RENEWABLE
CARBON
INITIATIVE
POLICY PROPOSALS

Policy Proposals for Facilitating the Transition to Renewable Carbon

A Brochure of the Renewable Carbon Initiative (RCI)

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Authors

Christopher vom Berg, nova-Institute, nova-Institute, Executive Manager Renewable Carbon Initiative (RCI)
Michael Carus, Executive Manager of RCI and Founder and CEO of nova-Institute
Jörn Harrandt, nova-Institute, Project Manager Renewable Carbon Initiative

V.i.S.d.P. (responsible)

Michael Carus, nova-Institut GmbH, Hürth (Germany)

Find more information at
www.renewable-carbon-initiative.com

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Authors

Christopher vom Berg is Executive Manager of the RCI and develops strategic concepts for transforming the chemical and material industry towards renewable carbon. He joined nova-Institute in 2017 and has worked on various projects for the Sustainability department and the Economy & Policy department. In 2020, Christopher helped founding the Renewable Carbon Initiative (RCI), where he took over increasing responsibilities over time. Today, he is mainly involved in the management, advocacy and networking of RCI, investigates policies and regulations that impact renewable carbon management, and shares and discusses its positions and opinions. He is also author and co-author of multiple background reports and position papers of the RCI.

Michael Carus is one of the leading European experts, market researchers and policy advisers of the renewable carbon economy – including bio-based, CO_2-based and recycling. At the end of 1994, he and five other scientists founded the private and independent nova-Institute for Ecology and Innovation. Ever since the beginning, Carus has been involved in the company as owner and one of the two Managing Directors. Today nova-Institute has nearly 50 scientists from a wide range of disciplines, covering markets, technologies, sustainability, communication and policy. In the year 2020, Carus founded the Renewable Carbon Initiative (RCI), which has today more than 70 members from chemicals and materials industries.

Jörn Harrandt has been part of the nova-Institute team since January 2024, where he supports and contributes to RCI and its projects as project manager. He brings broad experience in scientific research and attention to detail scrutinize complex datasets and regulatory frameworks for analytical assessments. His expertise bridges project management and scientific research, which he applies to develop comprehensive reports that support RCI's efforts in transforming chemical and material industries towards renewable carbon solutions.

We would like to extend our sincere gratitude to all RCI members for their invaluable support, thoughtful input, constructive feedback, and creative ideas throughout the development of these policy proposals. Your engagement and critical perspectives have been essential in shaping the document.

We also wish to thank the external stakeholders who generously reviewed earlier drafts and provided insightful comments. Your contributions have greatly enhanced the quality and relevance of our work.

Executive Summary

Europe's chemical industry, a cornerstone of manufacturing with significant economic impact and a key enabler for many other industries, is facing an acute crisis in the form of global competition, rising energy costs and regulatory burdens. The industry has seen a significant decline in global importance, falling behind China and the US in terms of patents and production. The sector's heavy reliance on fossil fuels for raw materials (over 90%) exacerbates its challenges, creating dependencies and limiting control over its carbon footprint at a time when Europe is grappling with the need for a green transition to ensure long-term prosperity and competitiveness. There are clear signs of ongoing deindustrialisation in the EU chemical industry.

In this context, the defossilisation of Europe's chemical sector and the transition to renewable carbon sources represents a compelling opportunity for the continent's industrial future. This shift is not just a response to environmental concerns, but a strategic move to increase Europe's competitiveness and resilience in the global marketplace. Key challenges include regulatory barriers, the slow expansion of renewable energy, insufficient demand for sustainable products and limited uptake of new technologies. To address these, Europe needs to streamline regulations, accelerate the expansion of renewable energy and develop policies that stimulate demand for sustainable products while improving the uptake of innovative technologies and approaches.

This transition requires a clear commitment to defossilisation, a credible vision with a clear pathway, **and a policy framework** that actively supports, guides and incentivises the transition to renewable carbon. With well-designed policies that enable and support renewable carbon, defossilisation can become a significant source of sustainable growth in Europe.

With well-designed policies that enable and support renewable carbon, defossilisation can become a significant source of sustainable growth. A focus on pioneering renewable carbon technologies in Europe could bring many benefits, including to:

- **Unleash Investment to Scale-up Cutting-edge Innovations**
- **Improve Industrial Competitiveness on a Global Scale**
- **Reduce Dependence on Volatile Fossil Fuel Markets**
- **Create New, High-value Jobs in Innovative Sectors**
- **Establish Global Leadership in Sustainable Chemistry**
- **Increase Strategic Autonomy in Critical Materials**
- **Build Economic Resilience Against Future Shocks**
- **Reduce Carbon Leakage and Improve Environmental Integrity**
- **Contribute to EU Climate and Circular Economy Goals**

To facilitate such an enabling framework, **the Renewable Carbon Initiative (RCI) has developed a comprehensive set of policy proposals aimed at accelerating the transition to renewable carbon in the chemicals and materials sector.** These proposals address key challenges and opportunities in the transition away from fossil-based feedstocks, focusing on instruments that the RCI has identified as particularly suitable for this purpose and that have proven effectiveness in other sectors.

The Main Policy Proposals to Address these Opportunities Include:

1. **Overarching Commitment to Defossilisation:** Decide on a high-level agreement to defossilise the chemical industry as basis for future policy.
2. **Targets for Renewable Carbon:** Introduce mandatory targets for renewable carbon use in chemicals and materials.
3. **EU ETS and CBAM Adaptation:** Enable the EU Emissions Trading System to facilitate a shift to renewable carbon, focusing on Carbon Capture and Utilisation (CCU).
4. **Waste as Feedstock:** Implement a harmonized EU framework to maximize the utilization of waste streams as feedstock.
5. **Local Access to Renewable Carbon:** Promote the use of locally available biomass and captured carbon as renewable feedstocks.
6. **International Trade of Renewable Carbon:** Establish fair, transparent, and sustainable trade rules for renewable carbon imports.
7. **Balance Regulatory Framework between Energy and Materials** using renewable carbon, and enable synergies between the sectors.
8. **Financial Support:** Establish comprehensive financial support mechanisms to enable the transition to renewable carbon.
9. **Renewable Energy and Defossilisation Pact:** Offer companies access to competitive renewable energy in exchange for binding defossilisation commitments.
10. **Carbon Utilisation Trading System:** Establish a European Carbon Utilisation Trading System (CUTS) to promote the transition from fossil to renewable carbon sources.

Addressing defossilisation and supporting the transition to renewable carbon would provide a comprehensive and reliable framework for the transformation of the chemicals and materials sector, **addressing the implementation gap** from innovation to scaled product. If properly implemented, these measures can align the chemical industry with the EU's sustainability goals, while maintaining industrial competitiveness, fostering innovation and increasing resilience.

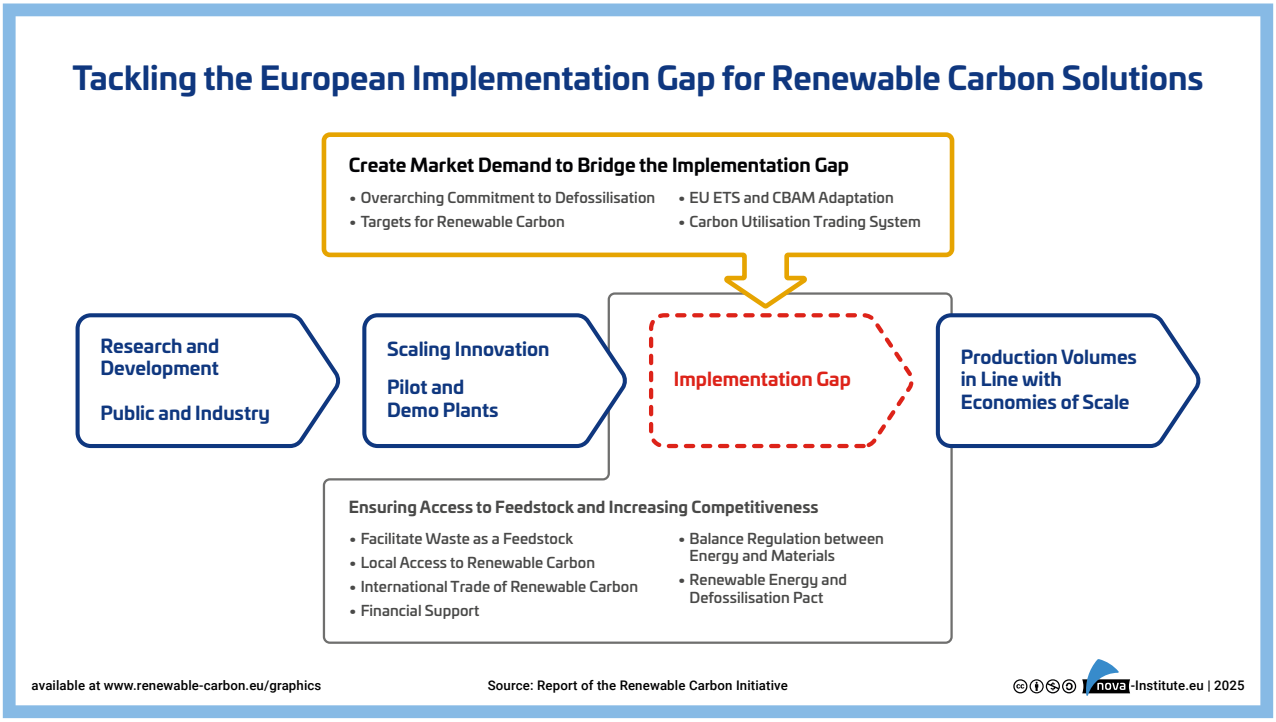

Figure 1: Impact of creating lead markets and demand for renewable carbon solutions specifically tackle the implementation gap.

As the EU Competitiveness Compass states, *"To shift the economy towards clean production and circularity, the EU needs to develop lead markets and policies to reward early movers."*

This transition is not just about environmental sustainability; it is about securing Europe's industrial future and maintaining its global competitiveness in a rapidly changing world.

Foreword

Dear Reader,

The chemical industry has long been a cornerstone of European innovation and manufacturing, shaping sectors as diverse as food and agriculture, packaging, textiles, automotives, construction and cosmetics. Its contributions are integral to our daily lives and economic prosperity. Yet today, like many traditional industries, it is facing profound and unprecedented challenges.

But with these challenges comes an extraordinary opportunity. The transition to renewable carbon is not just a technical adaptation; it represents a paradigm shift in the way we produce, use and interact with the materials that underpin our societies. This transformation is essential to achieve a sustainable and resilient future while maintaining Europe's global leadership in chemical innovation and manufacturing.

Having watched the industry evolve at first hand, we are deeply aware of the scale of the challenge. At the same time, we are confident in the immense potential for innovation that this transition offers. This document is more than a policy proposal – it is a strategic roadmap for reinventing the chemicals sector in alignment with Europe's sustainability goals, competitiveness objectives, and key initiatives such as the Clean Industrial Deal.

It is also a call to action for one of the most critical transitions of our time. An overarching commitment to defossilisation will pave the way for a thriving, sustainable European chemical industry – one that attracts investment, fosters innovation, and ensures prosperity for generations to come.

We encourage you to approach this document with an open mind and a sense of possibility. The road ahead is complex, but the destination – a thriving, sustainable European chemical industry – is well worth the effort.

Sincerely,

Michael Carus and Christopher vom Berg
Executive Managers
of the Renewable Carbon Initiative

Introduction

The Critical Role of Renewable Carbon in Achieving a Sustainable and Competitive European Chemical Industry

The State of the European Chemical Industry

Europe stands at a pivotal moment in its industrial history. Technological advances, sustainability imperatives, global competition and geopolitical tensions creating a complex and challenging environment that requires a green transition while ensuring long-term prosperity and competitiveness on the global stage. This was clearly highlighted in the reports by Mario Draghi[1] and Enrico Letta[2]. In particular the chemical industry, a cornerstone of European manufacturing, is facing unprecedented challenges. With more than 1.2 million employees, a turnover of EUR 655 billion and R&D investments of EUR 10.2 billion, the European chemical industry is a wealth-generating sector of the economy and a critical enabler for building a sustainable future for Europe. In the EU, nearly 30,000 companies are active in the chemicals sector, including essential derived products such as pharmaceuticals, rubber and plastics.

But the European chemical industry is in acute crisis. Its global importance has been declining in recent decades with, Europe now lagging behind China and the US in terms of patents and production. In recent years, a combination of increasing global competition, rising energy costs and ambitious EU regulation, has led to plant closures and job losses, with more than 11 million tonnes of capacity set to close in 2023 and 2024 alone[3]. Europe's global competitiveness is under enormous pressure and there are clear signs of de-industrialisation. The situation is exacerbated by the fact that more than 90% of raw materials are still derived from fossil fuels, mainly oil and natural gas. This not only creates dependencies but also means that a significant share of the carbon footprint of chemicals is beyond direct control.

> *"[…] they are now facing increasing competitive pressure, primarily due to increased energy costs and stronger decarbonisation efforts required in Europe compared to its international competitors. Deindustrialisation in the EU in some of these sectors has already started, and may accelerate without dedicated policies."* [1]
>
> **Draghi Report**

> *"The EU's dependence on external suppliers of chemically synthesised active ingredients, components, and finished products is increasing rapidly. European production of active ingredients has plummeted from 53% in the early 2000s to less than 25% today."* [2]
>
> **Letta Report**

1 European Commission 2024: The Draghi report – A competitiveness strategy for Europe https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en. Retrieved February 22, 2025.

2 European Council 2024: Much more than a market: Speed, security, solidarity. https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf. Retrieved February 22, 2025.

3 Econopolis 2025: "The competitiveness of the European chemical industry", https://www.econopolis.be/en/blog/posts/2025/january/the-competitiveness-of-the-european-chemical-industry/

The Urgent Need for Transformation of Europe's Chemical Industry

The chemical industry plays a central role in the economy, with entire cascades of products based wholly or partly on its intermediates, derivatives and products. Virtually no industrial sector can function without chemicals and derived materials (Figure 2), which is why it is also referred to as "industry of industries". Polymers/plastics and rubber are by far the most important applications, accounting for 65% of the total chemical value chain of derived materials. Other relevant applications include solvents, detergents, additives, personal care and pharmaceuticals. In consequence, **without an innovative, competitive and defossilised chemical industry in Europe, other sectors will not be able to achieve their green and digital transformations,** in particular potential net-zero targets and addressing scope 3 emissions – those outside of direct control of a company or EU legislation.

