# Spend Smarter

## A bit of advice on climate innovation financing

sandbag

smarter climate policy

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**Principal Authors**

Sandbag, with ClientEarth contributing legal expertise.

**Acknowledgments**

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**Image credits**

Luxurious cars, Photo by Jannis Lucas on Unsplash

# Contents

# Acronyms

| | |
|---|---|
| BF | Blast Furnace |
| CBAM | Carbon Border Adjustment Mechanism |
| CC | Carbon contract |
| CCfD | Carbon contract for difference |
| CCS | Carbon Capture and Storage |
| CCS/U | Carbon Capture and Storage or Utilisation |
| CEEAG | Commission Guidelines on State aid for climate, environmental protection and energy |
| CINEA | European Climate, Infrastructure and Environment Executive Agency |
| $CO_2$ | Carbon dioxide |
| DRI | Direct Reduced Iron |
| EAF | Electric Arc Furnace |
| ETS | Emissions trading scheme |
| EU ETS | European Union's Emissions Trading Scheme |
| GHG | Greenhouse gas |
| IF | Innovation Fund |
| kWh | Kilo-watt hour |
| MWh | Mega-watt hour |
| NER300 | New Entrants Reserve 300 (an innovation support programme) |
| R&D | Research and Development |
| $tCO_2e$ | Tonnes of CO2 equivalent |
| TRL | Technology Readiness Level |

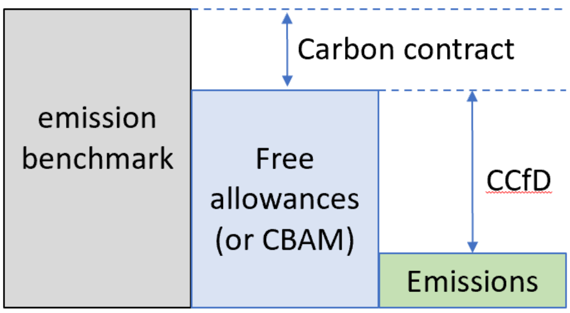

# Summary

Europe's industrial decarbonisation policy revolves around carbon pricing (the EU Emissions Trading System or ETS), some of the proceeds of which go to subsidy schemes, at the Member State or EU level.

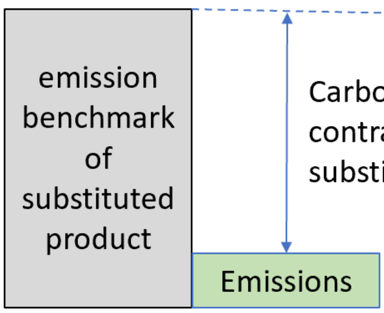
Currently, most EU-managed subsidies go to innovation (through the Innovation Fund) whereas initiatives led by Member States put a lot of emphasis on hydrogen. While the most polluting plants also receive public support through the free allocation of emission permits under the ETS, there is a gap in subsidy-granting concerning 'ordinary' low-carbon solutions which are neither innovative nor given free emission allowances, for example circularity practices or the substitution of carbon-intensive materials, which leaves them at a competitive disadvantage.

Main findings:

- Subsidies to innovation should not be paid upfront when technology risk is low. Instead, they should be based on performance. The Innovation Fund's current approach is too costly and inefficient.
- Carbon contracts for difference (CCfDs) are only useful when they match the number of spare free emission allowances held by their beneficiaries.
- CCfDs with high strike prices (higher than the carbon market price) increase the competitive distortion in favour of the installations which receive free emission permits.
- To reduce competitive distortions while free permits are given to polluting plants, **carbon contracts for substitution** should be set up to cover activities receiving few or no free allowances that reduce the demand for carbon-intensive products (see figure below).
- The scale of the climate change challenge requires careful funding allocation: more parsimonious innovation financing would free up the funds needed to support activities with high abatement potential currently left out of the grant system.




Low-risk innovative project receiving free allowances




Activity not receiving free allowances

Instead of being awarded solely on the basis of innovation, subsidies should go to carbon reduction measures where the carbon price ‘doesn’t work’. Simply put, the carbon price is ineffective in stimulating the development of these measures because either the carbon price is too low, or because polluting industries receive free emission allowances, making it harder for clean processes to compete.

The Innovation Fund currently distributes up to 100% of subsidies upfront, to projects based on their degree of innovation, regardless of their level of risk. This is a policy error that needs to be corrected. Many technologies considered ‘innovative’ are low-risk and should receive only performance-based subsidies instead, for example, through CCfDs. For those projects, providing upfront subsidies leads to the crowding out of private investment, whereas performance-based funding would crowd in private investment. Through the Innovation Fund, the EU assumes the wrong type of risk while at the same time not incentivising performance. Carbon contracts can be granted at the EU or State level. However, State Aid law does not appropriately take into account any measure of project risk.

Though CCfDs are a good solution for some projects, they are only relevant to installations covered by the EU ETS which receive free emission allowances and are not the ‘one solution fits all’ answer to funding. The biggest market failure of the EU ETS concerns the technologies it does not cover because they are not eligible for free allocation. These are, for example, the timber industry (which should be allowed to compete more fairly with concrete) or recycling in general, which contributes to reducing demand for primary products. For those activities, instead of CCfDs, we propose to introduce carbon contracts for substitution.

Upfront funding could continue, but only for projects with an elevated risk related to the technology’s performance. For the rest, CCfDs and carbon contracts should be trialled at the market $CO_2$ price, with no premium, because the market price should reflect the level of ambition of the EU ETS. For the EU to pay more would be counterproductive. If applied uniformly enough to even out the distortion between ETS-covered and non-covered sectors, carbon contracts at market price should suffice to meet the EU’s targeted level of ambition.

Image by Erich Westendarp from Pixabay

# 1 Innovation support: how it emerged as a complement to carbon pricing

## 1.1 Carbon prices and innovation

Many EU policymakers had believed that setting a carbon price in Europe through the EU ETS legislation introduced in 2005 would push industrials to innovate to find new technology and processes that would be less polluting instead of having to pay for their costly emissions. Unfortunately, innovation did not take off as many had hoped. The need for finding new ways of supporting innovation became a subject of debate at the EU climate policy level in the late 2000s in the context of low carbon prices, when it was assumed that new technologies typically go through a ‘valley of death’ of scarce funding and low or negative profitability, at which point they need public support in order to grow before reaching commercial maturity (European Commission - DG ENVI, 2009).

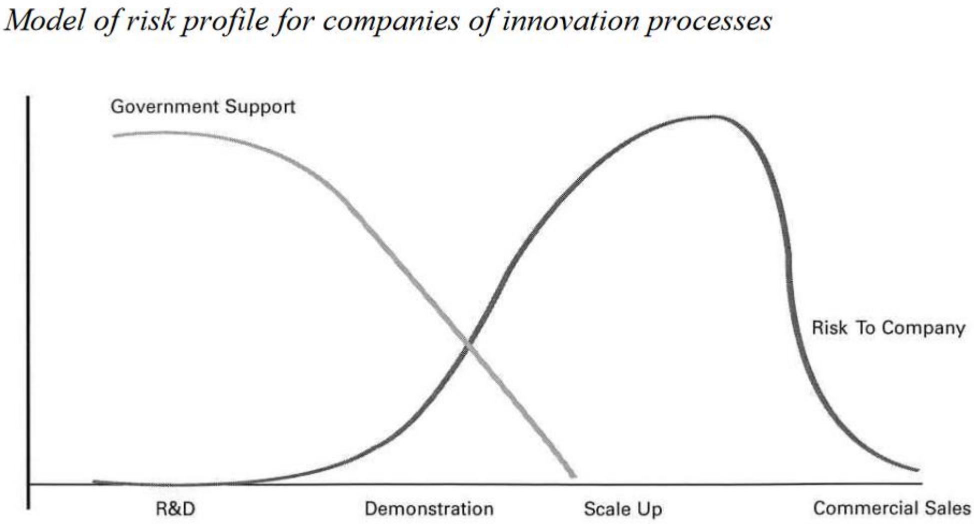



Figure 1. Model of risk profile for companies of innovation processes.
Source : (European Commission - DG ENVI, 2009)

EU carbon prices have come a long way since those early years, from a low of €2.90 per tonne of $CO_2$ emissions in 2012 to over €100 in 2022. Unfortunately, the policy narrative has not totally caught up with this new reality. In its impact assessment for the ETS reform, the European Commission focused on $CO_2$ price levels as it considered that, for "*the first industrial scale alternatives (to polluting technologies) to be deployed during the coming decade", "complementary policies to the ETS (…) seem justified because of:*

*(1) the current high abatement costs of these technologies compared to the $CO_2$ price,*
*(2) uncertainty regarding $CO_2$ price developments over the next decade(s) (and associated investment and financing risks) and*
*(3) the need to first lower costs through learning by doing, industrialization and economies of scale.*" (European Commission, 2021)

The assessment quoted a 2019 report by IDDRI estimating the marginal abatement costs for selected low-carbon technologies, showing abatement costs clearly higher than the then current ETS market price, as shown below.

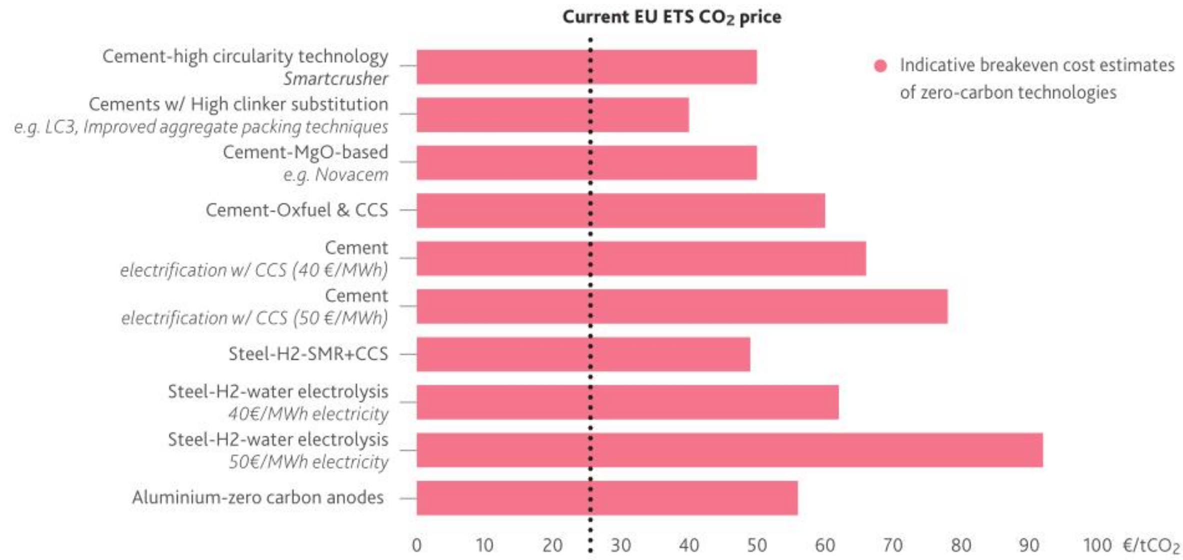



Figure 2. Breakeven cost estimates of very low-carbon cement, primary steel, and primary aluminium technologies. Source: Oliver Sartor and Chris Bataille (IDDRI), Oct. 2019

But carbon prices hitting €100 in February 2022 did not trigger a tsunami of investment in greener technologies, contrary to what the above chart would suggest based on the indicated break-even costs for zero-carbon technologies in 2019.

