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White Paper on Insetting-Based Decarbonisation for the Chemical Industry

Executive summary

The chemicals industry is vital to the global economy, supplying essential materials across sectors like agriculture and healthcare. However, it is also a significant contributor to greenhouse gas (GHG) emissions. Achieving net zero emissions in this industry is critical, but progress has been slow due to high capital costs, long asset life cycles, complex supply chains, and insufficient regulation. Despite these challenges, key players in the value chain are willing to pay more to accelerate decarbonisation.

One promising solution to accelerate decarbonisation ahead of and complementary to regulation lies in market-based mechanisms (MBM), in this case, the Book and Claim (B&C) Chain of Custody (CoC) model, which enables companies to co-fund decarbonisation efforts without the need for physical tracking and material segregation through the entire value chain. The B&C model offers flexibility, allowing companies to support low-carbon products, making it easier to engage in decarbonisation and accelerate investment.

Adopting a well-designed roadmap for the B&C system, along with establishing a clear, transparent, and traceable market for low-carbon chemicals, would further incentivise the integration of industrial decarbonisation options such as carbon capture, utilisation, and storage (CCUS), electrification, fuel switching etc. While any one approach alone cannot resolve all the challenges facing the chemicals industry, these strategies enable a viable pathway for driving significant progress toward decarbonisation, fostering innovation, and enabling even smaller industry players to participate in the transition to a more sustainable future.

A particular challenge in the chemicals sector is that the value chains are long and complex, with a relatively small number of “platform molecules” being produced upstream and a very large variety of final chemicals and materials being derived from these and being incorporated into other products. Another complicating feature is that the major GHG emissions tend to occur in the upstream part, far removed from the end users who may be willing to pay more for low-carbon products ahead of regulation. These features mean that maintaining segregated systems and infrastructure for “Business-as-usual (BAU)” products and low-carbon products is either very inefficient or infeasible, and other strategies will be needed to encourage investment in upstream emissions reductions and to associate these environmental benefits with final products. This is where the MBMs come in, being inspired by the success of other models such as green gas certificates or renewable energy guarantees of origin, where gas and electricity grids are used to connect producers and consumers; these grids are analogous to the more complex value chains seen in the chemical industry.

Essentially, the concept is as follows: an upstream producer invests in decarbonisation technology and reduces the overall emissions in a process. The emissions reductions against a standardised baseline are then used to generate environmental attribute certificates (EACs), similar to green gas certificates for biomethane (The “booking” part of the procedure). The emissions reductions and the certificates are attributed to specific platform molecules, which allow them to be considered low- or zero-carbon. These molecules enter the value chain and at this stage lose their identity. However, the producers of final products which incorporate the same type of molecules (i.e., not necessarily the specific physical, low-carbon molecules) can purchase an appropriate number of EACs which allow them to make specific claims about their products (the “claiming” part of the procedure) – for example “contains low-carbon packaging (x% lower than standard packaging)”.

By creating a market between the two key players in the value chain, who may not be directly connected, the MBM is an efficient way to connect final consumers who are willing to pay for low-carbon products with upstream platform chemicals producers, who are far removed from them in the value chain. It is our view that it is critical to encourage the uptake of such voluntary measures ahead of regulation as time is of the essence.

This report explores MBMs for low-carbon chemical value chains in detail. The guidelines for calculating baseline product carbon footprints (PCF) using established frameworks and for attributing carbon savings to specific products are outlined. In this report, we use carbon capture and storage (CCS) as an example, although this methodology can be applied to any decarbonisation interventions. The attribution of CO_2 savings from certificated CCS units follows a systematic approach to ensure transparency, traceability, and compliance with established standards. In a system driven by voluntary purchase of certificates, CO_2 savings can be attributed in two primary ways: **proportional attribution**, where savings are distributed across products based on their share of emissions or other metrics (e.g. mass or energy content), and **preferential attribution**, where CO_2 savings are assigned to selected "low-carbon" products to appeal to sustainability-focused consumers. In all cases, CO_2 savings remain within the certificated CCS supply chain and cannot be transferred to unrelated supply chains or compensate for downstream emissions beyond the cradle-to-gate scope. This approach supports the strategic use of EACs to foster decarbonisation initiatives.