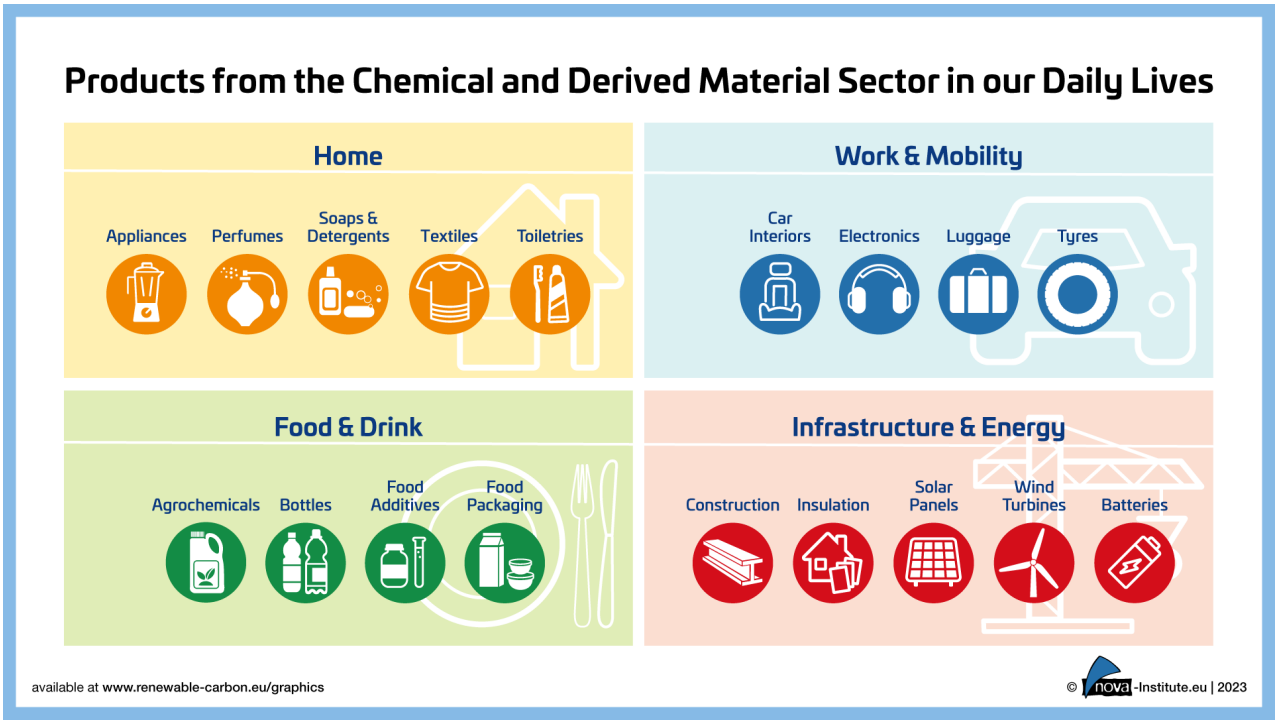

Figure 2: Products from the Chemicals and Derived Materials Sector in our Daily Lives

Defossilisation and Decarbonisation: The Chemical Industry's Unique Challenge

Most industrial sectors can achieve climate neutrality through decarbonisation, i.e. by switching to renewable energy or electricity that eliminates carbon-based feedstocks and, consequently, climate-relevant emissions. However, the chemical industry and its downstream industries cannot be truly decarbonised because their products are largely made of carbon. Achieving net-zero in this sector requires a dual approach: reducing climate-relevant emissions and addressing the carbon used as feedstock. While the energy used in chemical production can be decarbonised using green electricity and hydrogen (for example, in electrically driven steam crackers), the carbon in the products themselves remains indispensable. This presents a significant challenge as carbon moves through complex supply chains. Defossilisation is an appropriate strategy to holistically enable circularity and sustainability. Currently, over 90% of the carbon used in European chemicals and materials comes from fossil feedstocks. Defossilisation aims to replace fossil carbon with renewable carbon from biomass, CO_2, and recycling.

> *"As rubber and plastics are carbon-based products, the industry's green transition objective is not to 'decarbonise', but to reduce the reliance on fossil fuels as carbon feedstock. In 2022, 80% of European plastics production was still fossil-based, compared to 20% bio-based or from recycled materials. […] international competitiveness in the green transition also depends on the stable and competitive supply of renewable energy, necessary carbon feedstock."* [1]
>
> **Draghi Report**

An Opportunity Amidst Crisis

The chemical industry is facing its biggest transformation since industrialisation. This transformation, driven by the imperative of sustainability and the shift towards renewable carbon, offers a unique opportunity to align the industry with both environmental goals and future competitiveness. The EU Competitiveness Compass[4] highlights the urgency for Europe to address key challenges: closing the implementation gap, aligning climate efforts with competitiveness, and reducing dependencies. The Clean Industrial Deal, unveiled in February 2025, provides a crucial framework for this transformation.

For the chemical and derived materials sector, a focus on renewable carbon emerges as solution that can address all of the identified needs. This shift is not only an environmental necessity, but also a strategic move to strengthen European competitiveness and resilience in the long term. As we approach the end of the decade, larger brands will increasingly require solutions that go beyond Scope I and II compliance to meet their climate targets, creating a favourable medium and long-term perspective for renewable carbon.

Europe's high level of innovation provides a strong foundation for this transformation. However, the region often struggles to harness this innovation effectively, with emerging technologies often being deployed and scaled up in other regions. The shift towards renewable carbon offers an opportunity to change this pattern. It allows for the continued use of existing large-scale chemical structures with alternative feedstocks ("alternative naphtha"), while also enabling the emergence of new structures with innovative sources, for example based on methanol (mainly from CO_2), ethanol (transfer from the bioethanol fuel sector) and biomass in biotechnology and biorefineries.

4 A Competitive Compass for the EU: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_339

Barriers to Defossilisation

The transition to renewable carbon in the chemical industry faces significant barriers that are rooted in both market failures and systemic challenges. At the heart of these barriers is the lack of competitiveness of renewable carbon relative to fossil carbon, which results from several critical market failures: the failure to price the true environmental costs of fossil fuels, the inadequate pricing of greenhouse gas emissions, and the underinvestment in scaling up renewable technologies. These economic distortions are further compounded by the deep entrenchment of existing infrastructure and systems in the use of fossil fuels, creating a formidable resistance to change.

The policy landscape exacerbates these challenges, often prioritising efficiency over the effectiveness needed for fundamental change. The European chemical industry lacks a comprehensive policy framework to enable a transition to renewable carbon. There is an urgent need for policies, instruments, and measures that synergistically combine environmental objectives with innovation, investment, and competitiveness, bringing together the European Green Deal with the Clean Industrial Deal. Developing such a framework is crucial for Europe's economic prosperity and independence, as highlighted in the Draghi report, *"[…] refineries, and chemicals […] sectors are pressed to transition to clean energy solutions and adopt new business models, but are confronted with uncertainties around the costs of decarbonization technologies, access to capital, and the timely, scalable availability of these technologies. SMEs are also facing specific challenges in charting their decarbonization pathways."* [1]

A concrete example of these challenges is evident in the EU automotive industry's ambition to increase the use of recycled and bio-based plastics. The current ambition is for 20–25% recycled plastics in future production, possibly supplemented by bio-based plastics. However, it is doubtful whether the EU chemicals/plastics industry could deliver these volumes under the current framework that.

> *"Recycling of most other waste streams, including chemicals and plastics […], to the contrary, does not have a viable business case at present. In the latter case, recycled materials can replace fossil feedstock, but the recycling comes with costs in collection, sorting and processing that make it more expensive (less competitive) than virgin material (despite the lower carbon footprint), and the recyclates tend to be of limited quality, making it difficult to justify a green premium. In addition, recycling of many waste streams is currently not viable economically also because costs for incineration and landfilling tend to be lower than the additional costs of recycling. […] and it is difficult to earn a green premium for recycled plastics to compensate for higher costs. […] While circularity reduces fossil feedstock needs, plastics recycling has no strong business case at present."* [1]
>
> **Draghi Report**

> *"[…] the EU must amplify access to circular materials by stimulating demand for high-quality recycled materials. This involves setting requirements for recycled content in critical areas, as demonstrated by the new battery regulation and the upcoming revision of packaging legislation for plastics. Such initiatives not only present significant economic opportunities, as evidenced by the planned €8 billion investment by European plastics manufacturers into chemical recycling by 2030, but also underscore the potential for high-quality recycled materials to drive innovation and investment in the circular economy."* [2]
>
> **Letta Report**

Enabling a Transformation by Creating Market-uptake

The successful transformation of the European chemical industry towards sustainability depends on two critical factors: accelerating the development of affordable renewable energy and addressing market failures between fossil and renewable carbon.

A consistent **energy transition to renewables** is fundamental to maintaining European economic competitiveness and independence. The energy and fuel sectors have already implemented clear policies to create demand for renewable sources such as solar and wind power, green hydrogen, and biofuels for road or sustainable aviation fuels, that trigger demand and investment. These established transformations must now be accelerated to create a fully established renewable energy system, including hydrogen and storage, that capitalises on renewables as the most cost-efficient energy. With the Clean Industrial Deal and the Affordable Energy Action Plan, the EU send a clear signal to address the energy topic.

However, the chemical sector lags behind in the transition to renewable carbon. Appropriate policies to create demand for products made from renewable carbon are lacking and urgently need to be developed. The Sustainable Carbon Regulation Package, proposed by several EU member states in 2024, aims to create a comprehensive policy framework for sustainable carbon[5]. But, as of yet, limited change has been driven primarily by demand from few brand manufacturers instead of policy, because they are asking for fossil-free plastics, for example. And even this minor demand can hardly be met competitively at the moment. EU policy urgently needs to create a framework that creates market demand for chemicals and products made from renewable carbon.

> *"To shift the economy towards clean production and circularity, the EU needs to develop lead markets and policies to reward early movers." [4]*
>
> **EU Competitive Compass 2025**

The global landscape presents additional challenges, with Asia leading in bio-based plastics and the US in CO_2 capture and utilisation. Although clearly focused on improving circularity, the European framework for chemical recycling is developing slowly, as is investment. Unless policy makers act quickly, the demand for fossil-free plastics will be met by production outside the EU. The success of incentive-based policies, such as the US Inflation Reduction Act, demonstrates that a balanced approach of "sticks and carrots" is more effective than punitive measures alone.

The time to act on this is now. To establish lead markets for the alternatives to fossil carbon, the EU needs to implement measures that create market demand, which in turn provide the regulatory security for companies to commit to the renewable carbon alternatives.

5 Government of Netherlands 2024: Joint Statement on a European Sustainable Carbon Policy Package, https://www.government.nl/documents/publications/2024/04/15/joint-statement-on-a-european-sustainable-carbon-policy-package

How can Competitiveness be Achieved in the European Chemicals Sector?

Achieving competitiveness in the European chemicals sector requires a multi-pronged approach. This includes cutting administrative red tape, speeding up processes and streamlining reporting. Energy costs must be reduced through the rapid expansion of renewable energy sources, combined with green hydrogen and storage capacity. Dynamic electricity tariffs and smart meters must give industry and individuals access to affordable solar and wind power.

But these measures alone are insufficient to make Europe's chemicals and downstream industries competitive and resilient for the future. Significant investment in R&D is essential, and in particular bringing the hundreds of innovations and start-ups developed in Europe to production. Attracting investment in innovative and sustainable solutions based on the use of renewable carbon is paramount. Europe's key challenge, apart from bureaucracy and excessive energy costs, it is to create a policy framework that creates stable, long-term demand for these innovations. If this can be achieved, it will trigger a veritable explosion of investment in innovation and commercial scale-up, positioning Europe competitively and sustainably for the future.

The aim of this report is to present and discuss policy instruments that can create the necessary demand for innovative and sustainable processes and products in the chemical sector. These instruments can enable Europe to realise its enormous potential in this critical area of economic and environmental importance.

A Path Forward: Catalysing the Renewable Carbon Revolution

Europe is at a crossroads and faces a critical choice: allow its chemical industry to migrate, delay that migration with subsidies, or unleash a catalytic wave of innovation and investment. The choice should be clear – the time for incremental change is over. A major reinvention of Europe's chemical industry is not just desirable, it's essential for a sustainable and competitive future.

Europe is on the cusp of a renewable carbon revolution, with a wealth of innovative potential ready to be unleashed. Hundreds of SMEs, and large companies across the continent have developed cutting-edge renewable carbon technologies that are ready for investment and scale-up. However, the current European framework is hampering progress, resulting in many of these innovations to be implemented outside of Europe instead. The barriers to deployment are multifaceted, including a reluctance to support new technologies, whether from biomass, carbon capture or advanced recycling such as pyrolysis and gasification, and new concepts like mass balance and attribution. In addition, the use of certain feedstocks that are ideal for biotechnology, such as starch and sugar, is restricted despite the potential for large-scale use that could support, rather than threaten the food supply.

Central to enabling renewable carbon are well-designed policy instruments that can ensure market uptake of innovations and renewable carbon-based products. The recently unveiled Clean Industrial Deal, with concrete measures including a Chemicals Industry Package at the end of 2025, will provide critical opportunities to put the right instruments in place.

> *"The Chemicals industry package at the end of 2025 will be of key importance to ensure the competitiveness of industry as well as the protection of human health and the environment, looking also at supply of critical chemicals."* [4]
>
> **EU Competitive Compass 2025**

The rewards could be immense. If the transition to renewable carbon is approached properly and with an enabling policy framework, Europe could:

- **Unleash Investment to Scale up Cutting-edge Innovation:** By creating a favourable investment climate, Europe can attract significant capital to scale up innovative renewable carbon technologies, accelerating their development and commercialisation.
- **Improve Global Industrial Competitiveness:** Adoption of renewable carbon technologies can give European industry a competitive edge, enabling it to offer unique, sustainable products that meet the growing global demand for green solutions.
- **Reduce Dependence on Volatile Fossil Fuel Markets:** The transition to renewable carbon sources can insulate European industries from the price volatility and geopolitical risks associated with fossil fuel dependency, thereby increasing economic stability.
- **Create New High Quality Jobs in Innovative Sectors:** The shift to renewable carbon technologies will create employment opportunities in research, development, manufacturing and related services, contributing to a skilled and future-proof workforce.
- **Establish Global Leadership in Sustainable Chemistry:** By pioneering renewable carbon technologies, Europe can position itself as a global leader in sustainable chemistry and influence international standards and practices.
- **Increase Strategic Autonomy in Critical Materials:** Developing renewable carbon sources can reduce Europe's dependence on imported fossil-based feedstocks, increasing its strategic autonomy and supply chain resilience.
- **Building Economic Resilience to Future Shocks:** A diversified, renewable carbon-based chemicals industry will be better equipped to withstand economic disruptions and adapt to changing market conditions.
- **Reduce Carbon Leakage and Improve Environmental Integrity:** By making sustainable production more economically viable within Europe, these policies can prevent the relocation of carbon-intensive industries to regions with less stringent environmental regulations.
- **Contribute to the EU's Climate and Circular Economy Goals:** The transition to renewable carbon is consistent with and actively supports the EU's ambitious climate and circular economy goals, demonstrating Europe's commitment to sustainable development.

Now is the Time for Policy-makers to Turn Crisis into Opportunity

Europe stands at a pivotal moment, with the power to transform the current crisis into a significant opportunity. By taking decisive action now, the chemical industry can become a model for how traditional sectors can reinvent themselves to meet the challenges of the 21st century. This transformation, however, requires a clear commitment to defossilisation and a policy framework that actively supports, guides, and incentivizes the transition to renewable carbon.

The future of Europe's chemical sector – and indeed, its wider industrial landscape – hinges on embracing the transition to renewable carbon. But the defossilisation of the chemical industry is far more than just a response to a crisis. It is an opportunity to fundamentally reshape the industry, making it more sustainable and competitive. This transformation would strengthen Europe's industrial resilience by reducing its dependence on fossil feedstocks, position itself as a global leader in sustainable, innovative chemistry and create sustainable prosperity for generations to come. Unleashing this transformation is also integral to achieving Europe's wider climate neutrality goals by 2050. Without an innovative, competitive, and defossilised chemical industry in Europe, other sectors will struggle to meet their climate targets.

With well-designed policies that enable and support renewable carbon, defossilisation can become a significant source of sustainable growth. To this end, this study provides detailed insights and recommendations on instruments that the Renewable Carbon Initiative (RCI) has identified as particularly suitable for this purpose. If implemented, these instruments will open the door to a successful transformation, laying the foundations and the path to a competitive and sustainable European chemical industry. The following chapters will delve into these policy proposals, offering a comprehensive roadmap for Europe's journey towards a renewable carbon future. By embracing these recommendations, Europe can turn the current challenges into opportunities, positioning itself at the forefront of a new era in sustainable chemistry and industrial innovation.

Necessary Enabling Conditions for the Renewable Carbon Transition

The chemical industry is a complex and multifaceted industry that has been designed upon and fully adapted to a fossil-based ecosystem. The transition to renewable carbon therefore requires a comprehensive set of enabling conditions to facilitate such a significant transformation, which extends beyond policy measures. While this document focuses on specific policy proposals, this section therefore highlights the broader landscape of factors that need to be addressed to successfully enable the shift towards renewable carbon in the chemicals and materials sectors. By addressing these conditions systematically, policymakers and industry leaders can create a robust framework that accelerates the adoption of renewable carbon technologies and practices across the sector. Solutions are already deployed at an industrial scale and many measures can be based on existing rules and standards.

