication COM(2018) 773 – A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy".

[5] Energy Transition Commission (2018), "Mission Possible", November 2018.

[6] Agora Energiewende (2020): "A Clean Industry Package for the EU: Making sure the European Green Deal kick-starts the transition to climate-neutral industry".

[7] Agora Energiewende and Wuppertal Institute (2020), "Breakthrough Strategies for Climate-Neutral Industry in Europe (Summary): Policy and Technology Pathways for Raising EU Climate Ambition".

[8] IEA (2017), "Energy Technology Perspectives", International Energy Agency, Paris, OECD/IEA.

[9] Fossil Free Sweden (2020), "Roadmaps for fossil free competitiveness".

[10] Green hydrogen is seen as a game changer for many industries and has a range of use cases, e.g. as a raw material in the chemical industry for the manufacture of ammonia, methanol and other chemicals. Various refinery and metallurgical processes can also be decarbonised by green hydrogen. Costs for green hydrogen are projected to decline fast, which can make a business case for some industries in only a couple of years.

[11] Rootzén, J. and F. Johnsson (2016), "Paying the full price of steel - Perspectives on the cost of reducing carbon dioxide emissions from the steel industry, *Energy Policy*, Vol. 98, pp. 459-469.

[12] Rootzén, J. and F. Johnsson (2017), "Managing the costs of CO2 abatement in the cement industry", *Climate Policy*, Vol. 17, pp. 781-800.

[13] With a carbon contract for difference (CCfD), a desired carbon price for investments can be decided ex ante, with the issuer of the CCfD (e.g. a government or an institution delegated by the European Commission) paying out the difference between the 'strike price' and the actual carbon price (or alternatively, the recipient refunding the payment if the actual carbon price exceeds the agreed strike price). See, for example, Sartor, O. and C. Bataille (2019), "Decarbonising basic materials in Europe: How Carbon Contracts-for-Difference could help bring breakthrough technologies to market", IDDRI Study No 6 October 2019 (www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Etude/201910- ST0619-CCfDs_0.pdf).

[14] Neuhoff, K., Chiappinelli, O., Gerres, T., Haussner, M., Ismer, R., May, N., Pirlot, A., and J. Richstein (2019), "Building blocks for a climate-neutral European industrial sector", Climate Strategies report (https://climatestrategies.org/wp-content/uploads/2019/10/Building-Blocks-for-a-Climate-Neutral-European-Industrial-Sector.pdf).

[15] Or more precisely, an installation.

[16] There are six benchmarks applicable to steelmaking, including separate benchmarks for the Electric Arc Furnace production routes and those related to steelmaking in blast furnaces, such the 'hot metal' benchmark.

[17] See https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf

[18] See the European Green Deal (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN) and Council conclusions from 25 January 2021 (www.consilium.europa.eu/media/48057/st05263-en21.pdf).

[19] E.g. for a comparison of investments between the EU, US and China, see www.eib.org/attachments/efs/economic_investment_report_2020_2021_en.pdf.

[20] See https://www.nature.com/articles/d41586-021-00736-2

[21] "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" (www.meti.go.jp/english/press/2020/

1225_001.html).

[22] See also Delbeke, Jos and Peter Vis (2020), "A way forward for a carbon border adjustment mechanism by the EU", European University Institute, 2020STG Policy Briefs, 2020/06.

[23] See the remark made by John Kerry on his visit to the EU in April 2021: https://www.ft.com/content/3d00d3c8-202d-4765-b0ae-e2b212bbca98

[24] See www.cbc.ca/news/politics/carbon-tax-conservatives-1.5988407

[25] See data from the EU transaction log.

[26] The European Parliament supports examining export rebates or other support mechanisms for exports should free allocations be phased out. See Report "Towards a WTO-compatible EU carbon border adjustment mechanism" (2020/2043(INI)).

[27] I.e. NACE and PRODCOM sectors using data from the Comext (Eurostat) database.

[28] The Modernisation Fund is another important fund, although this is targeted specifically at the energy sector in central and eastern EU member states.

[29] See https://advances.sciencemag.org/content/5/9/eaax3323

[30] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2019.120.01.0020.01.ENG&toc=OJ%3AL%3A2019%3A120%3AFULL

[31] See e.g. the annual State Aid Scoreboards by DG COMP.

[32] European Commission (2019), "The European Green Deal", Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2019) 640 final.