In a 2021 report on CCfDs, Agora Energiewende explained that innovation was still lagging because breakeven cost estimates were even higher than those 2019 estimates (see Figure 3 below), although, with a carbon market price at €60 at the time, several technologies like EAF steel from natural gas, oxyfuel with Carbon Capture and Storage (CCS) or Bioenergy with Carbon and Capture Storage (BECCS) for cement appeared 'in the money'.

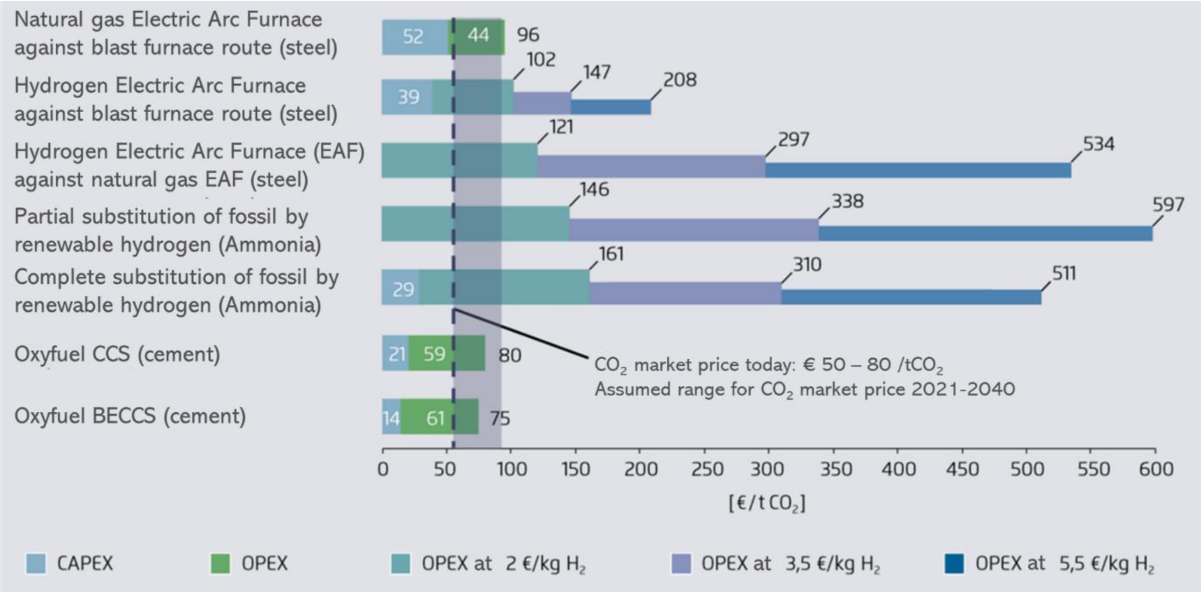



Figure 3. Typical $CO_2$ abatement costs from selected low-emission technologies
Source: (Agora Energiewende, 2021)translated from German by Sandbag

## 1.2 An obstacle: free allocation

So why have higher carbon prices not stimulated innovation as many EU policymakers had hoped?

Let's take hydrogen production as an example. A study published by Sandbag[1] in 2021 demonstrated that in many parts of Europe the cost of emissions reduction through the switch from 'grey' to 'green' hydrogen (from water electrolysis using renewable electricity) was already lower than the prevailing carbon market price (see Figure 4).

The study highlighted that, despite relatively low costs, a switch to renewable hydrogen was not expected because free emission permits were only given to hydrogen production facilities using steam methane reforming or partial oxidation, making 'green' hydrogen facilities less attractive.

[1] Sandbag (2021), Untangling the knots – Clearing the way to fast green hydrogen deployment

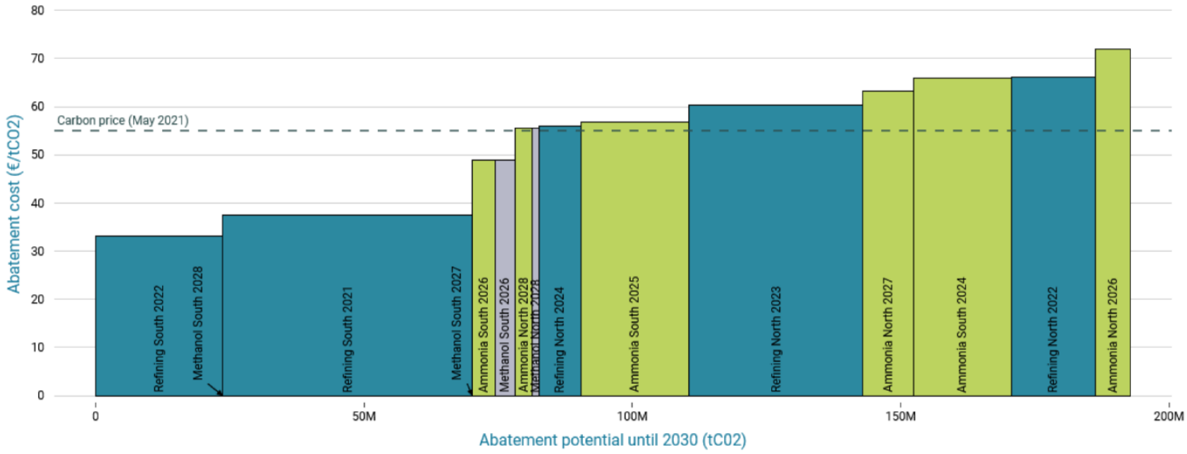



Figure 4. Switching potential and cost from 'grey' to 'green' hydrogen in chemical sector (year numbers indicate investment decision). Source: Sandbag

Although free allocation creates obvious obstacles to decarbonisation and innovation, the European Union has exclusively relied on this mechanism as protection against 'carbon leakage' (the outsourcing of production to third countries with lower carbon costs) since the carbon market's creation in 2005. Free allocation puts less polluting products not covered by the EU ETS or with lower free allocation at a disadvantage compared to those that receive more free permits. Some additional perverse effects of free allocation are discussed in another Sandbag article[2].

## 1.3 Innovation financing as a necessary complement

In a framework where free allocation continues to support 'legacy' techniques and processes, something else is needed to make low-carbon solutions competitive. This is where support for innovation is sometimes said to be able to play the role that carbon pricing is not playing to incentivise decarbonisation.

Innovation support can take a number of forms: grants, equity, loans, loan guarantees, tax credits, feed-in tariffs etc. The mechanisms funded by the ETS have been dedicated to projects with a particular degree of innovation: both the NER300 (set up in the early 2010s) and the Innovation Fund (ten years later) aim at developing first-of-a-kind demonstrators, i.e., projects using technologies already proven at the pilot stage but that have not yet been commercialized.

### 1.3.1 A low-risk instrument: the NER300 Fund

First, the NER300 programme, a fund of about €2bn, financed by the sale of 300 million emission allowances under the ETS, awarded grants in two tenders ('*calls*') in 2012 and 2014. The programme was set up to support the development of 8 CCS facilities, as well as innovative renewable electricity generation using a selection of technologies including: photovoltaic, concentrated solar power, ocean energy and wind energy among others.

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[2] Sandbag (December 2021), [Why Free Allocation in the EU ETS Must Stop Urgently]

A key feature of the NER300 scheme was its pay-out scheme "dependent upon the verified avoidance of $CO_2$ emissions"[3]. In practice, pay-outs are based on a proxy measure of emissions avoidance, such as renewable electricity output.

NER300 is widely considered a failure, as reflected in numerous reports (European Commission, 2019) (European Court of Auditors, 2018) (Max Åhman, 2018) (Borys, 2020). No CCS facility was built with funding from NER300, and only €1.4bn of its €2.1bn budget was awarded.

In a report on the NER300 published in 2018, the European Court of Auditors, an independent EU budget watchdog, criticised: 1) its small size; 2) public acceptance issues for CCS facilities; 3) insufficient risk sharing between public authorities and project sponsors; 4) lack of program flexibility to adjust to the technologies to be funded and changes in the macroeconomic environment; and 5) governance issues. The performance-based nature of the funding was also mentioned by the Commission in its impact assessment as a key obstacle to the program's success (European Commission, 2019).

Those criticisms deserve a bit of nuance. Looking at the glass half-full, €0.7bn unspent budget represents savings for the taxpayer, as the 8 CCS demonstrators expected from the scheme were aimed at coal-fired power plants for which the technology is now no longer contemplated in Europe. The NER300 programme did not make the required commitments to these projects, which, in retrospect, was a good decision.

### 1.3.2 A risk-taker: the Innovation Fund

In 2018, the Innovation Fund (IF) was set up with a strategy quite different to that of the NER300. With a larger size and a broader range of sectors (covering industry and power), it was designed to pay a significant share of its grants upfront: 40% of the grants can be disbursed at or before financial close, as per Delegated Regulation 2019/856, with few conditions related to any milestones or proof of expense. As for the remaining 60%, although the amount is subject to the project's verified emissions avoidance, it can also be paid upfront which means that up to 100% of the pay-outs can occur before performance is ever measured, even during construction. The rule is that for the remaining 60%, the project may have to repay a share if it does not deliver at least 75% of the pledged emissions reductions. However, this truing-up only occurs 10 years after the start of operations, and only if the project company is still solvent at that time.

### 1.3.3 The new idea: Carbon Contracts for Difference (CCfD)

Upfront funding is the key principle of the Innovation Fund's design, in response to critics of NER300 which was a performance-based funding scheme. Yet, over the past few years, performance-based support schemes involving Carbon Contracts for Difference (CCfD) have become more and more popular (at EU level but also Member State level) and the Innovation Fund's scope may soon be extended to include such instruments.

[3] as per the wording of Article 10a.8 of the 2009 version of Directive 2003/87/EC (European Commission, 2010)

The principle is for the public authority to pay (or charge) a yearly amount during operations based on:

- A measure of avoided emissions, and
- The difference between the ETS emissions permit price and a contractual “strike price” (i.e., the emissions permit price at which the project would have been profitable).

This principle is very similar to an NER300 type of support, which was also based on a measure of avoided emissions during operations. The main difference is the ‘difference’ concept, which indexes pay-outs on the prevailing market price of carbon allowances, possibly down to negative values (in the case of a ‘two-way CCfD’). It should be noted that, even if the pay-out goes negative, the advantage is that a fixed carbon price was secured, thereby mitigating revenue risk.