Foundational Definitions and Data Baselines

- → **Clear definitions of renewable carbon and related terminology** are required, based on existing understanding and definitions[6].
- → **Data baselines on availability of renewable carbon,** from biomass, captured carbon and recycling, will become increasingly relevant to identify gaps between sustainable supply and demand.
- → **A holistic understanding of carbon management:** A comprehensive carbon management concept should encompass reducing reliance on carbon, minimising GHG emissions, and replacing fossil-based carbon with renewable alternatives in sectors with long-term carbon needs. Additionally, it should incorporate benefits of substituting fossil feedstock, facilitate the handling of unavoidable emissions, consider ecosystem carbon cycles, and integrate agri-food strategies.

Standards, Certification and Methodologies

- → **Development of robust standards** which provide the baseline for transparent and effective pathway towards a sustainable renewable carbon economy.
- → **Define and enable a mass balance approach** with clear rules and transparency to attribute renewable carbon input to materials and products.
- → **Implement certification and labelling** of renewable carbon are important to ensure robust 3rd party verification and also enable that imports meet the same standards as domestic products.

6 The terminology regarding carbon as feedstock is often not clearly defined, and the RCI has developed a glossary where we have defined various relevant terms according to our understanding: https://renewable-carbon-initiative.com/renewable-carbon/glossary/

Fair and Applicable Sustainability Assessment

→ **Sustainability criteria for renewable feedstock** from biomass, CCU and recycling are needed to ensure environmental safeguarding.

→ **Investigate the environmental impact of fossil feedstock** at the same level of detail as renewable carbon feedstocks to enable fair comparisons.

→ **Establish and refine Life-Cycle Assessment methodologies** for biogenic carbon, CCU and recycling, in particular in combination with mass balance.

→ **Involve future scenarios and sensitivity analysis in sustainability assessments** to better enable future-oriented policy, that can consider factors with significantly changed future impacts, like the energy system or agriculture.

Financial and Economic Measures

→ **Invest in research and innovation:** To drive the transition to renewable carbon, significant investment in research of new technologies and processes is crucial. This includes advancing carbon capture and utilisation technologies, developing new bio-based materials, and improving recycling technologies.

→ **Financial support for upscaling** through instruments like the Innovation Fund, the Strategic Technologies for Europe Platform (STEP), the Industrial Decarbonisation Bank or declaration of an "Important Project of Common European Interest" (IPCEI).

→ **Effectively address the externalities of fossil carbon** through a combination of carbon pricing mechanisms, targeted subsidies, and policy instruments like renewable carbon targets or tax credits (on national level, but enabled by the EU) while simultaneously phasing out support for fossil-based carbon.

Enabling Technologies and Infrastructure

→ **Develop necessary infrastructure and supply chains** for renewable carbon sources is essential for scaling up their implementation, utilisation and scale-up. This includes transportation networks, storage facilities, hubs, and processing plants for biomass and recycled materials.

→ **Ensure hydrogen availability** because it plays a crucial role particularly for CCU and biomass conversion. To fully leverage its potential, it is essential to integrate the hydrogen strategy with carbon management, which will avoid underestimating the demand for renewable hydrogen and ensure its availability for various industrial processes in the transition to a low-carbon economy.

→ **Facilitate carbon capture** as a key technology to enable net-zero and carbon circularity. Carbon capture should also be supported for virgin fossil carbon capture as long as it continues to enter the technosphere, to reduce barriers for upscaling of the technologies. Reduced reliance on fossil feedstock should be tackled explicitly (e.g. through a high-level commitment to defossilisation), but not on the back of carbon capture technologies.

Develop Lead Markets and a Robust Regulatory Framework (Main Focus of this Publication)

- **Holistically integrate renewable carbon considerations across regulations:** when carbon use is unavoidable, alternatives from renewable carbon should be prioritised. EU policy should account for carbon demands from diverse sectors, including future needs, while working to increase the availability and affordability of renewable carbon.
- **Implement market-pull mechanisms for renewable carbon:** shift consumption patterns towards renewable and more sustainable materials by creating market-pull mechanisms for renewable carbon in chemicals and materials.
- **Discourage the use of fossil resources:** gradually discourage the use of fossil resources through a potential combination of measures, including the removal of existing subsidies, incorporating the external costs of fossil resource use into pricing mechanisms, and increasing the price for greenhouse gas emissions.
- **Creating a level playing field between energy and materials:** incentives between energetic and material use of carbon need to be balanced, addressing the existing non-level playing field between energy, transport and chemicals and derived materials.

Stakeholder Engagement and International Cooperation

- **Educate and engage stakeholders:** A comprehensive strategy should include efforts to educate and engage various stakeholders, including industry, policymakers, and the public, about the importance and benefits of transitioning to renewable carbon sources.
- **Foster international cooperation:** Given the global nature of climate change and industrial supply chains, international cooperation is vital. This includes aligning standards, sharing best practices, and coordinating efforts to scale up renewable carbon solutions globally.
- **Public acceptance:** Raising awareness and fostering societal support in the wider public will increase acceptance for renewable carbon solutions and consumer demand.

Relevant Stakeholders that Should be Involved

Defossilisation of the chemical industry requires a collaborative effort involving a wide range of stakeholders to ensure a successful and sustainable transition. Key stakeholders that need to be involved in European-centered discussions on defossilisation include:

- **European Commission:** As the executive arm of the European Union, the Commission plays a crucial role in proposing and implementing policies related to defossilisation. It is responsible for developing strategic frameworks and actionable plans, such as the Transition Pathway for the Chemical Industry. The following DGs are particularly relevant to the chemical industry: GROW, ENV, CLIMA, RTD, AGRI, ENER, MOVE, SANTE.
- **European Parliament:** Ensures democratic oversight and stakeholder representation, essential for the adoption and approval of legislation.
- **European Council:** Provides high-level endorsement and drives consensus among Member States and their interests, essential for the adoption and approval of legislation.
- **National Governments:** Member States' governments are essential for implementing EU-wide strategies at the national level and adapting policies to local contexts. They also play a key role in providing funding and creating a supportive regulatory environment.
- **Stakeholders from all Carbon-dependent Industries:** This includes not only chemical companies but also downstream industries that rely on chemical products, such as the automotive, construction, and consumer goods sectors. Their involvement is crucial to understanding the wider implications of defossilisation across value chains.
- **Research Institutions and Academia:** Universities and research centres are essential for driving innovation in alternative feedstocks, new production processes, and technologies that enable defossilisation.
- **Civil Society & NGOs:** These organisations provide valuable perspectives on the environmental and social impacts of defossilisation strategies and can help ensure that the transition is just and equitable.
- **Renewable Carbon Providers:** Companies developing innovative solutions to provide renewable carbon as feedstock or intermediates whether from biomass, carbon capture, or recycling technologies – are key to enabling the technical aspects of defossilisation.
- **Investors and Financial Institutions:** Their support is crucial for funding the significant investments required for transitioning to defossilised production methods.
- **Consumers:** As end users of chemical products, consumer preferences and demands can drive market shifts towards more sustainable options.

By involving this diverse group of stakeholders, discussions on defossilisation can benefit from a range of perspectives, expertise, and resources, leading to more comprehensive and effective strategies for transforming the chemical industry.

Overview of RCI's Policy Proposals

1. Overarching Commitment on Defossilisation
To create a clear vision and target of where Europe wants to go, and provide a baseline that every future regulation can be kept accountable upon.

2. Targets for Renewable Carbon in Chemicals and Materials
To achieve meaningful progress in defossilising the chemicals and materials sectors, we propose introducing mandatory targets for renewable carbon use.

3. Adapt the EU ETS and the CBAM
To enable a systemic shift by pricing embedded fossil carbon and incentivising renewable alternatives. The CBAM ensures that imports are subject to the same rules.

4. Facilitating Waste as a Feedstock
To maximise waste utilisation as feedstock, essential for achieving circularity.

5. Enabling Local Access to Renewable Carbon
To enhance local access to renewable feedstocks and strengthen resilience.

6. International Trade of Renewable Carbon
To secure sustainable supply chains for critical raw materials and forge partnerships.

7. Balance Regulatory Framework Between Energy and Materials Using Renewable Carbon
Create a level-playing field and enable synergies between the sectors.

8. Financial Support for theTransition
To maintain industrial competitiveness while boosting the transition to renewable carbon.

9. A Renewable Energy and Defossilisation Pact
To accelerate the transition to renewable energy with reliable storage and incentivise defossilisation.

10. A Carbon Utilisation Trading System (CUTS)
To complement existing emissions trading mechanisms by focusing specifically on embedded carbon used in the chemicals and materials sectors.

To effectively accelerate the transition to renewable carbon, it is essential to systematically address the sector's most pressing challenges. By clearly aligning each identified problem with targeted solutions, this approach not only highlights the complexity of the transition but also demonstrates a pathway for coordinated action. The following table presents a structured overview, pairing key obstacles with corresponding policy proposals designed to drive meaningful progress.

Identified Problem	Proposed Solution(s)
Lack of Reliable Vision to Reduce Dependency on Fossil Feedstock in Chemicals and Materials	Overarching Commitment on Defossilisation
Missing Market Demand for Renewable Carbon	Targets for Renewable Carbon in Chemicals and Materials
Embedded Fossil Carbon not Adequately Priced	• EU Emission Trading System (ETS) and Implementation of Carbon Border Adjustment Mechanism (CBAM) Adaptation • A Carbon Utilisation Trading System (CUTS)
Limited Access to Non-fossil Raw Materials	• Facilitating Utilisation of Waste as a Feedstock • Enabling Local Access to Renewable Carbon Feedstock • International Access to and Trade of Renewable Carbon Feedstock
Non-level Playing Field Between Energy and Materials in Allocation of Renewable Carbon	Balance the Regulatory Framework Between Energy and Materials Using Renewable Carbon
High Costs and Investment Barriers for Transition to Renewable Carbon	Financial Support for the Transition
Need for a Rapid Transition to Affordable Renewable Energy with Reliable Storage	A Renewable Energy and Defossilisation Pact

The accompanying figures provide a dual framework for advancing renewable carbon transition. Figure 3 maps policy proposals to critical systemic levers – such as access to feedstock, market demand, and regulatory balance – illustrating their interconnected role in reducing fossil dependency. Figure 4 focuses on addressing the implementation gap, outlining how targeted policies bridge early innovation (e.g., pilot projects) to scaled market solutions (e.g., industrial deployment) by aligning financing, infrastructure, and international collaboration. Together, they visualise a structured pathway from strategic design to real-world impact.

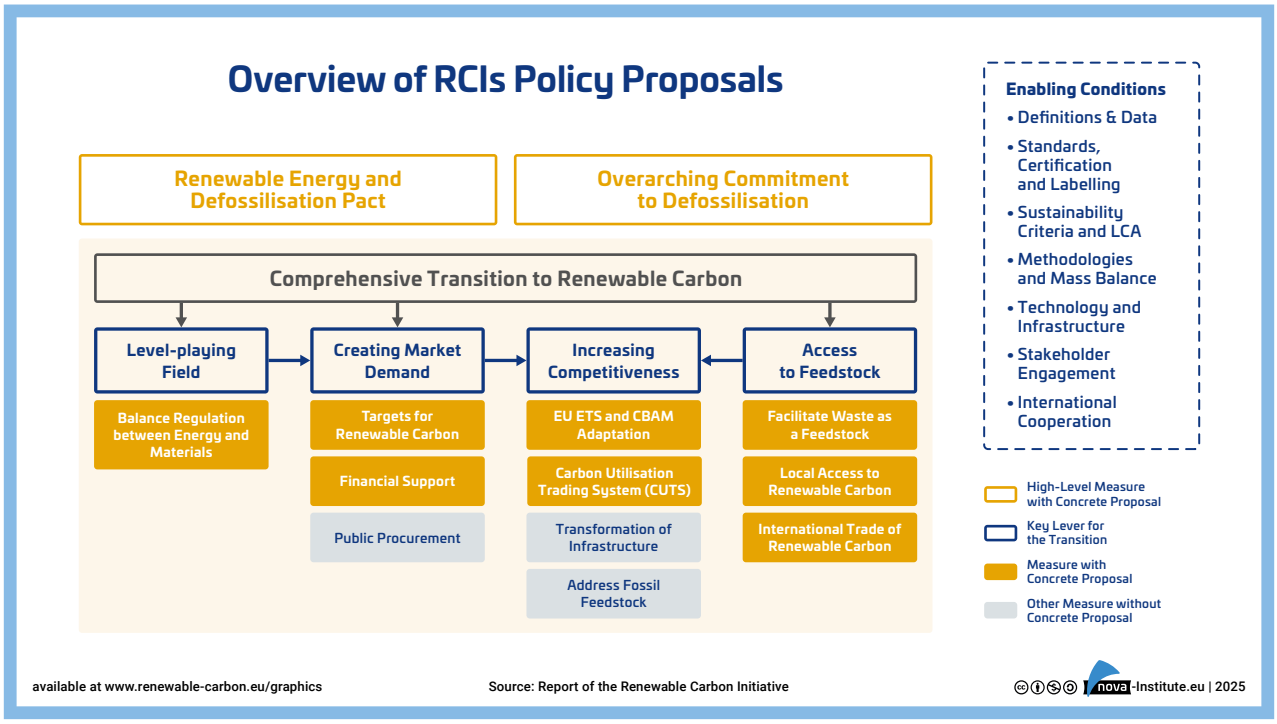

Figure 3: Overview of policy measures to enable a comprehensive transition to renewable carbon.

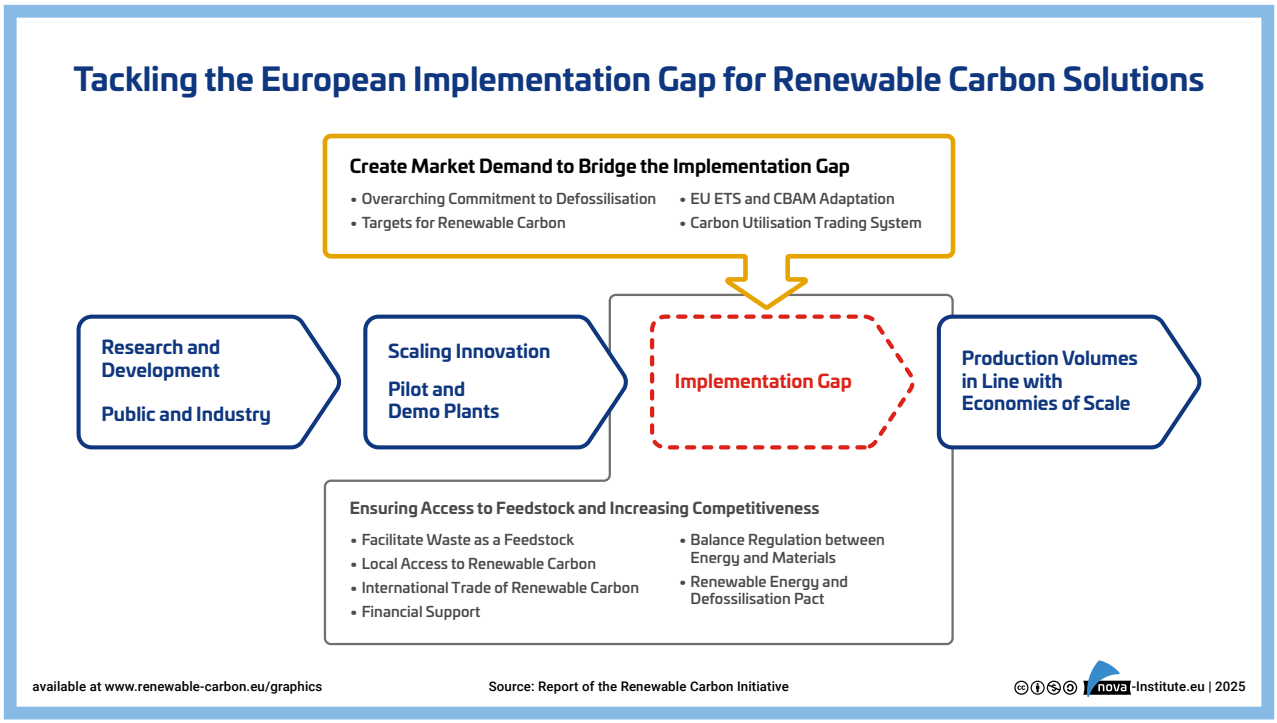

Figure 4: Impact of creating lead markets and demand for renewable carbon solutions specifically tackle the implementation gap.