[33] Arguably a hidden driver of striving for effective regulation of the finance industry as well.

[34] See www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/deloitte-norcat-future-mining-with-ai-web.pdf

[35] See also www.oecd.org/cfe/leed/45484420.pdf

[36] See https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/financial-assistance-eu/funding-mechanisms-and-facilities/sure_en

[37] Directive 2014/24/EU on public procurement and the Utilities Directive 2014/25/EU.

[38] Kadefors, A., Lingegård, S., Uppenberg, S., Alkan-Olsson, J., and D. Balian (2021), "Designing and implementing procurement requirements for carbon reduction in infrastructure construction–international overview and experiences", *Journal of Environmental Planning and Management*, 64(4), 611-634.

[39] Núñez Ferrer, J. (2020), "The EU's Public Procurement Framework - How is the EU's Public Procurement Framework contributing to the achievement of the objectives of the Paris Agreement and the Circular Economy Strategy?", Briefing Requested by the IMCO committee, European Parliament.

[40] See European Commission (2020), "A new Circular Economy Action Plan for a cleaner and more competitive Europe", Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2020) 98 final.

[41] See Kadefors et al. (2019) ibid. and Núñez Ferrer (2020) ibid.

[42] The EU Ecolabel legislation provides one avenue to pursue this, while globally ISO standard 14024:2018 could allow for greater global coordination.

[43] GHG-protocol scope definitions: Scope 1: All direct GHG emissions; Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam; Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

[44] The sum of non-ETS industrial emissions is significant and cannot be ignored with the EU's climate neutrality objective in place. In 2019, just under 200 million tonnes of emissions were caused by fuel combustion in non-ETS industry. Power and heat provision add another 150 million tonnes. Another 125 million tonnes of CO_2e were the result of non-energy process emissions. Non-CO_2 greenhouse gases such as HFCs and PFCs play an important role here; they are much more powerful greenhouse gases, although this also means that successful reduction efforts have a large impact on emissions expressed in CO_2e. While a lot of these emissions may be linked to a large number of smaller companies, lighter industry can also cover major manufacturing industries – just not of the energy-intensive types. Well over 400 million tonnes of non-ETS industrial emissions is about half of total ETS industry emissions and more than the combined emissions of the steel and cement sectors. Unlike these sectors, however, for which precise emissions data is tracked through the EU transaction log, data about non-

ETS industry is less transparent, and only briefly referred to in National Energy and Climate Plans.

[45] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0176

[46] See https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-Ministerial-Conference-Parallel-Session-4.pdf p. 3.

[47] See https://climatestrategies.org/wp-content/uploads/2021/03/CFM-Industrial-Clusters-briefing_FINAL.pdf

[48] The online tool found on www.euets.info shows the location of ETS installations in different sectors across the EU. A comparison of e.g. the steel and cement sectors highlights the differences in geographic distribution.

[49] Benachio, G.L.F., Freitas M. do C.D. and S.F. Tavarese (2020), "Circular economy in the construction industry: A systematic literature review", *Journal of Cleaner Production*, Vol. 260, 121046.

[50] See https://ec.europa.eu/commission/presscorner/detail/en/AC_20_1916

[51] See https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-buildings_en

[52] International Resource Panel (IRP) (2020), "Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future", United Nations Environment Programme, Nairobi, Kenya.

[53] De Groote, M. and M. Lefever (2016), "Driving Transformational Change in the Construction Value Chain", Buildings Performance Institute Europe (BPIE).

[54] For example, buildings could have embedded carbon limits, or be required to use a certain share of carbon neutral materials.

[55] Edgar, G.H. et al. (2019), "Material efficiency strategies to reducing greenhouse gas emissions associated with buildings, vehicles, and electronics—a review", *Environ. Res. Lett*. Vol. 14.

[56] The reverse is also true. Efforts to accelerate the utilisation of new technological innovations may shorten the lifetime of buildings.

[57] International Resource Panel (IRP) (2020) ibid.

[58] The increased use of CO_2 as part of "carbon capture and use – CCU" projects also requires strong accounting rules as some uses of CO_2 (such as synthetic fuels) only defer the release of carbon into the atmosphere, and are therefore not compatible with climate neutrality.

[59] See also Michael Liebreich (2021), "Climate and Finance – Lessons from a time machine" (https://about.bnef.com/blog/liebreich-climate-and-finance-lessons-from-a-time-machine/).