In a staff working document annexed to its Directive proposal, the European Commission justified that such an instrument would be “well-suited for commercial second or third-of-a-kind projects”. One recommendation is that this type of support be “allocated through cost-effective, competitive, and (if preferred) technology neutral tendering processes” (European Commission, 2021). However, using this type of process is not specific to CCfDs as many support schemes for renewable energy in Europe are based on competitive auctions and the Innovation Fund is already, to some extent, technology neutral.

## 1.4 How much innovation do we need?

In many cases, there is a fine line between what is considered innovative and what is not. A 2018 supporting study to the EC’s impact assessment for the Innovation Fund estimated that reaching 80-95% emissions reduction would require “*radical process innovations*” like CCS, renewable hydrogen, synthetic methane, electrification and biomass as fuel (European Commission, 2018). Although these technologies are not widespread, calling them “radical process innovation” was challengeable, even at the time.

The perceived necessity of innovation also varies depending on the source. Industry associations tend to consider it as essential, whereas researchers and consultants often see a major role for technologies already on the market today (McKinsey, 2020). For example, the Confederation of European Paper Industries considers that commercially available technologies can only reduce the sector’s direct emissions by 53% in 2050 compared to 2015 (CEPI, 2017) whereas the Potsdam Institute for Climate Impact Research estimates it closer to 90% through ‘stage 1’ electrification, which “involves technologies that are fully developed and established in industry (Silvia Madeddu, 2020).

In the decarbonisation report published by McKinsey (McKinsey, 2020) the authors quantify how much of the emission avoidance linked to the European Green deal can be achieved through technologies that are “mature” (28%), in “early adoption” phase, like electric cars or heat pumps (32%) or “already demonstrated” like CCS (27%). This 87% reduction will be enabled by technologies considered less innovative than the remaining 13%, which includes technologies in “R&D” such as electric and fuel cell technologies for aviation, shipping, and long-haul road transport, and long-term flexibility solutions in power.

## Table 1. Technological maturity according to different observers

| Sector | GHG emission abatement technology | Contribution the sector's 2050 emission abatement | | Technological Maturity |
|---|---|---|---|---|
| Cement & lime | | Agora Energiewende (for Germany) [100%] | Northwestern University (US building sector) [100%] | |
| | Material substitution and more efficient use of concrete | 21% | 61% | Commercial scale |
| | Plant technology optimization | 11% | 3% | Commercial scale |
| | Clinker-to-cement ratio reduction | 2% | 2% | Commercial scale |
| | $CO_2$ sequestration in concrete | | 20% | Commercial scale |
| | Lower-carbon cement chemistries | 1% | 13% | Pilot scale |
| | At-plant CCS | 65% | 0% | Pilot scale |
| Chemicals | | DECHEMA [85%] | Conseil national de l'industrie (for France) [50%] | DECHEMA (TRL) / CNI |
| | Energy Efficiency | 6% | 8% | TRL 11 |
| | Heating with biomass | | 10% | Mature |
| | $N_2O$ and HFC emission reduction | | 8% | Mature |
| | Electricity-based steam | 19% | 2% | TRL 10 |
| | Low-carbon hydrogen | | 13% | Not mature |
| | At plant CCS | | 9% | Not mature |
| | Olefins via low carbon $H_2$ to Methanol | 25% | | TRL 7 |
| | BTX via low carbon $H_2$ to Methanol | 13% | | TRL 7 |
| | Amonia via low carbon $H_2$ | 11% | | TRL 7 |
| | Olefins biobased | 8% | | TRL 7-8 |
| | Urea via $H_2$, Methanol via $H_2$ | 4% | | TRL 7 |
| Pulp & Paper | | Silvia Madeddu et al. | CEPI [69%] | CEPI / Madeddu |
| | Energy Efficiency | | 28% | State-of-the-art |
| | Full electrification | 90% | | Fully developed and established |
| | Fuel switch to biomass, Combined Heat and Power | | 25% | Already used extensively |
| | Emerging and breakthrough technologies | | 16% | |

**Technological maturity:** Mature (TRL 11) Early adoption (TRL 9-10) Demonstration (TRL 7-8) Large prototype (TRL 5-6)

# 2 Unaddressed challenges: The Innovation Fund

Photo by Darren Halstead on Unsplash

Although the Innovation Fund's design was supposed to fix the issues faced by its predecessor NER300, it also has several shortcomings, many of which relate to its excessive use of upfront funding.

## 2.1 Carbon Capture and Storage / Utilisation (CCS/U) dominates

One observation about the Innovation Fund is how beneficial it has been to CCS/U projects. In the first Large Scale call, 30% of the Phase 2 candidates were implementations of CCS/U, as well as 5 out of the 7 laureates. In the second Large Scale call, 7 out of the 17 laureates (41%) were implementations of CCS/U (Innovation Fund, 2022).

While it may seem logical that the Innovation Fund seek success where its predecessor NER300 failed, this is not really the case. NER300, specifically dedicated to CCS, aimed at demonstrating CCS at in-land coal-fired power stations whereas all IF laureates plan to implement the technology on industrial sites on the shores of the North Sea, which makes a big difference both for the capture and the storage of the $CO_2$. In fact, probably none of the projects initially contemplated for NER300 funding even applied for Innovation Fund money.

Such a concentration of CCS/U projects seems disproportionate when taking into account the modest potential of CCS technology as a solution to climate change: 12% of Europe's abatement effort by 2050[4] according to the International Energy Agency (International Energy Agency, 2020), whereas McKinsey estimates only 6% (McKinsey, 2020).

[4] as estimated by the European Commission (European Commission, 2020)

Table 2. Laureate projects of the Innovation Fund's first large scale calls.
Source: Innovation Fund

| # | Project | Sponsors/participants | Technology | Sector |
|---|---|---|---|---|
| #1-1 | Kairos-at-C | Air Liquide; BASF; Antwerpen NV | CCS | Chemicals |
| #1-2 | TANGO | Enel | Solar PV | Power |
| #1-3 | BECCS@STHLM | Fortum; city of Stockholm | CCS | Buildings |
| #1-4 | K6 | Air Liquide; VDZ | CCS | Cement |
| #1-5 | ECOPLANTA | Repsol; Energkem; Aguas Barcelona | CCU | Chemicals |
| #1-6 | HYBRIT | SSAB; Vattenfall | H-DRI | Steel |
| #1-7 | SHARC | Neste Oyj | CCS | Refining |
| #2-1 | Holland Hydrogen | Rotterdam Hydrogen, Shell | H2 from Electrolysis | Refining |
| #2-2 | Pulse | Neste OYJ | CCU | Refining |
| #2-3 | Nordsee 2 | RWE, Northland Power | H2 from Electrolysis | Power |
| #2-4 | FUREC | RWE | Waste-to-hydrogen | Chemicals |
| #2-5 | ReLieVe | Eramet | Battery recycling | Mining |
| #2-6 | C2B | Holcim | CCS | Cement |
| #2-7 | BIOZIN | Bergene Holm, Shell | Biofuels | Refining |
| #2-8 | Rise | REC Solar, CEA | Heterojunction | PV modules plant |
| #2-9 | ANRAV | Devnya cement, Petroceltic | CCS | Cement |
| #2-10 | Coda Terminal | Carbfix, Dan-Unity CO2 | CCS | Chemicals |
| #2-11 | AIR | Perstorp, Fortum, Uniper | CCU | Chemicals |
| #2-12 | High Skies | Shell, Vatenfall, BASF | Synthetic fuels | Refining |
| #2-13 | ELYgator | Air Liquide | H2 from Electrolysis | - |
| #2-14 | NorthSTOR PLUS | Northvolt | more energy-dense cells | Battery plant |
| #2-15 | ION Fiber | Metsa spring | Change of wood pulp | Textile |
| #2-16 | GO4ECOPLANET | Lafarge | CCS | Cement |
| #2-17 | CalCC | Chaux et dolimies du Boulonais, Air Liquide | CCS | Lime |

Why then are CCS/U projects seemingly favoured by the Innovation Fund?

It would not seem wrong to favour a technology that delivers the cheapest abatement, even in small amounts. However, cost efficiency is not so decisive in the IF ratings: section 2.5 shows projects selected for grants with costs as high as €1000 per tonne of avoided $CO_2$ emissions. Additionally, the figures used to assess cost efficiency do not reflect a project's full abatement costs (see 2.8.1).

One key criterion for IF scoring relates to 'project maturity', which aggregates technical, financial, and operational maturity. As storage technologies have been used for decades by the oil and gas sector for enhanced oil recovery in depleted fields, CCS often involves large companies with strong operational and financial means, likely to score high at 'project maturity'.

It does not seem logical to award such a large share of subsidies to CCS/U projects when their overall abatement potential is estimated to be so low.

## 2.2 Innovation for the sake of innovation

The "Degree of innovation" criterion, which is required to be "beyond incremental", does not require the innovation to be particularly useful, as being useful is only considered a plus. According to the call text, "optimally, but not necessarily, (the technology) outperforms competing innovations" (European Commission, 2022).

So even though a technology such as alkaline electrolysers has already been commercially developed for large scale hydrogen production from water electrolysis, a competing technology such as polymer electrolyte membrane (PEM) electrolysers is more likely to be eligible simply because it is less developed, even if it fulfils the same role. CCS/U technology is still perceived as innovative, which also helps explain its success in landing IF grants.

This quest for innovative solutions pushes project proponents to introduce risky gadgets to otherwise sound projects, which is more likely to alter their ability to deliver than to actually deliver substantial emission reductions.

Focussing solely on innovation may also lead to over-spending. For example, Nordsee Two, which is one of the laureates of the second large-scale call, is a 450MW offshore windfarm to which a 4MW offshore electrolyser was added to fuel the service operation boats commuting from the shore. This latter feature is considered innovative despite not being the most efficient use of electrolysing capacity.

Innovation is assessed at the project level, not taking into consideration the way it may impact the **supply chain** of competing activities. For example, despite the scarcity of green hydrogen, its uses in applications where better solutions exist (such as light vehicles) are not considered less beneficial than its uses in hard-to-abate applications such as aviation or fertilisers.

## 2.3 Bad projects get 'good' marks

Eligibility for IF funding is checked against five criteria, represented in Table 3, for which the thresholds are set quite low.

A project's emission intensity must be below the ETS benchmark level of the corresponding process, but those are notoriously too high to ensure a net zero emission trajectory. Also, the reference is the benchmark at the time of the IF call rather than at a projected time during the project's operation life. So, for example, in the 2021 call, the reference was the benchmarks set at the time, which was based on the 10% most efficient plants but in 2007-8! This set the threshold for hydrogen production to 8.85 t $CO_2$e per tonne of hydrogen, whereas *average* carbon intensity in European refineries and steam methane reformers had already fallen to 4.09 t $CO_2$e by 2016-17 (European Commission, 2021).

The other four criteria were generally marked on a scale from 0 to 5, from 'Fail' to 'Excellent', with 'Good' (3) as the condition to pass. However, 'Good' does not mean good in the sense that normal investors would use to evaluate a project: it allows for several shortcomings in essential aspects such as technology readiness, credibility of the business assumptions, ability to deliver the claimed emission reductions, risk mitigation, or even profitability. The ranking is given on the basis of the information provided, with limited evidence to support it.