Policy Proposal 1

Overarching Commitment to Defossilisation

In Brief

- **Measure:** Strategic high-level document to substantiate an EU commitment to defossilisation – analogous to climate change or renewable energy commitments.
- **Impact:** A clear path towards defossilisation; confirmation of political will; basis for innovation and implementation; accountability; resilience of European industries.

Rationale

While there is widespread agreement that defossilisation of carbon-dependent sectors is relevant to reduce carbon emissions and achieve net-zero targets, there is also still pushback when it comes to enabling the individual pillars of biomass, CCU and (advanced) recycling. The EU has successfully implemented high-level targets in climate change (e.g., 2030 and 2040 climate targets) and energy transition. These targets have provided a clear framework and pathway for subsequent legislation, funding mechanisms, and Member State-specific action plans. For a successful transition to renewable carbon, the EU should establish a similar high-level commitment on **defossilisation.**

Measure

1. **A Shared Understanding of Defossilisation** – among EU policymakers, Member States, and the public.
2. **Differentiation and Prioritisation of Decarbonisation and Defossilisation** – where carbon is not a necessary feedstock, feasible decarbonisation processes should be prioritised.
3. **Official Definition of Renewable Carbon Feedstocks**[7] that can replace fossil carbon – which are already widely established as biomass, CCU and recycling.
4. **A Comprehensive Set of Sustainability Criteria** for the renewable carbon feedstocks, from biomass, CCU and recycling.
5. **Determination of a Clear Vision** that is both ambitious yet achievable, balancing environmental goals with global competitiveness. These discussions should include sector-specifics, targets and their measurement, milestones, frameworks covering imports, and timelines.

7 Renewable carbon entails all carbon sources that avoid or substitute the use of any additional fossil carbon from the geosphere. Renewable carbon can come from the biosphere, atmosphere or technosphere – but not from the geosphere. Renewable carbon circulates between the biosphere, atmosphere and technosphere, creating a carbon circular economy.

Impact

An overarching commitment to defossilisation aligns seamlessly with the EU's current policy focus, particularly the upcoming Clean Industrial Deal, the EU Competitiveness Compass, and the Sustainable Carbon Cycles Communication. Such a commitment, enshrined in a **strategic high-level document,** would provide a clear pathway and vision for Europe's future, guiding the continent towards a sustainable transformation while fostering industrial resilience and ensuring future competitiveness. A high-level commitment enables alignment and harmonisation across regulations, but also allows for individual solutions between industries and the different carbon sources, which each come with their own set of challenges but need to be developed simultaneously.

Once such a high-level commitment has been established, **actual implementation will follow through full integration into future policy** (potentially through incentives for the use of renewable carbon, penalties for the use of fossil carbon, support for innovation and project funding, etc.), **a robust impact assessment** (assessment of environmental, social, and economic impacts) and **comprehensive stakeholder involvement** (including industry leaders, policy-makers, researchers, and the public) through transparent communication and cooperation.

Policy Proposal 2

Targets for Renewable Carbon in Chemicals and Materials

In Brief

- **Measure:** Introduce regulation that defines targets mandating the use of renewable carbon in chemicals and materials.
- **Impact:** Planning security for the industry; market demand for renewable carbon products; defossilisation of chemicals and materials.

Rationale

Our reliance on fossil feedstock depletes limited resources, pollutes the environment, drives climate change, harms biodiversity and creates dependency on third countries. The urgent need to address climate change and environmental degradation demands a fundamental shift in how we source and use carbon in our industrial processes, with defossilisation as one key lever to enable sustainability. In the existing policy landscape and considering successful examples that initiated transitions in the past (e.g. renewable energy), targets that mandate renewable carbon use in chemicals and materials represent a strategic and effective approach to drive this transition. Mandatory targets are a prescriptive regulatory measure, and several significant aspects should be discussed for proper implementation, but they are likely the central option for defossilisation for several key reasons:

- **Proven Effectiveness:** Studies on climate change show that many policy interventions fail to bring significant change. Quotas, while prescriptive, are a powerful tool for achieving large-scale change in complex systems, as evidenced by the success of renewable energy and fuels.
- **Market Failure Correction:** The current market dynamics heavily favour fossil-based feedstocks due to their established infrastructure and artificially low prices that don't account for environmental externalities.
- **Level-playing Field:** Quotas would establish fair competition with other carbon-dependent sectors, such as aviation, where the transition away from fossil sources is already strongly supported.
- **Clarity and Reliability for Industry:** Quotas offer clear and reliable guidance, enabling industry to plan long-term and make substantial commitments to renewable carbon.

Principally, there are two options on how to implement targets on renewable carbon through policy: either via a high-level regulation to provide an overarching framework and long-term direction for defossilisation policy, or by implementing targets via more specific regulations, e.g. for specific sectors or products. Potentially, both options could of course be combined, with the former providing an overall goal, and the latter providing more specific, tailor-fit implementation measures. For both options it remains key that all renewable carbon sources are stimulated simultaneously.

Measure

Option 1 – Establish Defossilisation in a New or Upcoming High-level Regulation

The first option is to focus on developing, adopting and implementing an EU-wide regulation which sets targets for renewable carbon in chemicals and materials, focusing on clear, phased milestones to stimulate market uptake. Key aspects of implementing renewable carbon quotas through a high-level regulation are outlined in the following:

Determine Realistic Targets for Renewable Carbon and Defossilisation

- **Establish a Realistic Initial Target:** To allow industry to transition to renewable targets, the quotas should start at a level that is close to the **current status quo (e.g. for the entire EU chemicals sector, it is 5.5%[8]).**
- **Gradually Increase the Targets:** following examples from the energy & fuels sectors and CCS, the EU should consider a more granular increase of targets than usual, with many (e.g. yearly) milestones towards a 2050 vision. While targets provide a clear direction, 5-yearly intervals create difficulties for companies in matching production with significant upward jumps from one year to the next, leading both to over- and undersupply.
- **Strong Targets are a Possibility:** The aviation industry, which competes for renewable carbon feedstocks, has already implemented ambitious targets for sustainable aviation fuels (SAF). These targets start at 6% in 2030 and progressively increase to 70% by 2050, demonstrating the feasibility of setting substantial goals for renewable carbon utilisation. However, learnings from the SAF targets should be applied, for example enabling flexibility mechanisms to counter short-term overproduction.

Consider Implementing a New High-level Regulation or Enshrining Defossilisation in an Existing High-level Regulation

- **New Regulation,** e.g. through a Renewable Carbon or Sustainable Carbon Regulation[9]:
  - Conduct an impact assessment to evaluate potential economic, social, and environmental impacts.
  - Public consultation to gather inputs from stakeholders.
  - Draft a proposal, which could be part of upcoming actions under the Clean Industrial Deal, for example the Chemicals Industry Package or the Industrial Decarbonisation Accelerator Act (IDAA).
- **Existing Regulation:**
  - Targets for renewable carbon could be enshrined in the ongoing legislative process amending the EU Climate Law to include a climate 2040 target.
  - The EC will be responsible for putting forward a legislative proposal, to be expected after adoption of the Clean Industrial Deal.

8 https://renewable-carbon.eu/publications/product/the-renewable-carbon-initiatives-carbon-flows-report-pdf

9 Renewable carbon entails all carbon sources that avoid or substitute the use of any additional fossil carbon from the geosphere. Renewable carbon can come from the biosphere, atmosphere or technosphere – but not from the geosphere. Renewable carbon circulates between the biosphere, atmosphere and technosphere, creating a carbon circular economy.

- **Define Consequences / Penalties** for not achieving the proposed milestones to ensure compliance:
  - The European Commission would set overarching rules and guidelines, with Member States being responsible for establishing specific national rules.

Examples of Potential Targets for Renewable Carbon

Implementing quotas for renewable carbon can be applied across various sectors, for example:

Chemical Feedstocks

Targets for renewable chemical feedstocks, including alternative naphtha, ethanol, methane, and methanol derived from biomass, CO_2, and chemical recycling.

Packaging Materials

Introduce targets for recycling and bio-based shares in packaging materials to reduce waste and increase sustainability.

Automotive Sector

Implement targets for renewable materials and biocomposites in the automotive industry, focusing on recycled, bio-based plastics, and natural fibre reinforcement.

Hygienic Products

Set targets for bio-based shares in hygienic products, including bio-based plastics and cellulose fibres.

Textile Sector

Establish targets for recycled and bio-based shares in textiles, encompassing recycled materials, natural fibres, cellulose fibres, and biosynthetics.

Detergent, Body Care, and Cosmetics

Introduce targets for bio-based shares in these products, focusing on new bio-based building blocks.

New Bio-Based Building Blocks

Implement targets for organic acids and their downstream products, which can serve as foundational components for various industries.

Asphalt

Set targets for bio-based shares in asphalt, particularly focusing on lignin.

CO_2-based and Chemical Recycling

Encourage the substitution of existing petrochemical products with targets for CO_2-based and chemically recycled alternatives, starting with initial shares. This approach allows in principle for a 1:1 substitution of all existing petrochemical products.

Measure
Option 2 – Adapting Existing Regulation

Adapting Existing Regulations to Introduce Quotas for Renewable Carbon

Amending existing regulation can be an efficient way to use and finetune existing frameworks, making implementation quicker, less resource- and cost-intensive, and more likely to be accepted by building on established rules. This provides continuity and consistency and may generally face less political resistance.

- **Ecodesign for Sustainable Products Regulation (ESPR)**
- **Food Contact Materials Regulation**
- **Cosmetic Products Regulation**
- **Detergents Regulation**
- **Packaging and Packaging Waste Regulation (PPWR)**
- **Fertilising Products Regulation**
- **End-of-Life Vehicles (ELVR)**
- **Textile Labelling Regulation**

We propose focusing initially – and only as a starting point – on the ESPR, the PPWR and the ELVR due to their broad applicability and/or timely relevance:

ESPR

- Covers a wide range of products; including chemical intermediates and end-use products like chemicals, plastics, textiles, detergents and lubricants.
- Has recently come into force and will be fine-tuned in the future through the Ecodesign Forum, working plans for the adoption of ecodesign requirements and implementing acts to refine the ESPR framework.

PPWR

- The packaging sector is highly relevant, with established reuse, collection and recycling systems for high circularity.
- Already includes recycled content quotas.
- Regulation is new and expected to be adopted soon.

ELVR

- Addresses the entire life-cycle of vehicles.
- EC proposal includes a 25% recycled content target for plastics in new vehicles.
- Current legislative proposal under review by EP and Council.

Key Steps to Implement Renewable Carbon Quotas in ESPR and PPWR

ESPR

Entered into force on 18 July 2024; primary objective is to improve the sustainability and circularity of products. It establishes guidelines and benchmarks across several dimensions, including product durability, reusability, resource efficiency and carbon footprint. A key feature is the introduction of a Digital Product Passport for detailed information on the sustainability performance of products.

Introduce renewable carbon as a horizontal ecodesign requirement (through the Ecodesign Forum and the first working plan). Renewable carbon content could be added as a specific ecodesign requirement (Article 5).

Identify specific intermediate and end-use products where renewable carbon most relevant (e.g. chemicals, lubricants, detergents, paints, textiles).

PPWR

Adopted in early 2025. The new regulation tackles growing waste, harmonises internal market rules and promotes the circular economy. It sets minimum recycled content targets for single-use plastic beverage bottles (30% by 2030, 50% by 2040), and contact sensitive packaging (10% by 2030, 25% by 2040) and other plastic packaging (35% by 2030, 65% by 2040).

Facilitate chemical recycling to meet recycled content targets. The PPWR is in principle technology-neutral, but aspects like the definition of high-quality recycling or application of mass balance should be clearly addressed.

Review technological development and environmental performance of **bio-based plastic packaging,** incl. the establishment of sustainability requirements, with the target of integrating bio-based plastics into the EU circular economy strategy.

ELVR

Proposed on 13 July 2023; aims to improve the quality of end-of-life treatment, incentivise reuse, and make the most efficient use of resources. It covers the entire cycle from design and production to end-of-life treatment and mandates 25% recycled plastic use in new cars. In February 2025, the EP proposed lower targets (15–20%) and inclusion of post-industrial and bio-based plastics.

Facilitate chemical recycling to meet recycled content targets. The ELVR will likely follow definitions of the PPWR, but chemical recycling should be recognised as a technology to meet recycled content targets.

Review technological developments and environmental performance **of bio-based and CCU-based plastic in cars,** building on the PPWR process.

Develop specific, progressively increasing renewable carbon targets for the identified products together with relevant stakeholders.	Also consider a similar **inclusion and review of CCU-based plastic packaging.**	**Amend the proposal to include bio-based and CCU-based plastics targets,** potentially through hybrid targets, as proposed by the EP.
Add renewable carbon to the Digital Product Passport, (Article 7-13, Annex III), **which will also require independent third-party verification.**	**Include bio- and CCU-based targets to complement recycled content targets,** with options for joint and individual quotas. In particular Article 7 (Recycled Content for Plastics Packaging) could be amended to refer to renewable content.	Consider including renewable carbon content as **a criterion in circular design requirements of vehicles** (Article 6) or **inclusion of renewable carbon metrics in the DPP for vehicles** (Article 9).
Include an assessment of renewable carbon targets in the review by 2030.	**Include an assessment of renewable carbon targets** in the next review.	**Include an assessment of renewable carbon targets** in the 2027 feasibility study.

Impact

Introducing clear, phased targets for renewable carbon in regulation in carbon-dependent sectors is a critical step towards defossilisation and sustainable carbon cycles. By fully engaging with stakeholders, balancing feedstock and product-level targets, regulation can drive the industry toward defossilisation while maintaining flexibility and fairness.

- **Increased Market Demand and Competitiveness for Renewable Carbon Products:** By setting clear quotas and targets for renewable carbon, regulation will drive demand for alternative feedstocks, levelling the playing field between fossil-based and renewable carbon options. This will make renewable carbon products more competitive in the market.
- **Clear and Stable Planning Security for the Industry:** Targets in regulation provide long-term transparency and certainty for businesses by setting clear, increasing requirements of renewable carbon. This allows companies to make strategic investments in renewable technologies and infrastructure, knowing that the market demand will be supported by policy.

- **Reduction of Fossil Fuel Dependence:** As industries begin integrating renewable carbon feedstocks at increasing levels, there will be a substantial reduction in the use of fossil-based carbon, which in turn will also lower greenhouse gas emissions. Over time, this will contribute significantly to meeting climate targets and reducing the carbon footprint of major sectors such as chemicals, textiles, and automotive.
- **An Enabling Framework Fostering Innovation and Diversification:** The measure promotes technological openness and encourages the use of various renewable carbon sources (e.g., bio-based, CCU, recycled carbon). This will drive research and development across different technologies and methods, as companies compete to meet the quotas using the most efficient, sustainable approaches.
- **Synergies Between Sectors:** Renewable carbon quotas for chemicals and materials can establish synergies with the aviation sector and their quotas on SAFs, e.g. through shared feedstock demands driving economies of scale, efficient use of side-streams, infrastructure alignment and overall investment in and development of technology.
- **Compartmentalise Complexity:** Develop sector and product-specific quotas (in ESPR) and packaging-specific quotas (in PPWR) to address and manage industry complexity.

Timeline

Option 1 – Defossilisation in a New, High-level Regulation

The timeframe for developing new EU regulations is typically 18 to 36 months, depending on complexity, stakeholder consensus, and urgency. This includes preparation and consultation (3–6 months), proposal drafting by the Commission (3–6 months), trilogue with the EP and the Council (6–12 months), and adoption of a final text (3–6 months). Correspondingly, a potential timeline would be:

2025–2026

Impact Assessment and trilogue for preparation, drafting, and adoption of the regulation, potentially within the Chemicals Industry Package, the Industry Decarbonisation Accelerator Act, or the amendment of the Climate Law.

