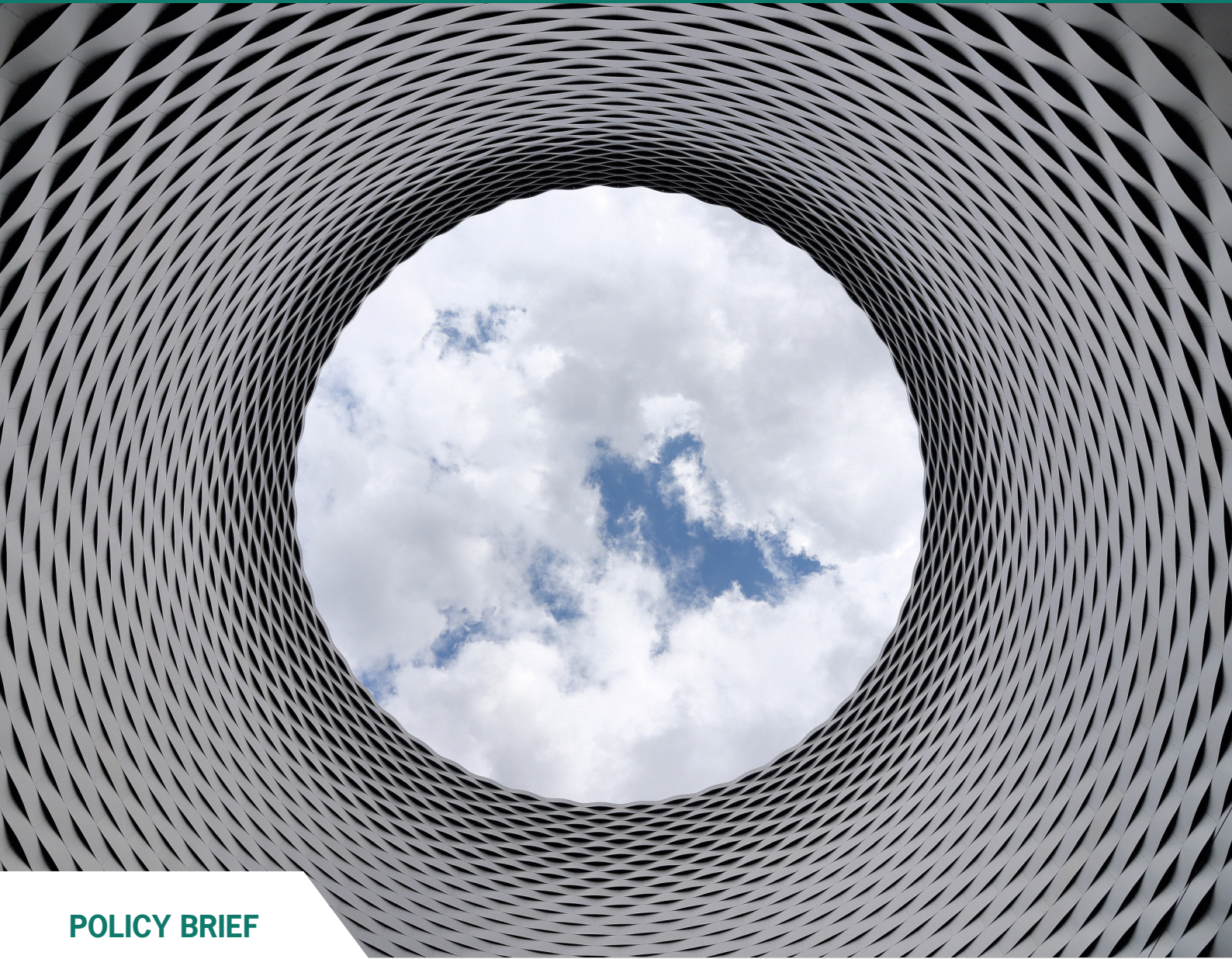


CLIMATE
FRIENDLY
MATERIALS
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Carbon Contracts for Differences:

*their role in European industrial
decarbonization*

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POLICY BRIEF



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Climate Friendly Materials Platform

The Climate Friendly Materials (CFM) Platform analyses the transformation of basic material production and use to achieve carbon neutrality by 2050. Its collective aim is to aid progress toward nationally-led industrial decarbonisation policy frameworks compatible with long-term EU strategy, and to capture the potential of a just and inclusive clean energy transformation.