Table 3. Grading system used for selecting and ranking the projects in the Innovation Fund
Source: (European Commission, 2022)CINEA

| Criterion | Sub-criterion | Score range | Minimum threshold (*) | Overall Score Range (**) |
|---|---|---|---|---|
| Degree of innovation | Innovation in relation with the state-of-the-art | 0-5 | 3 | 0-5 |
| | Contribution to further EU policy objectives (energy efficiency, circularity, renewable electricity) | 0-5 | None | |
| GHG emission avoidance potential | Absolute GHG emission avoidance | 0-5 | < ETS benchmark | 0-5 |
| | Relative GHG emission avoidance | 0-5 | None | |
| | Quality of the calculation<br>Net carbon removals<br>Other GHG savings | 0-5 | No manifest error | |
| Project maturity | Technical maturity | 0-5 | 3 | 0-5 |
| | Financial maturity | 0-5 | 3 | |
| | Operational maturity | 0-5 | 3 | |
| Scalability | | 0-5 | 3 | 0-5 |
| Cost efficiency | | 0-5 | No manifest error | 0-5 |
| | | | **TOTAL SCORE** | **0-25** |

(*) Any project not meeting the minimum threshold on any criterion is rejected
(**) The score for each criterion is calculated as the average of the sub-criteria scores

The Innovation Fund runs separate calls for Large Scale projects (with more than €7.5m CAPEX), on which €1bn to €3bn are granted each year, and for Small Scale Projects, for which the annual grant budget is around €100m per year. In the first Large Scale call, launched in July 2020, 311 projects competed in the first phase, of which 70 were selected to continue to Phase 2.

Of the 70 projects that passed Phase 1, 4 dropped out while 66 applied for Phase 2, of which 1 was deemed 'ineligible' due to excessive changes, 17 were rejected due to 'manifest errors' and the other 48 met all three criteria (GHG emissions avoidance, innovation, project maturity). A total of €1.1bn was granted to the 7 'best' projects (announced in November 2021).

Meeting all criteria does not make the 48 eligible projects good projects. By the European Commission's own admission, the mediocre 'maturity' scores achieved by the 41 projects that were not selected despite meeting all criteria were evidence of "big room for improvement"[5]. But improving maturity is not just a matter of time and effort. Some projects are simply not sound (e.g., technologically) and for that reason will never reach financial and operational maturity.

The second Large Scale call, which closed in March 2022, had only one phase. 121 valid applications were received, including 66 resubmissions from the first call (and only 55 new ones), of which 48 met the minimum thresholds for all five criteria. The available budget of €1.8bn was pre-allocated to the top 17 projects. The third call, which opened on 3 November 2022, will allocate €3bn. **With the trend towards fewer projects and more budget, the likelihood of receiving a grant will be greatly increased but the quality of the winners is likely to drop**[6].

[5] See (European Commission - DG CLIMA, 2022)
[6] Small scale calls also saw declining submissions, with 66 projects in the second call down from 232 in the first one.

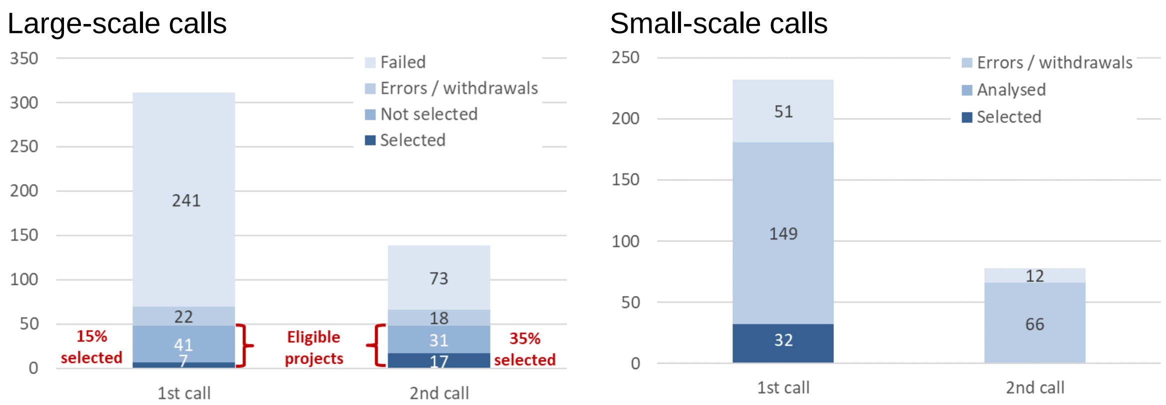



Figure 5. Result of first two Innovation Fund calls

## 2.4 Already profitable projects receive grants

Another questionable aspect of the Innovation Fund is its ability to provide grants to projects that are already profitable.

Profitability is indeed scored favourably in the financial maturity rating, leading some projects to use high profitability as a selling point to get subsidised. For example, promoters of the BCP project (Saint-Gobain) state that "*The expected economic benefits in terms of natural gas and $CO_2$ savings are significant, hence reducing production costs and increasing the overall profitability of the plant*." Using the information published by the project, we found a 10-year internal rate of return (IRR) of about 15% without any subsidies[7].

The distribution of subsidies to already profitable projects might sound surprising. Indeed, European law usually prohibits this kind of practice by Member States, as per the principle of "necessity of the aid" of the European Guidance on state aid (CEEAG), but this does not apply when the aid is given by the EU itself (see 4.4 below).

This practice is likely to change with the ETS reform thanks to an amendment to Article 10a proposed by the Commission: "*Technologies receiving support shall be innovative and not yet commercially viable at a similar scale without support*" (European Commission, 2021). However, even if this reform is enacted, it will not be applied retroactively.

## 2.5 Projects at €1000 per $tCO_2e$ get grants

The 'Cost-effectiveness ratio' (subsidy per unit of avoided emissions) of the laureate projects shows huge differences between projects: from €5 to €30 per $tCO_2e$ claimed by large-scale projects and a few small-scale ones such as CarBatteryReFactory (€3/$tCO_2e$) and NorthFlex

[7] The project claims 35 GWh/yr natural gas savings and "relevant costs" (capex) of €7.2m. If we consider a conservative price of natural gas of 41.6 EUR/MWh, the saving is around €1.5m per year.

(€4/t$CO_2$e), to several hundred euros per t$CO_2$e for Aquilon (€1300 /t$CO_2$e) and NAWEP (€420 /t$CO_2$e), both airborne wind energy (AWE) projects.

Such high cost-effectiveness ratios typically have a negative effect on the overall score. In order for those projects to win grants, they must have rated high on other criteria. However, AWE is a nascent technology, consisting of generating electricity by flying kites at high altitudes. It faces a lot of challenges for air traffic security reasons (no operating permits have been granted thus far), so it is unlikely that any AWE project was given a high mark on technical maturity.

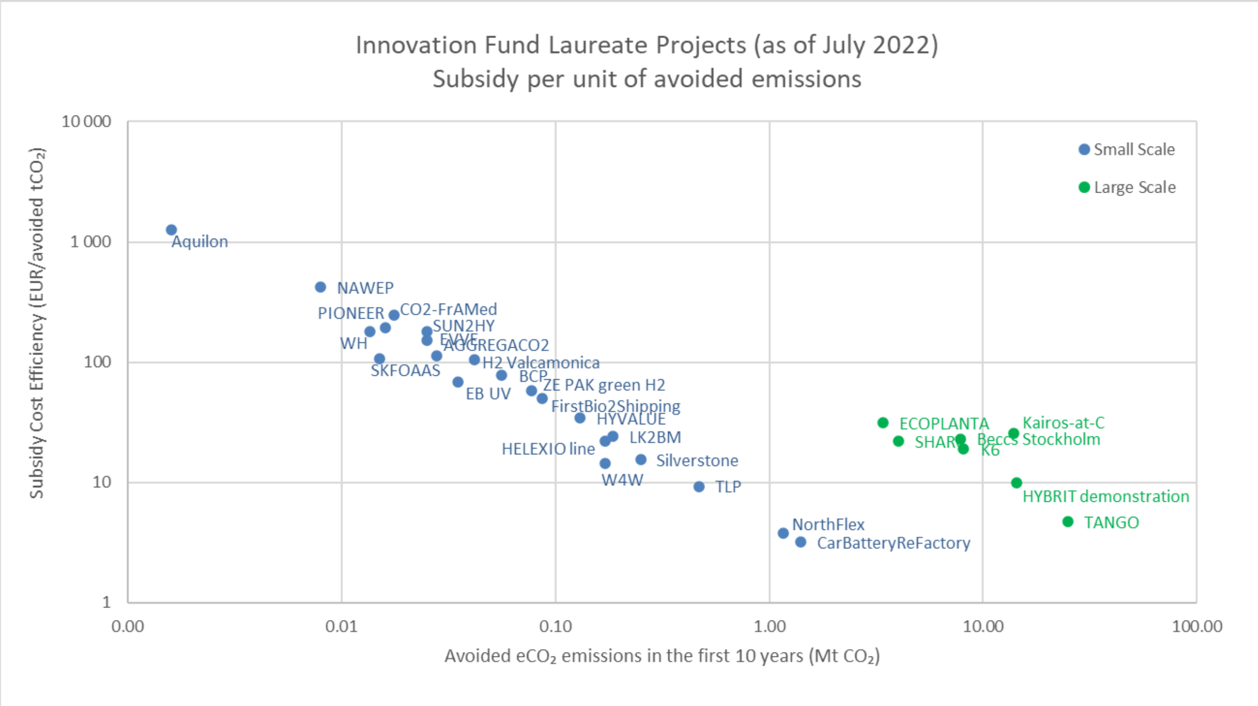



Figure 6. Cost efficiency ratio of the laureates of the Innovation Fund's first calls.
Data source: CINEA

## 2.6 Inefficient allocation of capital

The IF's approach allows grants to be secured and even funding disbursed at a project's very early stage, including before financial close (FC), i.e., before a project's overall funding has been secured. FC would typically involve securing revenues and expenses with supply and sale contracts, as well as building permits and other administrative authorisations. With the Fund's approach, grants can be approved for projects likely to reach FC within up to four years. During this preliminary period, **the full amount is reserved and not made available to other projects.**

In section 1.3.2 we explained that 60% of each grant is subject to the project's verified emissions avoidance but can still be paid upfront. After 10 years of production, the project may have to repay a share of that 60% if it does not deliver at least 75% of the pledged emissions reductions, however, only if the project company is still solvent at that point.

Client Earth notes that in case of insolvency or bankruptcy, the applicable national law will determine the seniority of any claim from the Innovation Fund or rather its administrator CINEA. The law of the relevant jurisdiction will determine which creditors qualify as secured creditors ("Secured Creditors") as well as the ranking of priorities between those creditors. While the laws of Member States differ quite a bit in this respect, they generally do not grant any privileged status to claims from EU institutions or EU agencies – including claims from the Innovation Fund administrator CINEA. Consequently, in an insolvency/bankruptcy proceeding, a claim from CINEA would normally not be considered more senior than bank debt or other debts to creditors that qualify as Secured Creditors under the applicable national law. Consequently, the proceeds of any sale or liquidation would **serve the Secured Creditors before** any remaining funds reach other creditors, including **the Innovation Fund/CINEA**.