2027–2030

Practical implementation of the regulation across EU member states.

2030–2050

Gradual scaling up of quotas, with regular reviews to ensure alignment with sustainability and net-zero goals by 2050.

Timeline
Option 2 – Adapting Existing Regulation

ESPR

2025 Establish the **Ecodesign Forum** as part of the ESPR implementation and begin developing the **ESPR Working Plan.** Introduce renewable carbon as a key horizontal criterion across carbon-based product categories.

2025 Adoption of the **ESPR Working Plan,** formalising renewable carbon targets as part of the regulatory framework.

2026 Publication of the first **Delegated Act** for **Digital Product Passports (DPPs),** specifying detailed requirements for renewable carbon content.

2027 **DPP requirements** enter into force, ensuring that products meet renewable carbon criteria and enabling traceability through the product lifecycle.

PPWR

2025 Finalisation and formal adoption of the PPWR – ensure inclusion of chemical recycling.

2025 –2026 Conduct a thorough review of **technological advancements** and **environmental performance** of bio-based packaging, while initiating similar reviews for **CCU-based packaging.**

2026 Issue clear recommendations on the integration of **bio-based** and **CCU-based packaging** into the PPWR framework, setting the stage for future amendments.

2027 –2028 Leverage the **mid-term review** of the PPWR as a key opportunity to introduce formal amendments that incorporate bio-based and CCU-based packaging quotas into the regulation.

ELVR

2025 Finalisation and formal adoption of the ELVR.

2025 –2026 Conduct a review of **technological advancements and environmental performance** of bio-based packaging, while initiating similar reviews for **CCU-based packaging.** This should be well-aligned with or following the review outcomes of the PPWR process and aligns with recent EP proposals.

2026 Onwards Delegated acts may be adopted to set targets for renewable content in plastics, which should be jointly agreed through involvement of expert groups and stakeholder consultations.

Aspects to Consider when Implementing Targets

Ensure Sustainable Feedstock Availability

sufficient sustainable sourcing and supply of renewable carbon is critical so that targets ramping up over time can be reliably met. This requires and understanding of overall availability, considerations on sustainability criteria for biomass, captured carbon and recycling, and reliable certification within and outside of the EU.

- → **Model and calculate availability of renewable carbon** from recycling, biomass and CCU.
- → **Establish sustainability criteria** that are equally applied between sectors.
- → **Clarify demand of sectors** that need carbon as a feedstock.

Create Transparency and Auditability in Tracking Renewable Carbon

- → **Implement proper carbon tracking mechanisms,** such as the digital product passport and chain of custody certification of renewable carbon.
- → **Address potential carbon leakage** and ensure a level-playing field between local producers and imports through transparent tracking systems.

Collaborate with Relevant Stakeholders

In order to effectively drive the integration of renewable carbon across different industries, it is crucial to engage relevant stakeholders to jointly develop targets on renewable carbon. This ensures targets are realistic and achievable for each sector, but also scientifically sound, fostering commitment to their adoption. This collaboration should:

- → **Empower Stakeholders:** The actual sector and product-specific quotas should be determined together with industry and other interested stakeholders.
- → **Discuss Sector-specific Pathways:** Form sector-specific working groups to discuss tailored and realistic pathways and timelines, e.g. for textiles, automotive, and packaging, considering with each sector's unique potential and challenges. For this, sector-specific working groups might be a functional tool.
- → **Examples:** include major streams like producers of chemical building blocks (naphtha, ethylene, propylene), municipal waste incineration and their emissions, or even much more specific graphite, which can also be derived from carbon capture.

Joint, Separate or Hybrid Targets

With renewable carbon, different pillars (biomass, CCU and recycling) unite under one holistic target (defossilisation). This means that there is a certain bucket of renewable carbon demand to fill as overarching target, but how to fill the bucket is another question. In this context, a decision needs to be taken whether a target on renewable carbon should be a joint target (all feedstocks count towards the same target) or involve separate targets for the different pillars of renewable carbon (bio-based, captured carbon, and recycling). Joint and separate targets could be combined into hybrid targets, e.g. with an ambitious overall target and minimum targets for biomass, CCU and recycling[10]. RCI believes that in terms of implementation, the focus in the short term should be on setting the ambitious overarching target. In the medium term, more specific sub-targets or minimum thresholds for different renewable carbon sources (bio-based, captured carbon, and recycling) can be developed. Long-term planning should include regular reviews and adjustments to strategies for meeting the overall target based on technological progress and market conditions. But this aspect should be discussed openly with all stakeholders, and we want to add a few pros and cons of each option to the discussion below:

→ **Joint Targets:** A single quota for all renewable carbon sources, including bio-based, CCU-based and recycled carbon.

- Simplifies administration and maintains technological openness.
- Market will decide / find the most economic/efficient solutions.
- Encourages innovation by allowing industry to choose the most appropriate feedstocks based on their needs and technological capabilities.
- May not fully take into account the unique requirements and potential of different feedstocks, potentially leading to uneven progress across sectors.
- May face resistance from stakeholders in favour of or invested in a specific option.

→ **Separate Targets:** Setting separate quotas for bio-based, CCU-based and recycled carbon allows for more accurate tracking and management of each type of feedstock.

- Supports the specific development of each renewable carbon source.
- Enables prioritising between renewable carbon options.
- Ensures that all types of renewable carbon are supported and scaled.
- May be more complex to manage.
- Undermines maximising the most economic option.
- Might face resistance from stakeholders concerned of watering down (mechanical) recycling.

→ **Hybrid Targets:**

- Encourages innovation by allowing industry a certain level of flexibility in their defossilisation strategy.
- Provides flexibility.
- Can enable prioritisation of recycling in line with the waste/resource management hierarchy while acknowledging that recycling alone will not be able to defossilise the industry.
- May be more complex to manage depending on the granularity of the targets.

10 Comparable to the joint target for Sustainable Aviation Fuels with a minimum target for Synthetic Aviation Fuels

Decide on Which Stage of the Value Chain to Implement Quotas and Targets

Targets could be implemented at various stages of the production process, with the most realistic options either at the feedstock (input) level or at the final product (output) level, depending on the specific sector and regulatory context. The focus on the origin can lead to carbon leakage and deindustrialisation if not properly tackled by supporting measures. RCI considers product-level target to be more effective, as this directly creates market-pull, but again we believe this should be openly discussed with all stakeholders. Again, we want to provide some arguments in favour and against the different options below:

→ **Feedstock-level Targets:** Implementing quotas at the feedstock level means setting requirements based on the input of carbon feedstocks. This approach has a number of advantages, but also some disadvantages:

- **Simplicity and Control:** Simpler administration and verification focused on raw materials.
- **Industry-wide Coverage:** Covers the entire chemical industry and derived products.
- **European Production:** Applies directly to European production, using existing infrastructure.
- **Feasibility:** Modest feedstock quotas (e.g., 15%) can achieve higher renewable carbon content in final products (e.g. due to recycled input on product level).
- **Responsibility Entirely on Producers:** Producers would be solely responsible for achieving the feedstock targets and would be left with the additional costs.
- **Challenging for Product Imports:** With a target at feedstock level, imports of products would need to claim their share of renewable carbon feedstock, which can be difficult to verify transparently and reliably.

→ **Product-level Targets:** Alternatively, quotas at product-level focus on the renewable carbon content of products placed on the market. This approach has its own merits and challenges:

- **Market Incentives:** Creates market pull for renewable carbon products along the entire value chain, balancing out the additional costs.
- **Green Premium Financing:** Can help to spread the higher costs associated with green premium for renewable carbon along the value chain.
- **Import Regulation:** Minimises potential issues with imports of counterparts by focusing the target of renewable carbon on final products.
- **Sectoral Flexibility:** Allows for specific targets across different sectors, providing flexibility to cater individual circumstances.
- **Avoids Value Chain Complexity:** by focusing on final products, the complexities of the chemical value chain can be mostly avoided.
- **Challenging Monitoring:** In contrast to the rather simpler level of monitoring at feedstock level, the much more complex and diverse product level would provide challenges in monitoring shares of renewable carbon.

→ **Discuss Classification of Feedstocks and Products:** To what extent are intermediates considered? At which part of the value chain is the target calculated when multiple feedstocks are subsequently added? Where does feedstock classification end and product classification begin?

Policy Proposal 3

EU Emission Trading System and Carbon Border Adjustment Mechanism

In Brief

- **Measure:** Enable the EU Emissions Trading System (ETS) to facilitate a shift to renewable carbon, focusing on Carbon Capture and Utilisation (CCU).
- **Impact:** CCU would be properly acknowledged in regards to its impact on mitigating greenhouse gas emissions and substituting the need for virgin fossil carbon.

Rationale

The European Union's Emissions Trading System (ETS), complemented by the Carbon Border Adjustment Mechanism (CBAM), is the EU's main Greenhouse Gas (GHG) emission reduction measures. In general, only fossil emissions is subject to the EU ETS, while atmospheric/bio-based carbon is exempted – in line with the general understanding that atmospheric/bio-based carbon are principally net-zero by balancing out original uptake with end-of-life emission. But the ETS is mainly targeting large point-source emissions, which means that the fossil carbon embedded in chemicals and materials is currently out of scope and not subject of an emission cost at end of life. With ETS 2, mainly targeted at fuel combustion in transport, buildings and smaller industries, and the upcoming 2026 revision, aiming to include emissions from products end-of-life (municipal waste incineration and landfills), this loophole might potentially be minimised or closed.
When it comes to carbon capture as a tool to avoid emissions, the ETS currently only incentivises CCS and CCU for "permanent chemically bound" products, meaning mineralisation. In both cases, the captured carbon is exempted from being counted as an emission, providing a clear, financial incentive to apply carbon capture. But for any other captured carbon – independent of further utilisation – surrender obligations still apply.

In recent years, there is an increased understanding that the transition of carbon-dependent industries from fossil carbon to renewable carbon (circular carbon economy) is necessary, and that CCU will play a prominent role in this transition. The European Commission has started to revisit CCU in the ETS, both for permanent storage not only via mineralisation, and also for other non-permanent utilisations. A full integration of CCU in the ETS could provide a relevant boost to this pillar, and provide incentives for use of CCU-based carbon as a feedstock in carbon-dependent sector – recognising that captured carbon substitutes virgin fossil feedstock, and help to achieve truly circular carbon economies.

Measure

Ensuring that also embedded fossil carbon is fully captured in the ETS will require to include the value chain where emissions from chemicals and derived materials occur, in particular referring to end-of-life of material products (municipal waste incineration, landfilling) and aviation fuels (kerosene).

Revision of the ETS (2026)[11]

The revision will set new rules and deadlines for ETS quotas, review the accounting method for non-permanent CCU products and assess the potential inclusion of municipal waste incineration (MWI) in the scope of the ETS. This has been confirmed by the Clean Industrial Deal: *"Measures will be developed to acknowledge the use of captured carbon in a wider range of products, and prevent double counting of embodied carbon emissions, should waste incineration be included in the EU Emission Trading System (ETS)".*

- **In Theory, an Economy-wide Carbon Price for Fossil Feedstock Would be a Systemic Solution:** The possibly most efficient solution would be to price all fossil feedstock when it enters the economy, automatically covering all process emissions no matter where they occur, with CBAM levelling the playing field for imports of products and fuels. This could be for example realised via a fossil carbon tax, theoretically an elegant solution but which can create significant issues, in particular for industries that are still heavily reliant on fossil carbon today.
- **The Practical Approach – Integrate a Carbon Loop View in ETS:** Embedded fossil carbon in chemicals and materials is currently not subject to ETS (because the actual emissions mainly occur outside of ETS boundaries), while the CO_2 captured from an ETS installation and used for chemicals and polymers is considered as emitted and has to be paid under current ETS regulation. The ETS should integrate a carbon loop view that acknowledges the benefits of capturing emissions and keeping carbon in a cycle. This would lead to incentives for CCU in non-permanent products like chemicals and plastics. It should further include end-of-life sectors like MWI, through which it also starts accounting for embedded carbon in products and their end-of-life emissions.
    - **Implement a Methodology that Provides Benefits for CCU also in Non-permanent Applications:** While with CCU – compared to CCS – at some point an emission will take place and needs to be accounted for, the technology is critical to enable circularity of carbon and substitutes the use of virgin fossil feedstock. A potential option for consideration is the carbon intensity label to be developed within the IDAA.
    - **Include Embedded Fossil Carbon in the ETS:** Municipal waste incineration (MWI) is a significant source of greenhouse gas emissions. In particular, it covers emissions from many day-to-day products which are manufactured from chemicals and derived materials, and which are not covered in the ETS as of yet. By inclusion of MWI, the embedded fossil carbon in most products would be covered at end-of-life. This would enable allowances for CCU in the ETS, as CCU-based products could largely no longer leave the system. An item for consideration is to distinguish between fossil and non-fossil shares of incinerated waste.

11 July 2026: Review clauses in Art. 30 of the ETS directive: Art. 30(5c): Accounting method for non-permanent CCU products and Art. 30(7): Potential inclusion of municipal waste incineration in the scope of EU ETS starting from 2028

- **Discuss Point of Pricing of Captured and Utilised Emissions:** Emissions that are captured and used can lead to another emission at end-of-life of the CCU-based product. The ETS needs to ensure that no emission is unaccounted for, but also that no double counting occurs. For CCU-based products, a critical discussion is whether the original (and captured) emission or the final emission should be accounted and priced for. This can either happen upstream (first emission) or downstream (last emission). Upstream pricing incentivises capture; downstream pricing is consistent with life-cycle emissions accounting. These discussions need additional considerations on consistency with LCA methodologies.
  - RCI believes that **payment by the end user** provides the most elegant solution and adheres to the "polluter pays" principle.
- **Ensure there are Similar Incentives to Apply CCU for Synfuels as well as for Chemicals and Products:** The quotas in aviation provide a strong incentive to produce Sustainable Aviation Fuels via CCU, but there is no comparable mechanism for CCU-based products and MWI.

- **Potential Conflict Between CCU and CCS Applications** post-2040: As the EU ETS might become a system where negative emissions are a source for certificate origination after 2040, there might be a potential conflict between CCU applications and CCS applications.
  - DACCU/BECCU vs. DACCS/BECCS compete for atmospheric/biogenic CO_2, but the latter would receive certificates for negative emissions.
  - Potentially, this might pose a risk of prohibitively high prices for chemical sector feedstocks from biomass and the atmosphere.

Carbon Border Adjustment Mechanism (CBAM)

The ETS in its current form has caused reduced emissions in the EU, but also migration of energy intensive industries out of the EU (carbon leakage). The CBAM introduces a carbon tax on products manufactured outside Europe, initially including cement, iron, steel, aluminium, fertilisers, electricity and hydrogen, to minimise carbon leakage. Full enforcement for the initial sectors is foreseen for 2026.

- **Acknowledge the Need to Include Embedded Carbon in the CBAM:** The CBAM needs to include embedded carbon in chemicals and materials, not just direct emissions, to ensure fair competition and address carbon leakage. The announced comprehensive CBAM review by the European Commission should include such an assessment.
- **Utilise 2027 Review Window to Include Chemicals and Polymers:** the 2027 review should be used to assess the effectiveness of the CBAM and expanding it to cover organic chemicals and polymers. This must furthermore apply to all value chain steps up towards end products to avoid circumvention.
- **Monitor and Improve CBAM Design to Avoid Carbon Leakage and Unfair Advantages of Imports:** to avoid carbon leakage and avoid advantages for imports not subject to the regulation, the CBAM needs to be closely monitored during the transition phase and ensure that there is no evasion of the CBAM upwards/downwards the value chain. This might require postponing the phase out of free ETS allowances for impact industries if implementation is ineffective.