Delving into the B&C CoC model for (EACs) for low-carbon chemicals, the following key principles for an effective B&C system are introduced:

- **Principle one:**
  Low-carbon EACs are limited to insetting within chemical production, i.e. they relate to identifiable interventions within the value chain. EACs are product-specific and cannot be transferred upstream but can be passed downstream.

- **Principle two:**
  EACs are used for insetting emissions which is a method of reducing emissions within a company's operations, so they cannot be used to reduce a particular product's carbon footprint to below zero. Excess EACs can be used as offsets (up to 5-10%) within corporate reporting, but negative emissions claims associated with particular products are not allowed.

- **Principle three:**
  EACs for low-carbon chemicals are valid only for a limited time and within the geographical scope of the supply chain. EACs cannot be sold years later or in regions outside the actual supply chain, ensuring traceability. Transfers are allowed only within the macro-level supply chain, and buyers cannot hold EACs indefinitely for future emissions reporting.

- **Principle four:**
  Emission reductions are claimed only after the reduction action occurs.

- **Principle five:**
  Reductions are registered within specific period of time with transparent disclosure if delayed. All reductions should be recorded by both parties (booker and claimer), with the option to share the data in a public registry in the future, depending on market dynamics. The record should detail the amount, application, and retirement of EACs.

- **Principle six:**
  EAC calculations follow best practices and standards, with third-party verification.

- **Principle seven:**
  Double counting is prevented through robust registry systems, public databases, and independent third-party verification.

After calculating the low-carbon PCFs and using them to generate EAC, the environmental performance of these low-carbon chemicals should be quantified through monitoring, reporting and verification (MRV) protocols. This ensures accurate recording and enables markets to differentiate and assign value to low-carbon chemical

products. Companies need to report the environmental performance of these products in their corporate sustainability reports using both compliance-based and voluntary frameworks. These frameworks ensure transparency on environmental impacts, alongside financial performance.

To integrate EACs into sustainability reports, the claims made should meet specific characteristics: they should be traceable, demonstrate additionality, address permanence and leakage, be certificated and verified, be relevant to the product's reduced emission profile, and be geographically matched. Companies should avoid using misleading terms like "carbon neutral" or "net zero" unless the entire product lifecycle has been assessed.

This white paper also synthesises the key questions covered and outlines the conditions necessary to establish a trustworthy EAC market for low-carbon chemicals. It identifies key ecosystem players and defines the boundaries of an insetting approach in the last chapter.

By integrating clear guidelines for EACs, enhancing corporate sustainability reporting, and fostering transparency, the industry can make significant strides toward decarbonisation. While these approaches offer a practical pathway, they are not a complete solution. A detailed roadmap is essential to guide the development of a robust, reliable, transparent EAC market, ensuring widespread adoption and success. The roadmap for developing a robust EAC market for low-carbon chemicals will be further explored in a following paper.

This White Paper is the start of a conversation

This paper focuses on a market-based model for accelerating the decarbonisation of the hard-to-abate chemical supply industry.

It is the result of a multidisciplinary collaboration between Leonardo Centre on Business for Society, Sargent Centre for Process Systems Engineering, Centre for Environmental Policy and Department of Chemical Engineering at Imperial College London, the world leading university for science, technology, engineering, medicine and business (STEMB).

It is the product of extensive engagement with experts from academia, business leaders and institutions throughout 2024.

We see it as a living document and the beginning of an evolving conversation. It will be revised periodically based on engagement and feedback from wider stakeholders.

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Get involved

We invite and encourage stakeholders to share their perspectives and thoughts on the concepts and ideas discussed and suggested in this paper.

Sign-up to join in

bit.ly/LoCarbChem-fdbk

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