## 2.7 Paperwork and delays

Although it is meant to speed up the development of technologies, a scheme like the Innovation Fund may in some cases slow it down.


Figure 7. Timeline of Innovation Fund

Projects apply for grants through a year-long process during which the applicants provide information formatted in a very specific way, including several forms, a financial model and GHG reduction estimates, before undergoing evaluation and selection. Presented in Figure 1 is the timeline showing the processing of Innovation Fund grant requests on both large-scale and small-scale projects. Most developers apply for multiple sources of funding, national or European, so they repeat this process under different formats. Some may keep shopping around for an extended period even for projects they would be doing anyway due to their strategic, or even profitable nature, and end up delaying their launch.

## 2.8 Assessment issues

The IF's scoring system is based on assessments of costs, greenhouse gas avoidance, and readiness (See Table 3). Although this is done independently, with an objective scoring system reviewed by panels of external experts, the assessment is based on estimates and forecasts which make it possible to strategically overstate or understate figures to get more favourable results.

### 2.8.1 'Relevant costs'

Grant amounts are limited to 60% of an amount called 'relevant costs'. For small-scale projects, *relevant costs* simply equal capital expenditure (CAPEX). For large-scale projects, they are defined as:

*"the difference between the best estimate of the total capital expenditure, the net present value of operating costs and benefits arising during 10 years after the entry into operation of the project compared to the result of the same calculation for a conventional production with the same capacity in terms of effective production of the respective final product."* (European Commission, 2021).

This definition uses several estimates regarding e.g., the discount rate, the value of benefits such as $CO_2$ prices for the next 10 years and, of course, the reference scenario (and its lot of commodity price forecasts) also for the next 10 years. The difference between optimistic and pessimistic estimates can be huge, without either being technically wrong.

The above definitions mean that grants are only awarded to large-scale projects that are unprofitable (at least over 10 years), whereas small-scale projects face no such constraint. They also mean that, even after receiving the grant, large scale projects must also remain unprofitable *with* the grant. It is however hard to believe that, despite the estimates provided, project sponsors would venture into such projects without secretly expecting to make a profit.

### 2.8.2 GHG avoidance calculation

In the first large-scale call, projects involving CCS/U reported GHG avoidance costs per tonne of $CO_2$ (i.e., relevant costs divided by tonnes of GHG avoided) between €32 and €78. This seems a very good value compared to the cost of CCS often claimed by the industry, of €100 to €150 per tonne of $CO_2$.

There are, however, less positive interpretations of the project results. Firstly, the costs indicated within the project scope might not include the entire cost of emission reductions. For example, project K6, a laureate of the first large-scale IF call which won a €153m grant, covers the capture of $CO_2$ from a French cement plant, but not its storage. The nearby D'Artagnan project, which will transport and store the $CO_2$ into the North Sea bed, will receive separate State funding as a Project of Common Interest. It is therefore unclear whether the captured emissions should be counted as 'avoided' as the rest of the chain is not 100% secured.

Secondly, there could be a tendency for applicants to overstate the emissions avoidance expected from their projects to improve their score and ranking. Unfortunately, despite all the methodology and tools provided, the GHG avoidance estimation exercise does not prevent such overstatements.

Thirdly, the reference scenario for avoided emissions can be misleading. For example, project ION Fiber, a textile plant in Finland, produces cellulosic fibres of a type similar to *viscose*, claiming "28% higher efficiency from wood to product" (CINEA, 2022) than viscose. Yet the project uses *polyester fibre* as the reference product to measure their claimed 93% of avoided GHG emissions.

Those calculations are only ex-ante estimates which often depend on a myriad of assumptions. The review panel can challenge the estimates by either declaring ‘clerical’ or ‘manifest errors’, neither of which correctly flag optimistic estimates. Although a shortcoming can be flagged on the ability of the project to deliver its stated emissions, the amount used for the GHG criteria to score projects remains the one stated by the applicant and not one corrected by the review panel (European Commission, 2021). The stated GHG avoidance criterion is the only one not reviewed in a consensus panel, but by one sole expert.

### 2.8.3 Experts

Finally, a bias in the assessment of projects subject to a scoring system is introduced by the diversity of the experts rating the projects.

Recruitment itself is challenging, as the experts need to be knowledgeable and competent in the financial, emission evaluation or technical domain, free of any conflict of interest and available on short notice. Typically, they must be experienced professionals in domains like project financing but must also have a lot of available time, which is not usually the case for such professionals.

# 3 How to address some of these challenges

Photo by micheile dot com on Unsplash

The Innovation Fund's shortcomings illustrate the difficulty of setting up a scheme based on the concept of innovation that evaluates projects using objective ex-ante criteria. In this section, we propose solutions to address those issues.

## 3.1 Provide upfront funding based on the risk of failure

The effectiveness of support instruments is closely linked to the risk they help mitigate. Like financial instruments, they provide scheduled cash flows with or without conditions, which helps mitigate specific types of risk. For projects involving technologies that already have commercial applications, risk of failure is usually lower so support per unit of output can be set up to help secure profitability. For R&D projects, upfront support is often needed, because many of these projects will fail before reaching commercialisation.

### 3.1.1 Interface risk

Innovation and risk of failure are not always correlated, though. In many projects, 'innovation' lies in combining commercially available components. For those projects, the risk of failure is limited, and upfront public funding should not be granted simply because they are deemed innovative.

Take, for example, carbon capture and storage (CCS) which is a 50-year-old technology commonly used for enhanced oil recovery in depleted oil fields. Large oil and gas companies routinely manage its implementation, with the associated construction risks. It should be possible for project sponsors to find suppliers of the technology offering the necessary guarantees of price, construction time, and performance. The main difference is the absence of a business case for storing $CO_2$ without the expected revenues of oil sales, but upfront financing for this type of component is excessively protective while not incentivising performance. Although the extra cost may require some downstream support, upfront financing should be limited to the strict minimum necessary to mitigate the residual risk (if any) related to the other parts of the project.

It is noteworthy that the US administration has used this different approach in its support of CCS in the Inflation Reduction Act, with a tax reduction of $85 per tonne of $CO_2$ for geological storage and no upfront payment (IEA GHG, 2022).

Similarly, hydrogen-DRI steelmaking consists of assembling an electrolysing component with a DRI plant using hydrogen instead of natural gas. Both the electrolyser and the DRI plant are of standard technology and have alternative business cases (without the DRI plant, the electrolyser is still valuable, and vice versa), so the risk is limited to the interface between the two. When sizing upfront financing, the residual unmitigated risk should be taken into consideration, rather than the cost of the entire project.

### 3.1.2 Bankable risks

Upfront funding should not be used to mitigate risks that are 'bankable'. Two projects, Nordsee 1 and Veja Mate, both large offshore wind farms off the coast of Germany, were successfully financed in the 2010s with the help of NER300: they started operating on or ahead of schedule and are producing power as specified. According to a NER300 report (JRC, 2022), their innovation content was "with respect to components (e.g., XL monopile foundations, bolted flange transition pieces, among others) and installation methods (e.g., Bubble curtain)." Neither project received upfront grants, and both attracted large syndicates of private banks.

Nordsee 1's shareholders won an Innovation Fund grant for a new windfarm, Nordsee 2, for which innovation is "in foundations (single piece monopiles, secondary steel concept, vibratory piling and green steel usage)" (CINEA, 2022) and in the 4MW electrolyser mentioned in 2.2 powering the commuting boats. Some of these aspects might incur extra costs but not extra technology risk (single piece monopiles, green steel, secondary steel), and others might incur slight risks of delays or cost overruns (the novelty of the installation method) but can be mitigated in case of failure (e.g., using a more classic fall-back method). Those types of risks are perfectly 'bankable', meaning that a certain level of expected revenue would suffice to ensure that the project attract financing from private sources.

Conversely, upfront public support reduces the need for private funding (equity + debt) without increasing revenues, thereby unnecessarily **crowding out private financing**. This is another reason why upfront support should be avoided for commercial projects as a rule of thumb. The very nature of project financing, a widely used structure which shields shareholders from any financial liability arising from the projects, makes the 60% of upfront funding very difficult for the public grantor to recover if the project underdelivers or if there are legal issues related to the use of funds, even when comfortable dividends have been paid to shareholders. This means that the public grantor will bear unjustified risk on these projects.

### 3.1.3 No risk at all

According to Innovation Fund rules, a technology is considered innovative if it has not yet been implemented in Europe or in a particular Member State, even if it is commercially available elsewhere. Therefore, the owner of any such technology willing to expand its business to a particular Member State would be eligible for a grant. In this case, there is **no technology risk** and even less justification for upfront funding.

### 3.1.4 Upfront subsidies do not mean success

There are good reasons to severely limit upfront funding and reserve it for addressing risk rather than rewarding 'innovation'.

According to Atallah (2014), subsidies conditional to the performance of projects are more efficient than unconditional subsidies when risks are lower. Upfront grant payments provide the highest level of protection to the grantee, which has no financial pressure to successfully deliver performance. Conversely, upfront grant payments with no performance requirement increase the grantor's risk. It is therefore advisable to provide upfront grants with parsimony and opt for performance-based payments every time this will provide sufficient risk cover.

With the NER300 programme, upfront funding was possible only if a Member State guaranteed the funds, which was the case for 4 projects[8] (European Commission, 2019). Of those, only one (Puglia Active Network, a smart grid project in Italy) was completed. A Dutch BioMCN project did not reach financial close despite securing €199m in upfront subsidies. A Hungarian project received €40m without starting any work and there was subsequent suspicion of embezzlement[9].

## 3.2 Spend smarter

There was much criticism of the fact that the NER 300 programme spent less than its available budget. The real failure, however, would have been spending money on useless or failing projects, as well as on projects that did not need so much support. In contrast, successful support ensures high output for each euro of public money spent. Since unspent money still leaves a chance for future success, parsimonious innovation spending should be praised rather than criticised given the size and cost of the broader climate challenge.

In principle, innovation benefits from experience. Implementing innovative projects using the same technology at the same time risks replicating errors rather than learning from them. In contrast, spreading such projects over time would better facilitate the development of technologies through trial and error.

One possibility would be to limit innovation support for a given technology to e.g., only one large-scale project per six-month period.