Impact

Integrating CCU and MWI into the ETS and CBAM would:

- **Enhance Carbon Management:** Provide a comprehensive approach to managing carbon by including both temporary and permanent CCU applications, and incorporating MWI emissions.
- **Boost CCU Adoption:** Encourage the use of CCU technologies by providing clear incentives and financial benefits.
- **Promote Fair Competition:** Address embedded carbon in imports, ensuring a level playing field for EU and non-EU producers.
- **Advance Circular Economy Goals:** Support the transition to a circular carbon economy by recognising and incentivising the use of renewable carbon feedstocks.

Timeline

2025

Start of the public consultation for the ETS revision, transition period of the CBAM ends 2025. Publication of a comprehensive CBAM review report by the EC to assess the scope of the CBAM extension.

2026

Revise the ETS to integrate incentives for CCU in non-permanent applications and assess the inclusion of municipal waste incineration (MWI). Full enforcement of CBAM for initial sectors begins.

2027

Implement ETS incentives for CCU and MWI, and use the review window to evaluate and potentially expand the CBAM to cover additional sectors, with a focus on organic chemicals and polymers.

Policy Proposal 4

Facilitating Use of Waste as a Feedstock

In Brief

- **Measure:** Implement a harmonised EU framework that facilitates a maximised utilisation of waste streams in Europe.
- **Impact:** Boost waste availability and accessibility to achieve significant recycling rates for a functional circular carbon economy.

Rationale

To advance towards a circular and sustainable economy, Europe needs to maximise the use of its limited resources. Increasing circularity by converting waste streams to feedstocks for recycling will effectively keep more carbon in the cycle. Recognising waste as a valuable resource is a central goal of the circular economy. However, current waste management practices and regulations often hinder the efficient use of waste as a feedstock, due to insufficient integration with recycling systems and regulatory barriers. Furthermore, a significant share of European waste is still exported outside of Europe. Addressing these issues is crucial to improving access to waste as a feedstock for the chemicals and materials sectors and enhancing the circularity of European industries. The Clean Industrial Deal puts a significant focus on circularity, which now needs to be followed up with concrete action. The planned Circular Economy Act in 2026 should therefore consider the following measures.

Measure

Create Harmonised End-of-waste (EOW) Criteria

There is a discrepancy between the overall understanding that waste is a source of valuable feedstock, but at the same time the definition claims that something ceases to be waste as soon as it is considered a feedstock. A harmonised, clearly established transition process from waste to feedstock would help to facilitate the transition from waste to feedstock.

- **Work on EU-wide Harmonised EOW Criteria – Focused on Textiles and Plastics – is Actively Ongoing**[12] and final recommendations should be transferred into relevant regulation like the EPSR or the WFD.

12 EU-wide end-of-waste criteria for plastic waste, technical report by JRC (November 24): https://publications.jrc.ec.europa.eu/repository/handle/JRC139303

Minimise Export of Waste Outside of Europe

Despite increasing efforts (e.g. through the recent Waste Shipment Directive), the EU is still exporting a significant share of its waste. This is largely because the treatment in Europe is more expensive than the export. The EU is working on several aspects in regard to minimising waste export, and we highlight key measures that likely create the highest impact:

- **Strengthen Regulations and Enforcement** (e.g. ensuring that only waste that cannot be processed or recycled can be exported)
- **Invest in Domestic Recycling Infrastructure** (e.g. improving sorting and collection)
- **Promote Market Demand for Recycled Materials** (e.g. through recycled content targets, aligned with renewable carbon targets)
- **Implement Extended Producer Responsibility** (to hold producers accountable for their products also at end-of-life)

Maximise Access to Waste as Feedstock in Europe

- **Enhance Waste Sorting and Quality Control:** investment and implementation of advanced sorting technologies enables more homogenous waste streams and ensures higher purity and quality of recyclables.
- **Enable Chemical Recycling (and Mass Balance):** Chemical recycling technologies are vital processes to maximise carbon circularity, as they enable conversion of complex waste streams and can handle contaminated waste streams that are otherwise not economically or technically recyclable.
  - **Maintain and Transfer Technology-openness** of PPWR to other relevant regulations like ESPR, ELVR, WFD etc.
  - **Fine-tune Differentiation and Potential Hierarchy** of chemical recycling technologies.
- **Clarify CCU in Waste Hierarchy:** In the existing waste hierarchy, CCU is not clearly positioned. Incineration of a waste is usually considered as energy recovery, but with CCU the carbon fraction of the waste can be reprocessed into substances and materials. Within the waste hierarchy, this positions CCU on similar footing as recycling, or on an intermediate level between recycling and recovery. By properly including CCU in the waste hierarchy as a recycling technology, waste incineration could be turned into an additional pathway of providing access to certain fractions of waste.
- **Continue to Minimise or Fully Remove Landfilling:** minimising landfill helps to increase access to waste by diverting more materials from landfills to recycling facilities. Through the EU Landfill Directive, the EU already demands from Member States that 10% or less of total municipal waste is sent to landfills by 2035. This could be complemented by targeted actions on wastes that usually end up in landfill, and how they could be alternatively treated. As a long-term vision, no waste should be landfilled, instead it should be treated via mechanical or chemical recycling, or incinerated with carbon capture.

Encourage Collection of Agricultural and Forestry Residues and Waste

Economically unviable crop residues, animal manure and processing waste from agriculture often remain unused on the field and could be made available with some effort. While a certain share should remain on the field for nutrient supply and soil health, farmers should be incentivised to collect surplus residues and wastes and make them available for industrial use. It is assumed that relevant shares of such residues can be utilised without negative impacts[13], which in turn could provide significant bio-based volumes as a feedstock.

- **Research Residue Availability for Industrial Utilisation,** by considering local soil situations, regional climate, residue types, economic requirements, etc.
- **Create Local Infrastructure / Hubs:** Efficient systems for collecting and sorting agricultural residues, forestry residues and wastes provide the foundation for their industrial use and increase stability and overall quality of the biomass collected. Located in larger agricultural areas for biomass or in industrial parks for CCU, hubs could serve to collect waste and residues from farmers, and then sort and process it to be transported to industry. The CID proposes "Trans-Regional Circularity Hubs", which could promote smart specialisation and economies of scale for recycling.
- **Involve and Educate Stakeholders:** Farmers, entrepreneurs and policy-makers need to be aware of the utilisation possibilities of their residues and wastes, and should be supported by best practice guidance.
- **Amend the CAP with Considerations on Residue Management:** e.g. through an eco-scheme for residue collection, modification of the GAEC standards to include residue management guidelines, payment schemes for residue collection, market development support via CAP Funds, financing of hubs or knowledge transfer via the Farm Advisory System (FAS).
- **Harmonise Wood Waste Classification Schemes Across Member States:** Across national waste wood schemes, there is generally agreement on an untreated / mechanically processed wood, but some divergence in classification of surface treated wood, chemically treated wood containing hazardous substances, etc.

Remove Barriers in Cross-Border Transport of Waste

Member States employ different definitions and categories for waste, which complicate the ability to balance supply and demand for waste across regions. Currently, discrepancies in waste classifications across Member States create barriers to the cross-border trade and transport of waste materials, leading to underutilisation of waste resources.

- **Continue to Harmonise Waste Classifications Across EU Member States:** Establish harmonised waste classifications across Member States including a harmonised definition for end-of-waste of plastics. The recent Waste Shipment Directive includes measures to harmonise waste classification, but further fine-tuning, e.g. on end-of-waste of plastics or hazardous waste is still necessary. A common framework for waste categorisation would ensure consistency and simplify cross-border trade and transport, facilitate better management of waste resources, and enhance scalability of recycling technologies.

13 E.g. Fu, B., Chen, L., Huang, H., Qu, P., & Wei, Z. (2021). Impacts of crop residues on soil health: a review. Environmental Pollutants and Bioavailability, 33(1), 164–173. https://doi.org/10.1080/26395940.2021.1948354

- **Streamline Cross-border Transport:** Create a streamlined regulatory approach to facilitate cross-border trade and transport of waste materials. This involves aligning classifications of waste in order to reduce barriers and ensure that waste can move freely across EU boarders.

Strengthen Design for Recycling

Design for recycling can significantly increase access to waste by ensuring that products are easier to recycle and recover valuable materials from at the end of their life cycle.

- **Establish Design Standards and Guidelines:** The Circular Plastics Alliance has been working on designing guidelines and standards to make priority plastic products recyclable. Building on this work, similar standards and guidelines could be developed for other sectors like textiles, non-plastics packaging, automotive and industrial rubber industries, polymers in electronics, or construction.
- **Facilitate Sorting and Recycling of Innovative Materials:** A barrier for innovative, more sustainable materials is their incorporation in the established recycling system. Currently, there is only a limited number of sorted plastics waste streams for the highest volume streams (e.g. polymers like PET, PP or PE, PVC), and a mixed waste stream for everything other of the more than 100 polymers. This hampers the recycling of many known polymers and creates a barrier to introduce innovative renewable carbon materials.

Impact

- **Increased Recycling Rates:** With harmonised waste classification and easier cross-border transport, Europe can increase recycling rates, divert more waste from landfills, and turn more waste into feedstock.
- **Reduced Waste Exports:** Strengthened regulations and investments in local recycling infrastructure will reduce the amount of waste exported outside Europe.
- **More Efficient Use of Waste Resources:** Chemical recycling and advanced sorting technologies, will enable recycling of additional waste and improve access to high-quality recycled feedstock, reducing dependency on virgin fossil carbon.
- **Support for Circular Carbon Economy:** Incorporating CCU into the waste hierarchy will allow more waste streams, such as those from incineration, to be repurposed for industrial use, reducing greenhouse gas emissions and facilitating a circular carbon economy.

Policy Proposal 5

Enabling Local Access to Renewable Carbon Feedstock in Europe

In Brief

- **Measure:** Promote the use of both locally available biomass and captured carbon as renewable feedstocks for the chemicals and materials sectors.
- **Impact:** Enhanced local access to renewable feedstocks from biomass and carbon capture, with benefits for farmers, technological innovation and a reduced dependency on fossil resources.

Rationale

As the EU advances its sustainability goals, local access to renewable carbon will be essential for meeting the growing demand for renewable carbon and bridging the gap between supply and recycling. Biomass from agriculture and forestry, as well as captured carbon from industrial point sources and direct air capture, are crucial resources for reducing dependency on imported chemical feedstocks. However, sustainable biomass availability faces challenges, and current regulations often prioritise biomass for energy rather than materials. The recently published Vision for Agriculture and Food[14] aims to strengthen competitiveness and attractiveness of the sector, and the bioeconomy and circularity offer a great potential for agriculture, forestry and the entire food system. The upcoming EU Bioeconomy Strategy update (Q4 2025) and the EU Biotech Act (2026) are perfect opportunities to implement the measures below.

Measure

To ensure biomass and captured carbon availability for chemicals and materials, we propose the following measures:

Include First-generation Biomass as a Necessary Part of a Sustainable Feedstock Supply

In recent legislation, first generation crops were not considered as a preferable, sustainable feedstock option, e.g. in aviation and maritime shipping. It is absolutely relevant to find a balance between biomass extraction and sustainability and biodiversity to ensure sustainable agriculture and forestry in the long run. However, mainly focusing on biogenic waste streams and residues will not be sufficient, and highly land-efficient first generation crops should be enabled through sustainable agricultural practices that encompass

14 EC 2025: “A Vision for Agriculture and Food Shaping together an attractive farming and agri-food sector for future generations”, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0075

regenerative practices and resource efficiency. First generation crops can simultaneously provide biomass for food, feed, chemicals, materials and energy. They are essential for several **established industries**[15].

Specifically, the EU should:

- **Support all Types of Biomass:** EU policies – in particular the CAP and material-focused regulations like the ESPR – should embrace industrial use of all types of biomass, including first generation crops, for non-food applications. This should of course be guard-railed by sustainability considerations and certifications, but will promote effective use of biomass for the bioeconomy.
- **Increase Public Awareness:** Educate the public on the benefits and challenges of first-generation biomass to improve perceptions and support its use in materials. Additional growth of food crops – mainly intended for industrial use – can actually increase food security.

Recognise Captured Carbon as a Sustainable Feedstock

Captured carbon, derived from industrial point sources, both fossil and biogenic, and from direct air capture, helps to close loops in carbon circularity and reduce overall greenhouse gas emissions. This is not only true for waste streams containing CO_2, but also for side-streams containing carbon oxides (e.g. in the steel industry or in biomethane processes). To fully leverage captured carbon, it's essential to recognise it as a viable feedstock under the right conditions. Specifically, the EU should:

- **Support the Use of Captured Carbon:** Develop policies that promote the use of captured carbon for various applications, including in the production of chemicals and materials. This support should include acknowledging the role of captured carbon as a sustainable substitute for fossil carbon.
- **Tap into the Potential of Biogenic CO_2 Emissions:** Europe has significant sources of biogenic emissions, e.g. from industrial fermentation processes and the pulp and paper industries. Most of the potential of biogenic emissions remains untapped.
- **Integrate Renewable Hydrogen:** Ensure that Carbon Capture and Utilisation (CCU) processes are coupled with renewable hydrogen at affordable prices. Renewable hydrogen is crucial to ensure that the required energy for using captured carbon does not lead to higher emissions than what was captured via CCU.

Establish Universal Sustainability Criteria for Biomass

The lack of universal sustainability criteria for biomass creates inconsistencies between different use cases.

- **Build on and Align with Existing Criteria:** The RED has clear and established sustainability requirements which should be the harmonised baseline for biomass sustainability criteria in materials. Alignment should also be considered with the EUDR to avoid over-regulation.
- **Develop Comprehensive Criteria:** Develop comprehensive sustainability criteria for all types of biomass, building on existing standards for biofuels and bioenergy, but generally applicable or tailored to the needs of the chemicals and materials sectors.

15 For an in-depth discussion on the topic, please refer to RCIs publication "The use of food and feed crops for bio-based materials and the related effects on food security", published in 2023, https://renewable-carbon.eu/publications/product/rci-paper-on-the-use-of-food-and-feed-crops-for-bio-based-materials-and-the-related-effects-on-food-security-recognising-potential-benefits-short-version-pdf

- **Certification Programs:** Build on the existing robust certification landscape to provide assurance of sustainability.

Clarify Sustainable Supply and Demand of Biomass and Captured Carbon

Biomass is a limited resource, with demand from several sectors – mainly food and feed sectors, bioenergy, biofuels, bio-based chemicals and materials. A missing link is a clear picture of biomass availability within sustainable boundaries in contrast to the total demand from the different sectors.

- **Model and Calculate Biomass and Captured Carbon Availability:** To provide a foundation of how much biomass can be sourced sustainably, modelling can provide a range of results to draw conclusions on. CO_2 Value Europe (CVE) and the European Commission modelled the need for carbon capture, RCI/BIC modelled sustainable biomass availability for chemicals and materials. Modelling on availability should consider future advancements (see next bullet point) and conservation demands (e.g. 30x30 initiative of Biodiversity COP 15).
- **Clarify Demand of Sectors:** To match available biomass with demand, a clear understanding of the individual needs of the different sectors is required. This should also consider which sectors can phase out carbon and which are reliant long-term. For the chemical sector, RCI estimates that the chemical industry will cover 20% of their carbon demand in 2050 (~1.150 Mt C) through biomass, which was verified as feasible by a recent joint modelling exercise from BIC and RCI. RCI and CVE both arrive at similar shares for CCU, with 25% and 30% of the entire carbon demand of the sector covered respectively.

Incorporate Innovation and Modernisation in Agriculture and Forestry

Prospective policy-making should also consider the impact of innovation and modernisation on sustainable biomass availability from agriculture and forestry. The Vision for Agriculture and Food12 also highlights that the opportunities of innovation should be leveraged for complementary sources of income for farmers, and linking agriculture and forestry to chemicals and derived materials provides a significant opportunity in this context.