Convened by Climate Strategies, the CFM Platform facilitates exchange between leading analysts, policymakers, industry leaders and other relevant stakeholders. It brings together leading think tanks and university research groups in Belgium, France, Germany, Hungary, the Netherlands, Poland, Spain and Sweden to enhance Europe's analytic understanding of how individual instruments fit together into a coherent policy package.

They also acknowledge funding from the European Climate Foundation (ECF).

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1. Introduction

The European Union has set up an ambitious strategy to meet the goals of the Paris Agreement. By 2050, Europe must be neutral in terms of greenhouse gas (GHG) emissions. This means that very few GHG emissions will be allowed and only if they can be compensated by GHG captured by natural sinks.

Industry is responsible for a very significant share of the EU's emissions: approximately 25% in 2019 (the production of basic materials represents 16%). Although other sectors such as transport or buildings will be able to reduce their emissions first, the decarbonization of industry is essential for reaching Europe's net-neutrality goals, and is also an opportunity to improve the long-term competitiveness of this sector in the global market. This idea is clearly reflected in the European Green Deal, and nowadays is also one of the underlying premises in the initial discussions about the COVID-19 Recovery Funds.

However, decarbonizing industry, and particularly the production of basic materials, is not an easy task. In some cases, decarbonized technologies are not available yet; in others, these climate friendly technologies are more expensive than the current ones and require significant additional investments. An effective set of policies is required that, on the one hand, promote and foster the innovations needed, and on the other, support the investments required. If implemented well, these policies will, in turn, set up a framework which can ensure the long-term competitiveness of the European industry in an increasingly decarbonized world, securing local jobs and contributing to a social, clean and competitive European economy.

The Climate Friendly Materials Platform, which brings together leading researchers and policy advisors from Spain, France, Netherlands, Belgium, Sweden, Germany, Poland and Hungary convened by the research network Climate Strategies, has presented a concrete package of policy instruments that should support this transformation, by creating markets for climate friendly materials and technologies and preventing relocation of production and jobs to other regions (Neuhoff et al, 2019).

The package combines five elements:

- A climate contribution that restores the decarbonization incentive for basic materials without differentiation by location (hence becoming a pragmatic alternative to a Border Carbon Tax);
- Contracts for Differences for Renewables, that create stable access to competitively priced clean electricity;

- Green Public Procurement that creates lead markets for low-carbon materials in infrastructure or buildings;
- Product Carbon Requirements that ban high-carbon products on the long run, when there is a low-carbon alternative;
- And Project-based Carbon Contracts for Differences (CCfDs) that help create successful business cases

If implemented individually as single measures, these policies would not be sufficient to support industrial decarbonisation, but they can unfold their true potential if combined in a policy package.

In this document, we focus on implications of CCfDs and their role within such policy package. We do believe that CCfDs are a very powerful tool for helping European industry transformation during the first stages of the transition period towards a low emission economy, and that the current discussion about a green recovery (Neuhoff et al, 2020) provides a great opportunity for their quick implementation. Indeed, CCfDs already play an important role in the considerations of domestic and European policy makers. As such, CCfDs have been specifically mentioned in the national German hydrogen strategy (BMW i, 2020), and also in drafts of the forthcoming Green Deal Recovery Package, as tools to bridge the cost gap between conventional and decarbonized hydrogen.

In this policy brief, we explain in detail what CCfDs are and how they can help create a successful business case for low carbon technologies; we assess their economic implications; revise practical aspects with regard to their implementation; and lastly analyse their connection with the Recovery Funds.