## 3.3 Support less innovative technologies as well

Spending less money on innovation could make significant funds available to support less innovative technologies. Innovation financing as a solution to the 'valley of death' problem mentioned at the beginning of this report was based on the false assumption that, as technologies mature, their costs decrease until they become competitive. The Innovation Fund was created to bridge this presumed gap between high-risk technology development and profitability, by

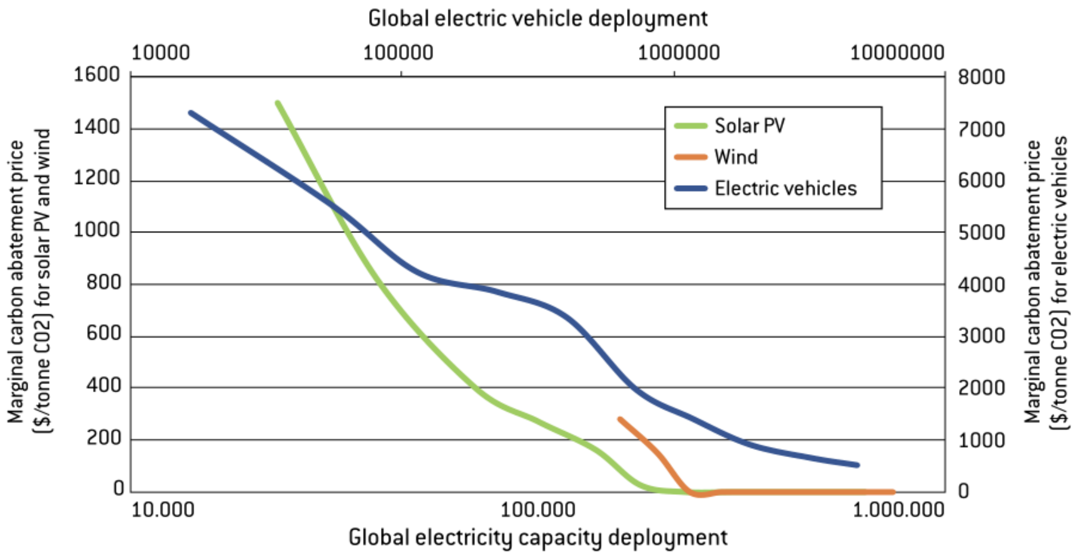
[8] South Hungarian EGS Demonstration; DRMa; OCN and BIOd
[9] Introducing the company web of the king of geothermal energy | atlatszo.hu

showcasing the technology on a large scale. However, in practice, things do not always happen this way, as mature technologies sometimes never become profitable and therefore need performance-based support.

The European Parliament's ETS revision position, passed at plenary in June 2022 and being currently negotiated in the trilogues, enlarges the scope of the Fund (renamed to the Climate Investment Fund). Its new objective includes "the scaling up of techniques, processes and technologies that may no longer be considered innovative, but nevertheless possess a significant greenhouse gas emissions abatement potential" .

### 3.3.1.1 The examples of renewable power and Electric Vehicles (EVs)

A good example is renewable electricity. Until quite recently, renewable energies were widely called "new energies" even though they had been around for decades, but still needed a lot of government support. For those technologies that did achieve "grid parity", it was not until hundreds of thousands of gigawatts (GW) were deployed (see Figure 8), without even addressing intermittence.  The example of electric vehicles is even more striking, as production costs are starting to plateau and their cost parity with internal combustion engine (ICE) vehicles has not been achieved despite millions of them being on the roads.




Source: Bruegel. Note: Lazard LCOE analysis is used to compare solar and wind prices to combined cycle gas plants. Solar deployment data from Solar Power Europe. Wind deployment data from GWEC. Electric vehicle deployment data from the IEA. Data on the price of an electric motor taken from Statista, compiled from Bloomberg NEF. A 50KWh electric motor is compared to the price of a 2L internal combustion engine. Electricity data starts in 2009, electric vehicle data in 2010. The figure shows annual data.

Figure 8. Learning curve for electric vehicles and renewable energy generation technologies. Source: (Bruegel, 2021) (capacity figures in MW)

Support for renewables and EVs has so far been left to the discretion of national governments and is unevenly distributed (some Member States not even having a support scheme for renewables), even though those technologies have a large abatement potential.

#### 3.3.1.2 Substitutions and circularity

Some abatement measures rely on very old technologies. For example, we have found that the substitution of concrete with timber in house-building has the largest abatement potential for the cement industry. However, it is not price-competitive, regardless of carbon prices, in a system where free emission allowances are given to cement factories.

As per Article 10a.8 of the ETS Directive, “products substituting carbon intensive ones produced in sectors listed in Annex I”: are eligible for IF funding. Eligible activities include (LSC fiche (28/05/2021)):

- Recovery of materials and energy from waste and wastewater, including biomass waste and residues e.g., as food, feed, nutrients, fertilisers, bio-based materials, or chemical feedstock
- substitution of virgin materials with secondary raw materials and by-products, more sustainable sourcing of raw materials
- reuse, repair, refurbishing, repurposing, and remanufacturing of end-of-life or redundant products, movable assets, and their components that would otherwise be discarded or immovable assets (buildings / infrastructure / facilities)

However, the Fund’s restriction to innovative technologies rules out any support for most of those technologies.

## 3.4 Think beyond projects

The project-based nature of the Innovation Fund’s support is another obstacle to tapping into large abatement potential. The projects eligible to obtain IF grants are individual projects located at specific production facilities.

Many abatement measures based on the potential for circularity or substitutions (such as listed in section 3.3.1.2) are not well-suited to a project-based scheme. These may include schemes to incentivize waste recovery or waste use. Other types of support should also be possible for substitution, such as subsidising timber-based house-building at the regional, national or EU level.


# 4 Conditional support: CCfDs, but not only

The previous sections demonstrated that upfront funding is not the right instrument to support many abatement technologies and measures needed to achieve carbon neutrality, and that some form of conditional support is better suited. Such instruments may include CCfDs, but not only.

## 4.1 What should CCfDs cover?

### 4.1.1 For installations receiving free emission permits

CCfDs are mechanisms for which pay-outs from the grantor to a beneficiary are calculated as:

“Avoided emissions” x (Strike price – carbon market price)

where the strike price is typically a pre-defined value that is not dependant on external volatility factors. “Avoided emissions” are calculated as the difference between a project’s GHG emissions and an imaginary “baseline” scenario. In its impact assessment on the ETS revision, the Commission proposed to measure actual emissions against the ETS free allocation benchmarks (European Commission, 2021), however they could be based on another benchmark[10].

It should be noted that the ETS benchmarks do not necessarily reflect the real number of free allowances that ETS-covered plants will receive. This is because of the following:

i) the number of permits calculated through benchmarks is potentially corrected based on the total number of permits available each year and;
ii) some ETS-covered sectors are set to be covered by a carbon border adjustment mechanism (CBAM) which will change the number of free allowances available.

Additionally, the current benchmarks, which are largely linked to production processes, will be thoroughly reviewed shortly after the ETS itself.

Furthermore, a CCfD is only useful if the signatory has spare emission allowances to sell. For each tonne of avoided emissions, they can then receive the market price (by selling 1 spare allowance) + the CCfD “difference”, which amounts to exactly the strike price of the CCfD. For each unit of

[10] This could avoid the issues mentioned in Sandbag (January 2021): *Benchmarks and Free Allocation: Details reveal problems in the EU ETS*

output, the "avoided emissions" factor in the CCfD formula can therefore only be calculated based on the number of free allowances actually received:

Payout(CCfD) = (Free allowances – actual emissions) x (Strike price – carbon market price)

With this formula, a project can secure a fixed price for its spare free allowances. However, as the supply of free allowances is subject to fluctuations[11], it does not fully secure the revenue from achieved emission reductions. To realise that extra security, it is, therefore, necessary to add a second type of support via a straight "carbon contract" (CC), i.e., not "for difference". The payout is, therefore, per unit of output (as illustrated in Figure 9):

Payout(CC) = (benchmark – free allowances) x Strike price

### 4.1.2 Phasing out free allocation

Unfortunately, CCfDs may worsen a competitive distortion that exists between processes receiving different amounts of free allowances, as is currently the case under the ETS. For example, producing a tonne of steel through the blast furnace / basic oxygen furnace route (BF-BOF) is awarded about 2 emission allowances, but only 0.5 allowances are awarded to the electric arc furnace route (EAF) which uses direct reduced iron. By potentially increasing the value of spare emission allowances, a CCfD may increase this distortion.

This problem is even more acute between plants covered by the ETS, which receive free permits, and plants making similar products (or fulfilling the same role) but falling outside the ETS. An ETS-covered plant receiving free permits + a CCfD would be far better off than a plant outside the ETS, receiving no allowances.

Another difficulty with granting CCfDs comes from the fact that free permits are often given at multiple stages of the value chain. For example, flat steel products are often made from coking coal, sintered iron ore, ferroalloys and in blast furnaces, with each stage receiving free permits. Alternatively, these flat steel products can also be produced from pellets made through direct reduced iron and then melted in an electric arc furnace. Contracting a CCfD might require singling out a recipient of free allowances despite the multiple processes involved. Removing free allocation altogether would avoid these issues.

### 4.1.3 The CBAM case

The phasing out of free allocation will happen gradually as the CBAM is introduced. For projects entering into CCfDs, there will be the issue of how to adapt the CCfD amount to reduced amounts of free allowances. The above considerations would suggest that the CCfD should gradually be replaced with a CC in the same proportions as free allocation is reduced. However, the CBAM is being introduced as a substitution to free allocation, the impact of which should be pretty much

[11] For example, compared to the ETS free allocation benchmark, actual allocation is based on the formula: Free allocation = benchmark * CLF * CSCF, where the CSCF factor can vary depending on the overall industry demand for emission permits.

neutral on EU plants. With a CBAM in place, carbon prices should be reflected in the prices of goods sold by the plants, so CCfDs remain justified as an instrument to hedge against falling carbon prices.

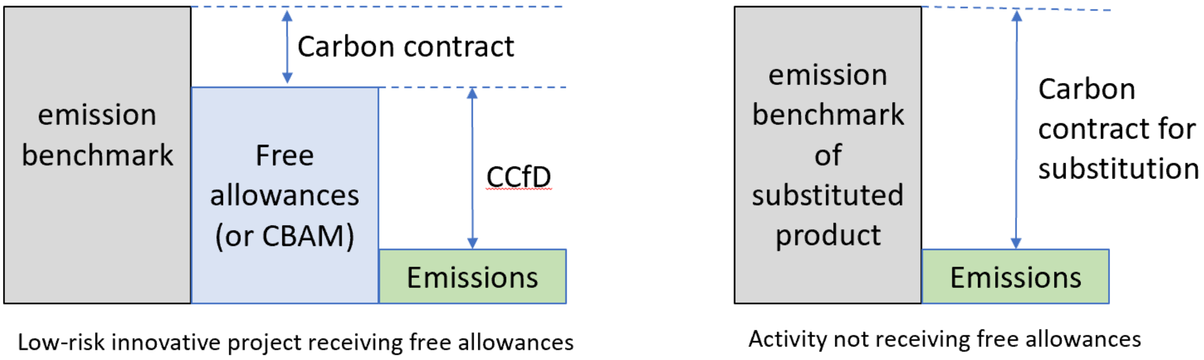



Figure 9. CCfD vs Carbon Contracts

## 4.2 Our proposal: carbon contracts for substitution

As mentioned in 4.1.1, CCfDs are not sufficient to keep a constant level of support for projects which receive declining numbers of free allowances, and straight carbon contracts (not for difference) will be needed to complement them. The formula in 4.1.1 could be generalised as the following:

Payout(CC) = “avoided emissions not covered by FA or CBAM” x Strike price

Straight carbon contracts might also be useful to even out competition between processes with different entitlements to free permits but manufacturing similar goods. For example, pure crude steel produced through the blast furnace route (BF) is eligible for about 2 emission permits per tonne of steel, whereas steel produced through electric arc furnaces (EAF) only receives about 0.5 per tonne of steel. If this distortion remains as the ETS benchmarks are reformed in 2026, the difference in entitlements should be evened out, for example through a carbon contract.