- **Using Biomass in Chemicals and Materials Creates Significant Value:** Industrial material use of biomass leads to high added value and employment per tonne of biomass.
- **Available Forestry Biomass will Likely Increase:** Reports from large organisations and modelling exercises agree that availability of roundwood and forestry biomass in general increases from 2020 relevantly by 2050[16].
- **Innovations in Agriculture Will Likely Provide Significant Increases in Land-use Efficiency:** The impact of new technologies like precision farming, AI, drones or GMOs can be significant, and increase outputs while having lower environmental impacts. Agro-PV will be increasingly combined to generate additional income and shade agricultural land, as a protective measure of intense heat. In a joint study with BIC, our HighTech scenarios assume that the entire agricultural biomass production increases 36–51% by 2050.

16 FAO. 2024. The State of the World's Forests 2024 – Forest-sector innovations towards a more sustainable future. Rome, FAO.

Promote Equal Access to and Use of Biomass and Captured Carbon

- **Holistically Evaluate Priorities of Biomass and Captured Carbon Distribution:** Prioritise food supply, but ensure fair distribution across sectors through integrated policy frameworks.
- **Address the Non-level Playing Field of Energy vs Materials:** Existing regulation warps the distribution between use cases beyond food in favour of energetic uses, creating a non-level playing field between energy and materials. The RED includes emission reduction targets for energy and transport (that can be fulfilled by use of renewable carbon) and ReFuelEU Aviation Regulation contains quotas for sustainable aviation fuels (from biomass or captured carbon).

Incentivise Temporary Carbon Removals for Useful Applications via carbon markets.

- The substitution of fossil carbon and carbon circularity should be two aspects that are positively reinforced by policy.
- Regulatory framework could be adapted in the LULUCF Regulation, in the EU ETS, in the CRCF or via voluntary carbon markets.

Integrate Primary Producers into Bio-based Value Chains, as they are often not fully involved in bio-based value chains.

- **The bioeconomy can contribute to mitigate production and income risks of farmers and foresters,** by reducing costs, valorising side-streams and wastes, and generating additional income.
- **Ensure primary producers receive sufficient benefits from their involvement** to create long-term business relations.

Evaluate how Future Developments can Reduce Pressure on Biomass Availability

Sector-specific changes may lower global biomass demand, helping to meet conservation goals and supply needs. Key factors may be:

- **Lower Demand for Solid Bioenergy or Firewood:** The global use of biomass for firewood and bioenergy (e.g., wood pellets) could decrease as sustainable alternatives become more available. This is also a cultural topic with traditional firewood use despite available alternatives.
- **SAF / Marine:** Demand for biomass might be lower in aviation, if synthetic aviation fuels are competitive and cover more than half the share of SAFs, and in shipping, if e.g. ammonia becomes a major transport fuel.
- **Reduced Demand for Feed due to Lower Meat Consumption:** The feed sector is a major biomass user, mainly for the rearing of cattle and milk production. Reduced meat consumption and meat/milk alternatives might significantly reduce feed demand.

Impact

- **Increased Local Resource Utilisation:** Recognising all types of biomass and captured carbon as viable feedstocks will enhance resource utilisation and reduce fossil dependency.
- **Diversified Feedstock Sources:** Local renewable feedstocks can contribute to a more diverse and secure feedstock mix, reducing dependencies and enhancing sovereignty.
- **Economic Benefits for Farmers:** Developing bio-based local resources and feedstocks can create jobs in agriculture and forestry and diversify and increase their revenue streams.
- **Local Environmental Stewardship:** Communities involved in local feedstock production are likely to be more invested in sustainable practices and environmental protection.
- **Economic Resilience:** Localising feedstock production can increase economic resilience by diversifying local industries and reducing vulnerability to global market fluctuations.
- **Support for the Emerging Carbon Capture Industry:** Increased access to captured carbon can foster the growth of new industries and applications and establish Europe as a technology leader in this field.

Policy Proposal 6

International Access to and Trade of Renewable Carbon

In Brief

- **Measure:** Establish fair, transparent and sustainable trade rules for the import of renewable carbon to meet demand for carbon feedstocks, while ensuring that global partnerships are forged responsibly.
- **Impact:** Secure of a reliable, sustainable supply of renewable carbon by forging new, global partnerships and diversifying sourcing of renewable carbon as a feedstock.

Rationale

Europe's drive towards sustainability and a circular economy relies heavily on the availability of renewable carbon-based raw materials. Europe has traditionally been strong in refining raw materials and manufacturing products for export. Due to its high population density, and comparably limited agricultural area, the domestic supply of renewable carbon will likely be insufficient to fully meet industrial demand. In this context, international access to and trade of renewable carbon will become one important aspect to meet growing demand. Such approaches should explore the potential of global partnerships, the challenges of sustainable trade and the solutions needed to ensure that international trade in renewable carbon is mutually advantageous, fair and environmentally responsible. This fully aligns with one main objective of the Clean Industrial Act, namely to foster global markets and international partnerships.

Availability of Renewable Carbon on a Global Scale: For all renewable carbon pillars, there might be global partners with potential excess of availability, even within sustainability boundaries:

- **Global Biomass Resources are Mainly Located in the Global South:**
  - Studies on the topic conclude that ~70-80% of the world's biomass is located in the Global South, offering significant partnership opportunities for Europe's bioeconomy.
  - Key regions with abundant biomass resources include for example Brazil, South America, Central Africa, India, China, South East Asia, and Canada.
  - This is a sensitive topic and proposition, because in particular the rain forests are threatened by deforestation. But if those with sustainable practices are rewarded access to the European market, this can help drive positive change, by showing local producers that sustainable business can be profitable. This is e.g. happening with biofuels producers that must comply with RED-III in order export to the EU and discussed in recent regulations like the EU Regulation on Deforestation-Free Supply Chains.

- **Direct Air Capture is Most Efficient with Affordable, Abundant Renewable Energy:**
  - Technologies such as Direct Air Capture (DAC) and solar energy can also contribute to the renewable carbon supply. In vicinity of Europe, in particular Northern Africa and Southern Europe are areas with significant sunshine and comparatively affordable solar power. Globally, many more regions will be able to combine DAC with affordable solar energy, including the US, China, Central America and Australia.

- **The EU Could Help Solve Global Waste Issues by Importing and Recycling Specific Waste Streams:**
  - While rather hypothetical – the business case currently is rather exporting waste instead of importing it – Europe could consider to become an importer of specific waste streams from regions that struggle to deal with these streams. Examples might be hazardous and contaminated wastes, which are potentially landfilled in other regions, and where import to Europe and chemical recycling might offer proposition to sustainably deal with these waste streams.

Measure

Determine Transparent, Fair, and Sustainable Trade Rules for Renewable Carbon

The EU should take the lead in setting clear international trade rules that include strong environmental and sustainability criteria.

- **Create a Biomass & Renewable Carbon Observatory:** Establish a central EU observatory to gather and analyse data on global biomass, CCU, and waste availability and their sustainability. This would provide evidence-based guidance for policymakers in managing renewable carbon imports.
- **Establish Fair Trade Rules:** Develop international trade agreements that enforce rigorous environmental, social, and sustainability standards. This should include adopting globally accepted certification systems that ensure renewable carbon feedstocks are sourced sustainably.
- **Use Free Trade Agreements (FTAs) to Ensure Sustainability:** Include binding sustainability and social safeguards in all FTAs to ensure that imported feedstocks meet EU environmental standards, particularly in areas like deforestation and biodiversity.
  - The just agreed trade agreement between the EU and Mercosur could ensure that imports of biomass, sugar crops, critical raw materials, and similar are subject to stringent sustainability criteria and monitoring

- **Critically Assess Sensitive Imports:** Building on the EU Deforestation regulation and potentially leveraging the CSRD (omnibus), evaluate the potential environmental and social risks of importing sensitive feedstocks, such as biomass from rainforests. Ensure that EU trade practices do not contribute to environmental degradation or social conflict in exporting regions.

Strengthen and Diversify Global Partnerships Through Trade of Renewable Carbon

The list of companies that extract fossil feedstock is limited. Biomass, captured carbon and waste are potentially available from every region of this world, and in particular from some regions that have so far only limited connection to raw material extraction in the field of chemicals and carbon-based materials. The EU could look to create new or strengthen existing partnerships – for example by investing and supporting built-up of infrastructure and skills in the partner regions in exchange for trade agreements – while diversifying their portfolio to reduce dependencies and bottlenecks.

- **Forge New Global Partnerships:** New partnerships with different regions across the globe can be envisioned, for example combining PV expansion in Northern Africa in combination with Direct Air Capture for methanol generation, with biomass-rich countries of the global South, in South America, Africa or Southern Asia, or with countries with less systematic waste collection and recycling systems.
- **Strengthen Existing Partnerships:** Free trade agreements and partnerships are already in place with a significant numbers of non-EU countries and regions, and these partnerships could further benefit from a focused exchange of renewable carbon feedstocks, technologies and know-how.
- **Utilise Clean Trade and Investment Partnerships (CTIP):** CTIPs, introduced by the Clean Industrial Deal, aim to better align EU's external action with EU's industrial policy objectives, and focus on better managing strategic dependencies and securing position in crucial global value chains. Renewable carbon should be included in any such CTIPs, as it helps to position in clean-tech and sustainable chemistry and reduces dependency on fossil feedstocks.

Impact

- **Diversified Supply Chains for Renewable Carbon:** By expanding the use of biomass, captured carbon, and waste streams, Europe can reduce its reliance on fossil fuels and increase its resilience to supply disruptions.
- **Increased Global Cooperation:** Strengthening and diversifying global partnerships will enable the EU to secure a stable supply of renewable carbon, while also promoting sustainable development in partner regions.
- **Enhanced Sustainability Standards:** Establishing fair trade rules and certification systems will ensure that renewable carbon imports adhere to high environmental and social standards, minimising ecological damage and social conflict.
- **Reduced Environmental Impact:** Careful assessment of sensitive imports, such as biomass from rainforests, and the use of sustainable technologies like DAC, will prevent deforestation and biodiversity loss, supporting global environmental protection efforts.
- **Economic Growth and Innovation:** Investment in renewable carbon infrastructure and partnerships will stimulate innovation and job creation in both Europe and partner regions, advancing a more sustainable global economy.

Policy Proposal 7

Create a Balanced Regulatory Framework Between Energy and Materials Using Renewable Carbon

In Brief

- **Measure:** Establish a balanced regulatory framework that creates a level-playing field between energy and materials, ensuring renewable carbon is equitably allocated and enabling synergies between the sectors.
- **Impact:** Avoiding lopsided competition for limited renewable carbon feedstock, facilitate transition to renewable carbon in sectors with long-term dependency, foster sustainable carbon cycles, and boost value generation by enhancing the uptake of renewable carbon in high-value material sectors.

Rationale

Over the previous decades, a strong emphasis on renewable energy has led to a non-level playing field between energy and material use of renewable carbon. It would be proportionate to support both the energy and material use of renewable carbon. The **Renewable Energy Directive (RED),** through its greenhouse gas reduction targets, has successfully created demand for renewable energy. The recent regulations **FuelEU Maritime** and **ReFuelEU Aviation** apply regulatory mechanisms that drive demand for renewable carbon as a feedstock for fuels in these sectors.

This has established a framework that only promotes renewable carbon in energy, rather than energy and materials. The current framework in energy and fuels effectively addresses negative externalities of fossil carbon with corrective market mechanisms. This would be also required for chemicals and materials. As a consequence, the price levels for renewable carbon in energy and fuels are higher than in materials, although they rely on the same feedstocks. This runs contrary to the principles of a circular economy and cascading use, which aim to keep materials in circulation and maximise their efficient utilisation. To move towards a circular economy and apply the cascading principle, policy needs to promote renewable carbon also in material applications.

Adapting the existing legislative framework in a way that provides a comparative supporting framework for renewable carbon in materials would create a level-playing field significantly boost the uptake of renewable carbon in chemicals and materials to reach EU climate targets by defossilisation of the resource base.

Measure

In general, the policy framework in energy and transport is much more straightforward than it can be for chemicals and derived materials, since the amount of products to be considered is much more limited. Still, there are different options to balance and expand the impact of the regulatory framework on distribution of renewable carbon:

Ensure a Holistic Approach to Carbon Demand Across Sectors

In every piece of regulation that has a connection to demand of carbon as a feedstock, Policy-makers need to take a holistic look not only at the problems and potential solutions at hand for the sector that is subject to the regulation, but there need to be reflection on and discussion with policy-makers of the other sectors that depend on carbon.

- **Coordinate Relevant Units Across the European Commission:** The economic system surrounding carbon-based products is immense, diverse and complex. The EU should allocate more resources on the matter and ensure that all relevant units of the European Commission are involved in developing policy for renewable carbon, ensuring consistency and addressing the complexities of the carbon economy. When discussions on facilitating renewable carbon for a specific sector (e.g. aviation) or product group (i.e. textiles) are on the table, only by widely including all relevant units working on carbon-dependent segments oversight of consequences can be ensured
- **Strengthen Cross-sectoral Impact Assessments Efforts.** While they are a standard of policy-making, the European Commission should enhance and mandate comprehensive cross-sectoral impact assessments in regulations related to renewable carbon. Interdependencies between sectors using carbon feedstock must be explicitly evaluated, ensuring that policies in one sector do not unintentionally harm another.

Aim for a Balanced Regulatory Framework Between Energy and Materials

Because renewable carbon is a limited and often not-yet competitive resource, policy interventions that aim to enable renewable carbon for chemicals and materials need to reflect that their solutions need to have a comparable impact to the existing framework for energy and fuel to finally establish a level-playing field.

- **Implement Measures with Comparable Level of Strength:** Renewable carbon is a limited resource and often more expensive than fossil carbon – with its inadequate pricing of externalities and subsidies. If market-pull measures between sectors differ in terms of strength, the distribution of the desired feedstock will be strongly skewed in favour of the sector with the stronger incentives.
- **In Context of Existing SAF Targets, Renewable Carbon Targets for Chemicals and Materials Would Provide Real Balance:** As long as the aviation sector is subject to clear targets for sustainable aviation fuels from bio-based and CCU-based feedstocks, any softer measures like public procurement to incentivise renewable carbon in chemicals and materials will fall short in creating change (refer to factsheets on “renewable carbon quotas”).

Apply the Cascading Use Principle

The application of the cascading use principle is mentioned in several pieces of EU legislations, e.g. in regards to the Circular Economy, Sustainable Carbon Cycles, and the Renewable Energy Directive. Principally, cascading use leads to greater added value from the same amount of renewable carbon. While not necessarily applied as a rigid framework, the cascading principle should be considered more holistically starting from virgin feedstock, across sectors and applications, to identify practicable implementation and enforcement and an additional measure towards circularity. Additionally, so far there is also a lack of methods and indicators to measure circularity and in particular cascading use properly.

- **Establish a Joint Understanding of Cascading Use of Carbon-based Products:** in particular between different sectors, understanding of cascading use can differ, and a high-level, joint understanding would help to create a common baseline.
- **Investigate Methods and Indicators for Cascading Use:** identify and evaluate already existing indicators that measure circularity and cascading use with regards to their utility within regulation, and if required, consider developing additional indicators. This also involves considerations on LCA methodology and how cascading use is reflected within LCA.
- **Implement and Enshrine the Cascading Use Principle** through the identified quantifiable indicators and implementation of SMART targets to increase cascading use, based on the developed joint understanding.

Establish Universal Sustainability Criteria Valid Across Sectors

The lack of universal sustainability criteria for biomass – and a wider sense renewable carbon – creates inconsistencies between different use cases, which further cements the non-level playing field and creates an additional barrier for renewable carbon uptake in materials.

- **Comparable Criteria Across Sectors:** Develop comprehensive sustainability criteria for all types of biomass (and again, in a wider sense renewable carbon). Build on the widely established, existing standards for biofuels and bioenergy (from RED), and make them generally applicable or tailor them slightly according to the needs of the chemicals and materials sectors.
- **Certification Programmes for Reliability:** Build on the existing robust certification landscape to provide assurance of sustainability. Recent EU research projects[17] in this field aim to further improve effectiveness and robustness and recommend e.g. harmonisation, policy integration, stakeholder engagement and continuous improvement.