2. What are Carbon Contracts for Differences?

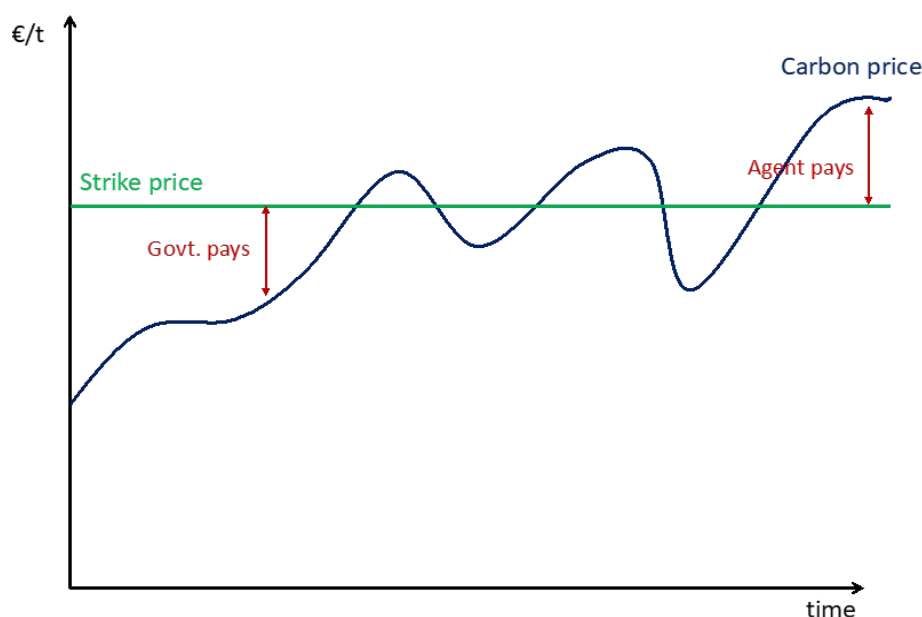
Investing in innovative low-carbon industrial technologies faces many risks, one of which is the uncertain revenue that might be obtained in the carbon market by selling carbon reductions or excess allowances. Future carbon prices are very difficult to predict due to intrinsic regulatory uncertainty regarding taxes or carbon markets (which drives supply), and also to the uncertain evolution of low-carbon technologies (which drives demand). This may explain why there are no long-term carbon markets that help agents hedge these risks.

Carbon Contracts are one way to minimize this price uncertainty. A Carbon Contract is a contract by which a government or institution agrees with an agent on a fixed carbon price over a given time period. During the contractually agreed period this agent can then sell any carbon emission reductions (or allowances) at that given price. If formulated as a strike price over a carbon market price (a two-sided option) then they become Carbon Contracts for Differences (CCfDs), as first proposed by Richstein (2017). If the market price is lower than the strike price, the agent receives the difference. If the market price is higher, the agent has to return the additional revenue to the government.

Carbon contracts were first proposed by Helm and Hepburn (2005) to correct the regulatory risk and lack of long-term carbon markets, in turn arising from the inherent lack of credibility of governments when setting carbon reduction goals or carbon prices.

It should be noted that other options have been proposed to try to reduce the uncertainty around carbon prices, but none is considered to be as powerful as CCfDs. Perfect information about national carbon reduction goals, such as that provided by the UK Climate Change Committee, does reduce regulatory risk, but is unable to reduce other risks, which are not subject to national policies. Carbon price caps and floors (as those implicitly set up by the EU ETS Market Stability Reserve) do not necessarily reduce the regulatory uncertainty, but only the short-term variability of carbon prices. Ismer and Neuhoff (2006) proposed that governments might award options on ETS prices. These would however impose significant risk for individual member states, if they were to issue such contracts in an uncoordinated way. Finally, it has also been argued that private agents might engage in this type of contracts. Unfortunately, this has not been the case yet, although there is no reason why they should be prevented for doing so. However, the question would still remain of whether having the government issue contracts directly would reduce the social risk, by allocating it to the agent that creates it in part.

To date, carbon contracts are therefore the best tool to provide certain revenue streams to decarbonized technologies, which investors could then capitalize over the lifetime of the project.



However, carbon price stability is only part of the framework needed to promote innovative investments. If innovation processes present knowledge spillovers, then the carbon price, even a certain one, will not provide the right incentives to innovate and achieve a given emissions reduction goal (Newell and Fischer, 2008). In this case, additional technology support that helps technologies become competitive is needed. This technology support can be included into the carbon contract, as a premium over the expected carbon price, as proposed by Groenenberg and de Coninck (2008).

Therefore, supported projects would receive additional non-market payments for each emission allowance they sell below the strike price, which, according to Richstein (2017) might be referenced to existing emission benchmarks of alternative products or production processes. For example, Bataille (2020) argues that 70€/tCO₂ would be sufficient to implement low emission options in most sectors, such as the steel, cement, pulp & paper and aluminium industry, as well as enable hydrogen production technologies within the 2020 – 2030 horizon. That means that if the EU ETS price is at 25 €/tCO₂, the project would be compensated by an additional 45 €/tCO₂. Such mechanism would result in significant transfer payments to the project in the early years of implementation but would be redundant as soon as higher EU ETS price levels are reached.