That which is true for projects receiving fewer free emission permits is also true for activities receiving no permits at all, i.e., those that are not covered by the ETS. Some processes or other economic activities serve purposes that are comparable to ETS-covered processes yet are not eligible for free allowances.

This is the case for circularity, which consists of substituting the primary production of goods with the reuse or recycling of already used products. This is also the case for some low-carbon products which, if used in a particular instance, provide an alternative to the use of more carbon-intensive products. One example is timber products, which could significantly reduce the need for concrete in the construction sector and therefore should be allowed to compete more fairly with concrete production. For those activities, straight **carbon contracts for substitution** (not for difference) should be introduced.

Carbon contracts consist of rewarding emissions reductions compared to a reference case for an activity that is not covered by free allocation. For the purpose of measuring the avoided emissions, a proxy can be used, in a way similar to that in which renewable electricity has often been used as a proxy measure to award NER300 funds. Other proxies could include the use of scrap metals, or timber products in construction.

## 4.3 Strike price

### 4.3.1 Competitive bidding

Through a CCfD or a CC, the granting public entity typically pays a price per tonne of avoided GHG emissions, with taxpayers' money. It is therefore important to keep that price as low as possible. This is typically achieved through a competitive bidding process, consisting of a single auction whereby the lowest bids win the contracts. There is a lot of experience with this type of bidding in the renewable energy sector, where participants compete for concessions to build production facilities with pre-set offtake agreements. Frequent auctions with a large number of participants have been proven key in ensuring good price discovery[12]. Competitive bidding comes with a number of potential issues such as technology-neutrality, eligibility criteria (or barriers to entry), sellers' liability and cumulativeness with other subsidies.

#### 4.3.1.1 Technological neutrality

Although most auctions carried out in the renewable energy sector were technology-specific, technology-neutral auctions are the most cost-effective. In principle, there is no reason why emission abatement should be achieved in all sectors at the same time, so technological neutrality and sector neutrality might be the wisest option.

#### 4.3.1.2 Eligibility

Low barriers to entry encourage competition and keep prices down but create a risk of "underbuilding", i.e., situations where the winner proves unable to carry out the activity. This is a serious issue in renewables, where the initiative (e.g., building an offshore wind farm) is usually driven by the State and would be derailed if a winner failed to deliver. In a technology-neutral auction, this would not be the case as the competing projects would not follow any State plan.

Although low barriers to entry contribute to keeping auction prices down, they also tend to create more contracts and financial engagements for the granting authority. If all projects are successful, it is good for the environment but may cost the authority a lot of money. If the authority wants to limit its financial commitment, then more restrictive criteria might be needed to limit the number of contracts.

To avoid the granting authority being saddled with excessive commitments, rules could be set to relieve the authority from contractual obligations if, for example, a project milestone has not been met by a certain longstop date.

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[12] Sulaiman Ilyas-Jarrett (2022) "Practical steps for auction design – GB's CfD for Power"

*Photo by Tetiana Shyshkina on Unsplash*

#### 4.3.1.3 Seller's liability

A carbon contract (for difference or not) typically commits the grantor to 'buy' emissions avoidance at a set price per tonne but does not hold the 'seller' liable in the event they do not deliver that abatement. From the signatory's viewpoint, the payoff profile of such contract is therefore that of a financial option, which is very valuable. If, after signature, abatement costs rise higher than the contract price, it is in the signatory's best interest to not use the option and apply for another auction.

This kind of behaviour could dramatically increase the number of open carbon contracts (and financial commitments for the grantor), as the same applicants could bid for multiple auctions at different times, even though they might do this through different project companies. Although this may contradict the subsidy nature of the contract, and raise the barriers to entry, some type of financial bond might be unavoidable to limit this kind of behaviour, for example in proportion to the option's market value.

#### 4.3.1.4 Cumulativeness

One difficulty in optimising subsidy efficiency comes from the fact that applicants may apply for subsidies from multiple sources at the same time. So, for example, a project that wins a CC or CCfD auction by bidding for the cheapest carbon price might have already received subsidies from another source. Ideally, auctions should reward the lowest overall abatement costs and not just the lowest extra support needed after other subsidies have been received, which means that the other subsidies should be subtracted from carbon contract aid.

Fair competition between projects will never be perfect because projects benefit from different levels of existing infrastructure.

### 4.3.2 The carbon market price

Although competitive bidding is, on paper, the solution that optimizes the efficiency of subsidies, there are still a few issues to overcome.

An alternative to competitive bidding consists of setting strike prices in advance. This typically leads to higher price levels due to the lack of competition but lowers transaction costs. This was the approach adopted by many EU Member States for determining feed-in tariffs for renewable electricity.

Experience of pre-set feed-in tariffs in Member States has generally been successful in terms of deployment, but also characterised by over-generosity, even ruinous in some cases, leading to regulatory backpedalling (e.g., in Spain and France) where already agreed tariffs were renounced by the governments who had signed them.

In general, granting CCfDs above the carbon market price would increase the competitive distortion between activities eligible and not eligible for free allocation of emission permits. So before doing this, one priority should be to grant carbon contracts to entities involved in activities not eligible for free permits, where the strike price would be set at the carbon market price at the time of signature. For ETS-covered processes, CCfDs could replicate this system, with strike prices at market price. Although such contracts would have no financial value at signature time (the value being driven by the difference between strike and market price), they would hold significant value in terms of cash flow predictability and revenue risk mitigation.

## 4.4 Upfront and conditional support under State aid rules – by ClientEarth

In addition to EU funding such as the NER300 Fund and the Innovation Fund, to reach the sustainability objectives set out in the Green Deal, a fair share of support to – less or more innovative – decarbonisation technologies will have to come from Member States' funding, in the form of individual measures or schemes. Such funding is likely to result in State aid.

The primary function of the rules on State aid is to prevent that Member States' support to domestic undertakings and sectors distorts the competition and affects trade between the Member States. In this context, as explained below in further detail, considerations of funding efficiency and funding risk have a very limited and only indirect role to play.

State aid rules leave considerable room to Member States to select, as part of the design of the aid measure or scheme, their preferred funding instrument. This freedom is curtailed by the principles of *appropriateness* and *proportionality.*

### 4.4.1 When is support from Member states covered by the rules on State aid?

The notion of State aid covers a wide variety of funding instruments, including upfront grants and conditional support instruments such as CCfDs. Other examples of instruments that can result in State aid are loans and state guarantees under preferential terms, subsidies, tax advantages/exemptions. The bottom line is that any measure or scheme that confers an advantage on a selective basis (i.e., to specific companies or sectors) that would not otherwise be obtained on the market, results in State aid.

More precisely, a measure or scheme results in State aid in the meaning of Article 107(1) treaty on the Functioning of the European Union ("TFEU"), if the following cumulative criteria are fulfilled:

a. The beneficiary of the aid is an undertaking: the aid supports an economic activity.
b. The aid has a State origin: the decision to grant the aid must be imputable to the State and funded through State resources.
c. The aid provides the beneficiary with an economic advantage that it would not have received on the market. The form of the advantage is irrelevant: a grant, a tax advantage, a loan, a guarantee, free emission allowances (ETS).
d. The advantage is selective: it is granted to one / a group of undertaking(s) or sector(s).
e. There is an actual or potential distortion of competition and effect on trade between Member States.

The basic principle is that State aid is *prohibited* under European law, *unless notified to and approved* by the European Commission.[13]

The European Commission may approve an aid measure under State aid rules, if it is aligned with a certain policy objective i.e., if it is compatible with the internal market (Articles 107(2) and 107(3) TFEU). Regarding this compatibility assessment, often the Commission is bound to assessment criteria that it has set out in area-specific guidelines and/or frameworks.

### 4.4.2 Compatibility of State aid for decarbonisation objectives

In principle, State aid measures and schemes aimed at decarbonisation objectives are covered by the Commission Guidelines on State aid for climate, environmental protection and energy ("**CEEAG**") (European Commission, 2022). According to the CEEAG, State aid must comply with several principles and cumulative conditions to be eligible for approval by the European Commission.

The main principles are that the measure must:

(i) Support a development/project that is subject to market failure or that would otherwise not be realised without state intervention and that goes beyond the current minimum standards in terms of environmental protection;

(ii) Be appropriate in that the measure constitutes the best policy instrument for remedying the identified market failure; and

(iii) Be proportionate in that the measure does not result in overcompensation of the beneficiary.

Importantly, the compatibility assessment of measures and schemes under the CEEAG must be performed on a case-by-case basis, taking into account the characteristics of the relevant decarbonisation projects as well as the relevant economic and legal realities.

The above elements will briefly be elaborated upon in the following paragraphs.

### 4.4.3 Necessity- or need for state intervention- requirement

A central requirement in the compatibility assessment of State aid measures is that it be shown that without the intervention the objective of the measure would not be realised within a reasonable time. This condition is also referred to as *the necessity- or need for state intervention-requirement*.

In sectors that are subject to the EU ETS, the low and/or uncertain development of carbon prices represents a serious negative externality with respect to the investment in $CO_2$ reduction i.e., decarbonisation technologies. Regarding sectors that are not covered by the EU ETS, other negative externalities can prevent certain projects or developments from materialising. In these situations, either upfront financing instrument or conditional finance instruments such as CCfDs or CCs can be used to realise the relevant objective.

[13] There are some exceptions to the obligation to notify the European Commission of a State aid measure before implementation. However, for the purpose of this brief, these are not discussed in further detail.

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### 4.4.4 Appropriateness

In addition to the necessity of aid, it must be demonstrated that the aid is the best choice among the available policy options.

First, this condition implies that the Member State must demonstrate that the objective cannot be reached through other less distortive policy instruments i.e., instruments that do not result in State aid, or other less distortive types of aid instruments. Examples provided by the European Commission of less distortive forms of State aid include repayable advances as compared to direct grants, tax credits as compared to tax reductions, or forms of aid that are based on financial instruments, such as debt as compared to equity instruments, including, for example, low-interest loans or interest rebates, State guarantees, or an alternative provision of financing on favourable terms.

Second, the Member State must demonstrate that the choice of the aid instrument and the design of the aid is appropriate to reach the objective or to address the market failure the aid aims to address. For the purposes of illustration, if a market failure is identified in relation to the financial markets, a loan under preferential conditions would in principle be more appropriate than a direct grant.