Therefore, CCfDs can help correct two problems:

- First, as a hedging instrument for future carbon prices, they address regulatory credibility issues, and stabilize revenue streams for low emission projects, therefore reducing financing costs;
- Second, as a vehicle for additional support for innovative industrial technologies, they address the market failure in the innovation market (or the valley of death).

These two elements help create a more favourable business case for investing in innovative low-carbon industrial technologies, which is totally justified on social grounds in light of long term decarbonization objectives.

Richstein (2017) and Sartor and Bataille (2019) elaborate further on this idea, and propose that CCfDs should be awarded only on a project-specific basis, so that they limit the exposure of the government to individual projects, and prevent the contract being fulfilled by a portfolio or traded, hence allowing the government to capture the upside of carbon price development. Focusing on projects where the cost of carbon is an important component would maximize risk reduction.

2.1 Differences with Renewable Contracts for Differences (RES CfDs)

Although CCfDs may be considered intuitively similar to RES CfDs, there are two important differences:

- In the case of RES, CfDs cover all the revenue stream of the investment. However, CCfDs only address the carbon revenue, which is just one of the revenue streams of an industrial production facility (the main one being the sales of the industrial product). Therefore, CfDs cover all revenue risk, whereas CCfDs only mitigate a limited part of it.
- “For-differences” is an essential part of the contract in the case of RES since operational price signals on the electricity market are maintained: to produce electricity when it is more needed. In the case of industrial projects, the need to operate efficiently in the carbon market is less justified (although it does help).

2.2 CCfDs as commitment devices and innovation incentives

CCfDs not only provide certainty to investors in low-carbon projects. They also work as commitment devices for governments, as shown by Chiappinelli and Neuhoff (2020), with the corresponding positive effects on innovation.

Without contracts, governments have a clear incentive to expropriate the rents of innovation in low-carbon technologies, by lowering carbon prices ex-post, once the innovation has taken place. A similar effect is created when investments in lower-carbon technologies result in lower carbon market prices. This in turn results in an underinvestment in innovative technologies, since firms anticipate this behaviour.

When CCfDs are introduced, innovation support is granted directly to the individual projects. But additionally, since CCfDs also create a strong incentive for governments to keep carbon market prices high (so that the financial cost of the CCfD will be lower), they also ensure that the incentives to innovate are maintained for all agents.

3. Economic aspects of CCFD

3.1 Public cost

CCfDs entail two cost elements for public administrations. First, there is a cost associated to the hedging of carbon price risk. It should be noted that, by allocating the risk to the government (partly responsible of the uncertainty of carbon prices), the overall social risk is reduced. But there is still an exogenous risk that the CCFD must cover. This risk can be valued in economic terms using traditional tools such as Value at Risk (VaR).

The second cost element is related to the direct technology support (including the risk of technology failure). This cost element has an expiration date: once the technology becomes competitive, it is not needed any more. This means that the contribution to innovation support by CCfDs should decrease for new projects over time, as the technology follows the learning curve (another alternative would be to keep CCfDs stable and use innovation funds for earlier projects). In fact, the formulation of the CCFD ensures that, when carbon prices are high enough, public support is not required any more.

Regarding expected annual public costs for CCfDs, similar trends as for other technology support schemes might be observed. While the relatively small first mover capacity requires high transfer payments over a long period of time, the successive large-scale implementation of the technology will require relatively low support payments per capacity installed.

An additional complication, in this regard, is the funding of flex-fuel technologies with CCfDs, such as the DRI-EAF route for primary steel making. These installations can first be operated with grey hydrogen, which reduces emissions compared to the classical blast furnace route but cannot be considered to be a near-zero emission technology. As a result, the amount of emission allowance certificates that can be sold at the strike prices agreed in the CCFD is limited. As soon as green hydrogen is used for Direct Reduced Iron (DRI), resulting emissions will reduce drastically, though increasing the allowances which can be sold at the strike price and increasing the public cost.

In absolute terms, CCfDs as a tool for funding novel technologies might therefore be relatively cheap for the government in the beginning, but can cause increasing follow-up costs over the next decades as more plants are converted to clean technologies, unless in parallel the ETS price reaches the range of CCFD strike prices. Some preliminary estimations by Sartor and Bataille (2019) show that, for France, costs could range between 100 and 500 million€/yr, for differences

between the strike and reference prices ranging from 5 to 25 €/tCO₂.

An important issue in this regard is how to obtain the public funds required for these CCfDs, moreover given that this is not the typical way in which government funding or public budgeting works. A consumption charge/ climate contribution, as described in the policy package mentioned in the introduction, would provide additional funding.

3.2 Social value

The two elements of CCFD also provide two sources of social value.

First, as mentioned before, CCfD provide certainty for a part of the project revenues, which in turns reduces investment risk, and hence the cost of financing. This effect has already been observed for renewable CFDs, with reductions of 30% in the overall cost of renewable technologies (Aurora Energy Research (2018); Hering (2019); May & Neuhoff (2017)). In the case of CCfDs this impact should be lower, since, as mentioned earlier, they only affect one of the revenue streams. Neuhoff et al (2019) show how CCfD allow for a higher debt ratio of low-carbon projects, in turn reducing the carbon price required to make the investment competitive by 35%, or reducing the Weighted Average Cost of Capital (WACC) of for the project.

The second positive effect is the improvement in the learning curve (and related knowledge spillovers) associated with the support to low-carbon technologies included in the CCFD. This will of course depend on the shape of the learning curve.

In this regard, the fact that CCfD are also commitment devices also increases welfare by strengthening the signal for innovation, as shown by Chiappinelli and Neuhoff (2020).

4. How to implement CCfDs

We have argued, hopefully convincingly, that CCfDs are a very important piece of the policy package needed to decarbonize industry. However, as usual, the devil lies in the details, and the potential success of this policy will depend on its design and implementation. This is particularly important given that decarbonizing industry will need a massive rollout of clean technologies, for which building a reasonable business case is essential.

There are several aspects related to the practical implementation of CCfDs that need to be carefully considered.

4.1 Geographical scope

The first element that needs to be discussed is whether CCfDs should be signed at the European or at the national level. Each approach has advantages and disadvantages:

The European approach would prevent distortions among national industries, by treating them equally, independently of the national resources available for financing CCfDs; in addition, this would avoid any considerations about whether CCfDs should be considered state aid.

Europe could also consider using CCfDs to incentivize projects in developing countries as a way to recycle revenues from border carbon adjustments, in order to make them more compatible with WTO rules.

On the other hand, the European approach would require EU-specific funding. Since, for example, revenues of ETS auctions are being transferred to Member States, other sources would be needed (such as a climate contribution, if implemented at European level).

Also, the European approach might make it more difficult to coordinate the support provided by CCfDs with national support systems (industrial policy, CfDs, etc).

On a more political basis, it might be difficult to convince Member States to relinquish their competences over a very important decarbonization/competitiveness/industrial policy element.

Given all these considerations, it seems more likely or practical (although probably not ideal) that CCfDs will be awarded on a national basis, which of course makes them subject to State Aid rules, and would require a certain degree of harmonization among Member States.

One possibility for this harmonization would be to make them consistent with the long-term strategic vision of the European industry (e.g., using hydrogen produced with cheap renewables in Southern Europe to fuel industries in the North, or include guidelines for the use of CCfDs in EU directives or regulations. Another element of harmonization would be designing EU rules for awarding CCfDs at the national level (including e.g. benchmarks), or even having Member States agree on a common CCfD strike price (Richstein, 2017).

4.2 Compatibility with State Aid

A CCfD, independently of whether it transfers carbon price risk to the government or whether it includes technology support, is technically state aid. It confers an advantage on a selective basis (e.g. to specific companies or sectors), and should therefore comply with the EU state aid rules.

According to the current rules, 100% of support (considered as the difference in costs with the conventional alternative) would be allowed as long as it goes beyond the current level of environmental protection, and is awarded through a competitive process (if not competitive, support allowed is reduced to a range between 60 and 80%). This is for example the proposal by Sartor and Bataille (2019): a technology neutral, competitive tender.

In fact, a tender would be also the preferred option to allocate a CCfD even if not subject to State Aid rules, given that it is the best way to address the information asymmetry between the government and industry.

However, there are important questions regarding the design of the tender, to ensure it is competitive. Restricting CCfDs to basic materials industrial projects would leave a rather narrow field of contestants (which in turn would be against the requirements of State Aid compliance). In addition, the technological complexity of the low-carbon processes results in large informational asymmetries. Both aspects could create opportunities for contestants to exert market power in the tender, and hence cause the extraction of rents by the awarded parties.

Administrative requirements might also create barriers for smaller companies and favour incumbents. One way to address this would be to award CCfDs to small companies directly, but with the price resulting from the tender.