It is worth noting that the CEEAG expressly recognise that CCfDs can be valuable in bringing technologies to market that may be necessary to achieve industrial decarbonisation. However, the CEEAG places CCfDs next to direct grants, by stating that "*Aid for decarbonisation can take a variety of forms including upfront grants and contracts for ongoing aid payments such as contracts for difference*" (European Commission, 2022 p. 121).

The CEEAG do provide certain safeguards with respect to CCfDs. They provide that the aid "*must be designed in such a way as to not undermine the efficiency of the market-based mechanism.*" (European Commission, 2022 p. 41). The CEEAG also provide that "*short and long-term interactions with any other relevant policies or measures, including the Union's ETS, should be considered*" (European Commission, 2022 p. 115). Despite these conditions, it is to be expected that **the European Commission will generally take a positive stance with respect to CCfDs**.

Nonetheless, the appropriateness of the use of a CCfD as part of an individual measure or general scheme will have to be demonstrated on a case-by-case basis, by taking into account all the relevant factual and economic circumstances, including the nature of any identified market failure. Also, it is worth emphasizing that it cannot be excluded that with respect to the same case, different instruments could be considered appropriate by the European Commission.

### 4.4.5 Competitive bidding: a tool ensuring proportionality

The CEEAG provides that aid must be limited to the minimum needed for carrying out the project or activity. This is also referred to as the principle of proportionality.

Generally, State aid will be considered proportionate if the aid corresponds to the net extra cost necessary to meet the objective of the aid measure, compared to the counterfactual scenario in the absence of aid – also referred to as the 'funding gap'. The net extra cost is determined by the difference between the economic revenues and costs (including the investment and operation) of the aided project and those of the alternative project which the aid beneficiary would credibly carry out in the absence of aid.

The funding gap is more than simply the price difference between product x and product y. It rather considers the net extra cost (on a project basis) necessary to meet the objective of the aid measure, compared to the counterfactual scenario (project) in the absence of aid.

Under the CEEAG, if a competitive bidding procedure is used for determining the aid amounts, this may, under certain circumstances, replace the necessity to make a detailed analysis of the net extra costs/funding gap which would otherwise be needed to demonstrate the proportionality of the aid. Also, the CEEAG clarify that without using a competitive bidding procedure, **complicated clawback mechanisms** may be required, using *"models that are not entirely ex ante. Instead, these models will be a mix of ex ante and ex post or introduce ex post claw-back or cost monitoring mechanisms"* (European Commission, 2022 p. 55).

The preferential treatment of competitive bidding is based on the evaluation report by the Commission (European Commission, 2020) which underlines the decreasing trend in the price of kWh for RES concomitant to the introduction of competitive bidding around 2015 and highlights several cases studies where the bidding price was consistently below the administratively determined price (Annex 1.2, Table A1.2.1). However, the Executive Summary warns that "direct comparisons of prices between competitively awarded and administratively set support are hard to identify and should be treated with caution".

Regarding the selection criteria to be applied in the context of a competitive bidding procedure, the CEEAG provide, amongst others, that "*The selection criteria used for ranking bids and, ultimately, for allocating the aid in the competitive bidding process should as a general rule put the contribution to the main objectives of the measure in direct or indirect relation with the aid amount requested by the applicant. This may be expressed, for example, in terms of aid per unit of environmental protection*" (European Commission, 2022 p. 50).

Specifically with respect to State aid for decarbonisation measures, the CEEAG provide that the "*subsidy per tonne of* $CO_2$ *equivalent emissions avoided must be estimated for each project, or in the case of schemes, each reference project*". Strikingly and regrettably, the footnote to this paragraph emphasises that while Member States may choose to use the level of subsidy per tonne of $CO_2$equivalent emissions avoided as a selection criterion in their aid measures, they are not required to do so.

The use of the competitive bidding procedure does not imply nor favour the use of certain instruments. Both upfront support and conditional support instruments are admissible. With respect to CCfDs, organising a competitive bidding process will – if successful i.e., if sufficient bidders qualify for the CCfD thereby ensuring a true competitive bidding process – resolve the challenge of determining a proportionate strike price. However, organizing a competitive bidding process will not automatically guarantee the proportionality of the CCfD design. For example, in assessing the proportionality of a CCfD, the Commission may have to consider whether the relevant circumstances justify a single sided CCfD rather than a double-sided CCfD or vice versa. Generally, assuming that a fixed strike price is determined through a competitive bidding process, **a double sided CCfD is more likely to be considered in accordance with the principle of proportionality** than a single sided CCfD or a CC.

### 4.4.5. Analysis of State aid rules in light of economic rationale

The rules on State aid, including the CEEAG, do not differentiate between aid instruments that constitute upfront support and those that constitute conditional support. For compatibility of a State aid measure, State aid rules take a neutral stance with respect to the proposed aid instruments, as long as the measure is in accordance with the principles of necessity, appropriateness and proportionality.

Moreover, the risk profile of the targeted project/technology is not, as such, a relevant factor in the compatibility assessment by the European Commission. This is because pursuant to the TFEU, the main objective of State aid rules is to prevent distortion of competition and affection of trade between Member States. In the compatibility assessment, the measure aimed at the pursued objectives will be balanced against these competition and trade objectives. It follows that the economic rationale that performance-based support instruments are more efficient than upfront funding when risks are lower (Atallah, 2014) is not incorporated in State aid rules.

In practice, because of the funding-gap approach and the principles of necessity, appropriateness and proportionality, State aid measures that are approved by the European Commission will often make use of instruments that naturally reflect the character and extent of the targeted market failure or conditions that prevent the pursued objective from materializing. For example, in light of the applicable principles, a market failure exclusively caused by $CO_2$ pricing externalities is likely best addressed through less distortive upfront CCfD mechanisms, whereas more fundamental i.e., structural market failures e.g., because of highly innovative technologies are best addressed through more distortive instruments such as upfront grants.

However, between these extremes there are a lot of instruments that qualify as upfront support and, under State aid rules, Member States retain considerable freedom to justify the use of these upfront support instruments. They also retain the freedom to focus support on highly innovative and risky technologies, as Member States remain free to determine – within the limits of the applicable frameworks – the focus of their national support measures.

Therefore, **the introduction, in State aid rules, of a clearer distinction between the role of upfront and conditional support instruments could be useful**. Emphasis by the European Commission on the advantages of conditional aid instruments over upfront instruments would especially be welcomed. The use of conditional support instruments has the potential to prevent lengthy and complex legal proceedings such as recovery procedures for misuse of State aid, in case the beneficiary does not comply with certain commitments or when the project does not develop at all despite the granting of upfront support. It also prevents the risk that upfront funding cannot be fully recovered in a recovery procedure, in case of bankruptcy of the beneficiary.

Finally, conditional support instruments might in particular be given a more prominent role in State aid rules, where the main objective of the aid measure is decarbonization. First, in this context the key advantage of conditional support instruments such as CCfDs is that it works on the basis of ex-post measurements of $CO_2$ reductions compared to very vague estimates and projections otherwise. This is especially valuable in respect of decarbonization technologies, where the prospective decarbonization results are in fact very difficult to predict. Second, conditional support instruments such as CCfDs easily align with the principle that the subsidy equivalent per avoided tonne of $CO_2$ must be calculated for each project (per 1 July 2023). (See Guidelines on State Aid for Climate, Environmental Protection and Energy 2022 (European Commission, 2022)

This would have been further reinforced, had the CEEAG imposed the subsidy per avoided tonne $CO_2$ as one of the mandatory selection criteria.

### 4.4.6 At EU level: no State aid rules

Not all funding will result in State aid because not all funding has a Member State origin (see 4.4.1) criterion b: regarding the State origin of the measure). Funding can have an EU origin instead. In that case, the specificities of the funding must be assessed to establish whether the funding is subject to the rules on State aid.

EU funds only qualify as State aid if the funds are controlled by Member States *and* if the decision to grant the aid can be attributed to the Member State (i.e., the funds are not centrally managed at EU level). This is, for example, not the case for the Innovation Fund, nor for funds from Connecting Europe Facility (CEF), EU Fund for Strategic Investments (EFSI), EU Investment Bank (EIB), and the EU Investment Fund (EIF). However, funding from the European Structural and Investment Funds (such as ERDF, ESF, RRF,…) can qualify as State aid. There are also EU funds for which the qualification is less obvious, because of a rather limited body of caselaw in this respect.

It follows that an EU-administered CCfD that is based on a legal framework that does not leave any room for a Member State to exercise control/management over the funds *or* the contracting of CCfDs, is not subject to State aid regulation. In this case, the conditions for compatibility of State aid do not apply. Instead, only the rules governing the EU fund in question will be relevant for determining the applicable conditions.

However, the political challenges of achieving a European approach to CCfDs should not be overlooked. In fact, these political challenges may be more fundamental than the legal challenges resulting from State aid regulation. Importantly, EU-level CCfDs may be difficult to coordinate with national support measures, and it might be very challenging to convince Member States to give up even further their competences over a very important policy element that is directly related to competitiveness and industrial policy. Hence, on a balance, it is likely that **the implementation of CCfDs at a national level will be achieved quicker than the implementation at EU level**. Implementation of CCfDs at EU level will require strong political consensus, which in uncertain times like at present is not guaranteed.


As the free allocation of emissions permits has dramatically reduced the decarbonisation incentive the ETS was supposed to create, it is necessary to try and create this incentive through additional support schemes.

However, this must involve rewarding those economic activities that are not covered by the ETS, in order to activate the abatement potential of circularity and the substitution of high-polluting ETS-covered products with less polluting alternatives. This is why we recommend introducing "carbon contracts for substitution" instead of the abundance of current policy initiatives that support ETS-covered sectors, which tend to further exclude low-carbon solutions.

Other misguided initiatives involve providing support to intermediate products or processes such as carbon storage or hydrogen. By lowering access costs to these technologies, industry is likely to excessively rely on them at the expense of more affordable, resource-liga ht solutions. It is also likely to add tension to already scarce commodities markets such as raw materials and electricity.

Free allocation is a very costly way of protecting industry against the risk of carbon leakage. Recreating the incentives destroyed by free allocation through new subsidies would cost more still. However, it would probably cost less and reduce more emissions than piling up aid to the same few entities that are already protected.

All three EU decision bodies (Commission, Parliament and Council) have proposed to increase the size of the Innovation Fund as part of the 'Fit-for-55' package. Although this could provide an opportunity to improve decarbonisation incentives by putting the carbon market's **trillion euro value**[14] to better use, it also increases the amount of funds at risk of being misspent. It is crucial to tap the decarbonization potential of those activities that have thus far been left out of the ETS incentives. Extending the scope of the Fund to "the scaling up of techniques, processes and technologies that may no longer be considered innovative, but nevertheless possess a significant greenhouse gas emissions abatement potential", as proposed by the European Parliament in

[14] See Sandbag (February 2022): EU ETS Revenues: Who Receives What? The Trillion Euro Question

June 2022, is a promising step in the right direction. However, a general policy to better prioritise the allocation of funds is badly needed.

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