The lessons learned in e.g. RES auctions (see e.g. Del Rio and Linares, 2014) or in the context of broader public auctions should

be used in order to reduce this possibility. For example, reserve prices do not solve this problem, unless confidential. A second question is whether this process will ensure that the final levels of support are harmonized across all Member States, which will depend partly on the degree of contestability of the tender.

Finally, tenders should be “technology-neutral”, and as broad as possible, so that they will address the competition not only among industrial sectors, but also with the circular economy (e.g., having primary steel decarbonization options compete with secondary steel), taking therefore into account the resource intensity criterion. From a risk perspective, this is probably reasonable. However, as a way to support different technologies (with different positions along the learning curve), specific auctions might be justified, particularly in the early stages.

4.3 Links with other elements of the policy package

We mentioned at the beginning that the different elements of the policy package should be used in a consistent way. This presents several opportunities for synergies between policy elements, but can also result in unexpected outcomes.

One seemingly reasonable link is the one between CCfD and green public procurement (GPP): CCfDs might be awarded automatically as a part of the tender for GPP to make the public support for greener options more explicit. However, if CCfDs are awarded ex-post, the carbon price contracted should take into account the implicit subsidy already included in the GPP. An alternative would be to only allow CCfD projects to compete for GPPs, since they may be the only ones that can comply with strict procurement requirements or shadow carbon prices used to evaluate bids (Hasanbeigi et al, 2019), although again this might present issues with oversubsidization and unjustified limited competition in the GPP tender. Oversubsidization might also be a concern if projects previously supported with CCfD compete with others in GPP tenders.

Another link, proposed by Sartor and Bataille (2019), is to award CCfDs automatically (but not exclusively) to projects selected for EU or national innovation funds. This would clearly streamline the selection process but might result also in oversubsidizing these projects (although, since innovation funds only cover 60% of incremental costs for 10 years, there is still room for adjustment). As discussed in Richstein (2017), the automatic award could also be announced beforehand to adjust the grant received.

CCfDs can complement consumer-based policies, such as carbon taxes or the Climate Contribution. Policies penalizing the use of carbon intensive materials favour low emission options and therefore improve the business case for projects eligible to

CCfDs. While the additional funding obtained by such contribution can off-set some government expenditure for CCfDs, the impact of the contribution on the competitiveness of low-emission production technologies might reduce the need for CCfDs to finance low-emission industrial installation. This means that CCfDs signed for high CO² prices in combination with significant charges for carbon intensive material use can result in windfall profits for pilot projects eligible to CCfDs. The policy design has to ensure that such undesirable effects are avoided.

CCfDs could be coupled with CfDs, to strengthen the level of support, address and hedge the risk of the two sources of decarbonization: energy inputs, and emissions outputs. In fact, for many industries the energy cost is more relevant than the carbon cost. However, an extensive use of CfDs might lower the market price of CO², thus increasing the cost of CCfDs for governments.

Finally, another interaction that should be studied carefully is that between CCfDs and the EU ETS. In principle, CCfDs ensure that projects can sell the allowances they have been granted for free (through the current benchmark process in the EU). If allowances are not grandfathered, the government should directly buy the carbon reductions, as explained by Helm and Hepburn (2005). Richstein (2017) also discusses in detail the connection between CCfDs and the ETS. Nevertheless, it should be emphasized that targeting carefully CCfDs on specific, high-carbon cost projects, would not substitute the ETS, but rather strengthen it.

5. CCfDs and Recovery Funds

CCfDs have been proposed in EU documents as one of the potential instruments to be associated with the use of COVID-19 Recovery Funds.

On the one hand, CCfDs do not seem to be suited for shovel-ready projects, but for innovative ones, which will need more time to develop, create jobs and hence contribute to the recovery of the economy. On the other hand, CCfD can certainly reduce the financing cost of green investments, which should be the backbone of the recovery programme (see Neuhoff et al, 2020).

Also, CCfDs are funds that need to be released over a long period, contrary to the urgent deployment of the recovery funds. They can ensure, though, that there is a long-term business case for projects eligible to immediate green investment funding and therefore increases the likelihood of novel technologies being implemented on industrial scale in the aftermath of the COVID crisis.

Finally, another aspect that may be relevant is that the recovery programme leaves a lot of room for Member States to design their own policies and programmes. This would result in a more heterogeneous application of CCfDs, along with the problems highlighted earlier.

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