17 Horizon Europe projects Harmonitor, STAR4BBS, SustCert4BioBased

Impact

The impacts of a level-playing field between the energy and material use of renewable carbon would be significant:

- **Improved Resource Allocation:** Renewable carbon feedstocks, such as biomass and captured carbon, are needed both in energy and chemicals and their derived materials sectors, fostering the gradual defossilisation of both at a similar pace.
- **Addressing all Sectors with Long-term Need of Carbon as a Feedstock:** By creating a level-playing field to renewable carbon feedstocks between energy and materials, those sectors with a long-term need for carbon as a feedstock – like chemicals, derived materials or aviation fuels –can be defossilised in order to enable net-zero targets.
- **Facilitating Sustainable Carbon Cycles:** a balanced approach between energy and materials promotes the efficient use of carbon in a circular system. This prevents premature incineration or energy use of carbon-based materials, extending their lifecycle through cascading use, reuse and recycling – helping close the carbon loop and reducing net emissions.
- **Boost Value Generation:** By levelling the playing field, value creation from renewable carbon is optimised. Materials and products derived from renewable carbon have higher value-added potential compared to one-time energy use and extend the life-cycle / duration carbon stays in the technosphere. This supports economic growth by expanding the bio-based market, creating jobs, and fostering new business models and innovations in high-tech sustainable materials.
- **More Resilient Supply Chains:** Diversifying the end uses of renewable carbon would reduce overdependence on fossil fuels, enhancing the resilience and flexibility of Europe's carbon supply chains.

Policy Proposal 8

Financial Support for the Transition

In Brief

- **Measure:** Establish comprehensive financial support mechanisms to enable the transition to renewable carbon in the chemicals and materials sectors.
- **Impact:** Create price parity between renewable and fossil carbon while supporting technology development, scaling and infrastructure.

Rationale

The transition to renewable carbon requires massive investments in technology development, scaling, and construction of new facilities. Currently, the high costs of renewable carbon options compared to fossil alternatives, combined with long development and construction timelines, create significant barriers to investment. For example, planning and construction of large commercial chemical plants alone takes 6-10 years. As highlighted in the Letta and Draghi reports, the EU needs approximately €340 billion over the next 15 years to decarbonise (and defossilise) its four largest carbon-intensive sectors, including chemicals. This investment is crucial for maintaining European industrial competitiveness while achieving sustainability goals. With the recently unveiled Competitive Compass, the EU announced their willingness to address the massive financing needs and aims to present a Strategy on a Savings and Investments Union in 2025, followed by the proposal of an Industrial Decarbonisation Bank in the Clean Industrial Deal.
The following measures would financially support renewable carbon:

Measure

Support Technology Development and Scaling: The development of renewable carbon technologies requires significant investment across all technology readiness levels, from basic research to commercial deployment.

- Provide funding for research, pilot plants, and demonstration facilities.
- Streamline permitting processes for new facilities.
- Create support schemes for first-of-a-kind commercial plants.
- Establish public-private partnerships for defossilising the chemical industry to share development and deployment risks.
- Support the construction of infrastructure needed for new value chains.
- Removal of permitting barriers for industrial transformation projects.

Create Price Parity Mechanisms: To overcome the cost disadvantage of renewable carbon compared to fossil alternatives, financial instruments must be implemented to level the playing field.

- Implement tax incentives or credits for renewable carbon (e.g., reduced VAT rates).
- Phase out fossil fuel subsidies.
- Develop carbon pricing mechanisms that reflect true environmental costs.
- Create dedicated funding instruments for large-scale investments.
- Establish blended finance approaches combining public and private capital.

Enable Infrastructure Investment: Large-scale infrastructure development is crucial for enabling the transition to renewable carbon and requires coordinated investment across multiple sectors.

- Fund strategic infrastructure projects.
- Prioritise upscaling of renewable carbon plants in programs like the Innovation Fund.
- Designate key infrastructure projects as Important Projects of Common European.
- Prioritise pilot plant infrastructure in Horizon Europe.
- Develop storage and logistics infrastructure for new feedstocks.
- Support development of renewable energy infrastructure.
- Create industrial clusters with shared infrastructure.

Enable Long-term Investment Security: Given the long timelines and high capital requirements of chemical industry investments, creating a stable and predictable investment environment is essential.

- Provide long-term policy certainty through regulatory frameworks (see “high-level commitment to defossilisation”).
- Create guarantees or insurance mechanisms for first-movers.
- Develop standardised approaches for risk assessment.
- Support the creation of off-take agreements.
- Establish clear timelines for fossil phase-out.

Leverage EU Funding Instruments: Existing and new EU funding mechanisms must be optimised to support the transition to renewable carbon across different project stages and scales.

- Expand Innovation Fund support for renewable carbon projects.
- Create dedicated funding windows for the chemical sector transformation.
- Consider new financial instruments for technology scaling.
- Support regional development of renewable carbon hubs.
- Enable better access to EU-wide funding programs.

Explore Diverse Funding Sources: There are different options available to provide relevant funds. These sources could be utilised and adapted to enable funding of renewable carbon. Relevant funding sources include:

- EU mechanisms (Innovation Fund, Industrial Decarbonisation Bank Modernisation Fund, Horizon Europe, InvestEU)
- Member State mechanisms (National Support Programmes, Tax Incentives)
- Public-Private Partnerships (Industrial Alliances, Venture Capital Funds)
- Public investors (European Investment Bank, National Development Banks)
- Innovative financing instruments (Green Bonds, Blended Finance, Carbon Contracts for Difference)
- Market-based mechanisms (Revenues from extended EU ETS, CBAM)
- International cooperation and global climate or sustainability finance

Impact

- Accelerated development and deployment of renewable carbon technologies
- Reduced cost gap between fossil and renewable carbon
- Increased investor confidence in renewable carbon projects
- Creation of new sustainable value chains
- Enhanced competitiveness of European industry

Exploratory Policy Proposal 9

A Renewable Energy and Defossilisation Pact

Affordable Renewable Energy in Exchange for Defossilisation

Note:
This proposal is presented as a food for thought piece or potential policy instrument, recognising the complexity of energy markets and the need for further discussion on implications and practicality.

In Brief

- **Measure:** Companies committing to binding defossilisation targets gain access to renewable energy at competitive rates, with incentives for investment in renewable energy infrastructure.
- **Impact:** Increased competitiveness; accelerated investment in renewable energy and defossilisation; retention of industry in Europe; reduction in Scope 3 emissions.

Rationale

European countries are increasingly exploring and implementing tax exemptions or reduced rates for energy-intensive industries, with Germany leading in interventions to lower electricity levies and fees. This trend is driven by concerns about maintaining industrial competitiveness in the face of rising energy costs, particularly for energy-intensive sectors. The European chemical industry and related sectors face challenges in transforming towards sustainability while maintaining global competitiveness. This idea proposes a pact that requests commitment to defossilisation of the chemical sector in exchange for access to affordable renewable energy. This fully aligns with the European Commission's Competitive Compass, which focuses on decarbonisation as a driver of growth, and the Clean Industrial Deal, which emphasises affordable energy as a key "business driver" for industrial competitiveness. Further, the proposal would complement the ongoing discussions among Member States to reduce grid costs with a transformation pathway.

Measure

Member States, with guidance from the EU Commission, would structure electricity supply costs so that companies in the chemicals and derived materials sectors can purchase renewable electricity at production cost, free of grid costs and other additional charges. Member States would define sector-specific defossilisation targets aligned with EU-wide goals, with input from industry and oversight from the European Commission.

Key elements include:

1. Access to Affordable Renewable Energy:

- Incentivises companies' investments in renewable energy generation and storage.
- Companies can form consortia for renewable energy investments, even across different Member States.
- Cross-border access to renewable energy at production costs is enabled.

2. Commitment to Defossilisation:

- Companies must set binding defossilisation targets, to be approved by Member States and aligned with EU-wide goals, including investment in green technologies such as electric crackers, green hydrogen production, and conversion of biomass, CCU, electrochemistry, and chemical recycling.
- Regular monitoring and reporting could track progress towards defossilisation targets.
- Mechanisms for measuring commitment to defossilisation and penalties for non-achievement to be developed and could include gradual withdrawal of energy cost benefits or financial penalties.

3. Regulatory Alignment:

- **Support competitive pricing:** Establish regulatory measures that ensure companies sourcing energy through the market (without direct investment) still have access to affordable renewable energy. This can be done through contracts for differences (CfDs) or other mechanisms to guarantee price stability and encourage long-term investment.
- **Align with competition law:** Ensure compliance with EU competition law through careful structuring of the pact as a voluntary opt-in program open to all qualifying companies.
- **Consider block exemptions or specific guidelines** for state aid related to this pact.

4. Flexibility and Fairness:

- Recognise differences between Member States in energy prices and renewable energy capacity.
- Ensure the program does not unfairly advantage the chemical industry over other sectors.
- Address potential impacts on renewable carbon availability due to increased bioenergy demand.

Due to the expected significant impact of this proposal, a comprehensive impact assessment should be conducted, covering economic impacts on industry competitiveness and markets, environmental benefits including greenhouse gas emission reductions, social impacts and potential market distortions.

Key Considerations:

Access to affordable renewable energy and storage is a critical enabling factor for the chemical industry's transition.

- The proposal recognises the differences in energy prices between EU Member States.
- While encouraging industry investment in renewable energy, it's acknowledged that chemical companies must balance this with investments in infrastructure and renewable carbon technologies.
- The practicality and potential externalities of this idea require further exploration, including impacts on energy markets and other sectors.

Impact

The proposed idea **integrates renewable energy and renewable carbon** into chemical and material industries, which would strengthen competitiveness, keep production, employment, value creation and innovation in Europe. Through this, it would significantly contribute to decarbonisation and defossilisation as key elements of the green transition (Figure 5).

In particular, the EC would address the following key issues facing the European Union:

- **Accelerate Investment in Renewable Energy:** Encouraging companies to invest in renewable energy will boost Europe's overall renewable energy capacity, further reducing energy and electricity costs for industries.
- **Incentivise Adoption of and Provide Companies Access to Affordable Renewable Energy:** In favourable conditions, solar and wind power can produce electricity for 4–6 cents/kWh. Current industrial prices are often 3 to 5 times higher.
- **Enhance Global Competitiveness:** The chemical industry can produce competitively in Europe, encouraging companies to stay and invest locally.
- **Enable Competitive Defossilisation:** The combination of affordable renewable energy and defossilisation targets will accelerate the adoption of renewable carbon technologies and their scale-up across chemical and materials sectors.
- **Retain and Grow Industry:** The pact makes Europe a more attractive investment destination by reducing energy costs. Companies will be able to invest in their own renewable energy projects, accessing energy at production cost without additional grid fees.
- **Enhancing Resilience:** Reducing dependency on fossil feedstocks strengthens Europe's strategic autonomy against geopolitical risks.

This new carrot-and-stick approach could have a significant impact on overcoming the EU's systemic weaknesses. This approach aims to incentivise investments in both renewable energy and defossilised chemical plants, potentially keeping the chemical industry in Europe and putting the continent at the forefront of defossilisation. It could help reduce Scope 3 emissions and make defossilisation more competitive. However, further analysis is needed to assess its full implications and practicality in the complex European energy market landscape.

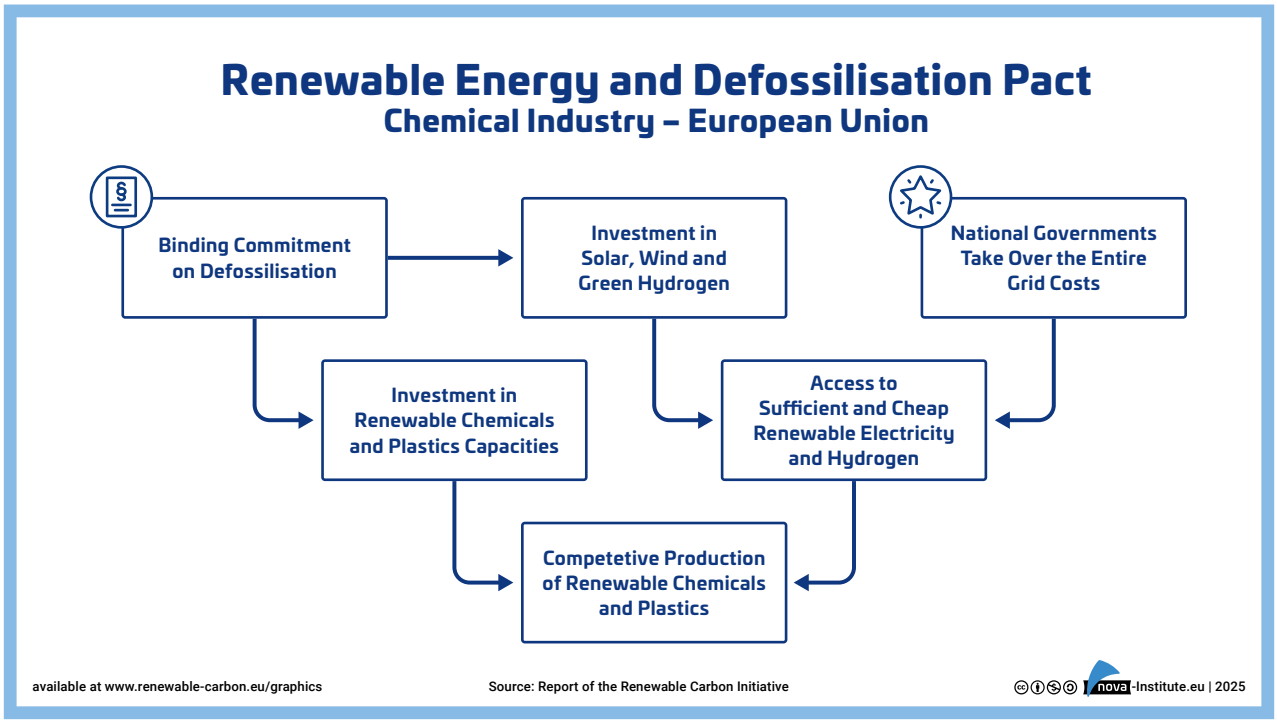

Figure 5: How a pact combining a binding commitment on defossilisation and support for cheap access to renewable electricity facilitate a competitive production of renewable chemicals and plastics.

Exploratory Policy Proposal 10

European Carbon Utilisation Trading System (CUTS)

Note:
This proposal is presented as a food for thought item, recognising the complexity of setting up an entirely novel system analogue to the EU ETS. This proposal was developed by our member Südzucker / CropEnergies, and in particular we want to thank Dr. Wolfgang Kraus for developing this concept.

In Brief

- **Measure:** Establish a European Carbon Utilisation Trading System (CUTS) to promote the transition from fossil to renewable carbon sources in the chemical and materials industries.
- **Impact:** Accelerate defossilisation, enhance competitiveness, drive innovation, and contribute to EU climate goals.

Rationale

The EU's aims to achieve net-zero emissions by 2050 and the long investment cycles in the chemical industry, immediate integration of defossilisation into the policy framework is essential. While renewable carbon from biomass, recycling, and CCU is scientifically recognized as essential for defossilisation in the chemical sector, its economic viability remains a challenge. Fossil carbon remains cheaper than alternatives, creating a barrier to widespread adoption.

The EU Emissions Trading System (EU ETS) has proven effective in reducing greenhouse gas emissions, contributing to a 47% reduction in emissions from power and industry plants since 2005. The EU ETS serves as an excellent role model for similar approaches due to its market-based mechanism that incentivizes cost-effective emission reductions. It has a proven track record of driving innovation in clean technologies and has achieved environmental goals without negatively impacting economic performance. Furthermore, the system's flexibility to adapt and expand to cover new sectors over time makes it a valuable template for addressing challenges in other areas, such as reducing fossil carbon in chemicals.

Instead of adapting the already existing, energy-focused EU ETS to address embedded fossil carbon in chemicals and derived materials, this exploratory proposal suggests the implementation of a novel system to fill this gap – called European Carbon Utilisation Trading System (CUTS), which may however be included in the ETS legislation. CUTS is designed as a market-driven system targeting embedded carbon in products rather than emissions.

Measure

CUTS is **designed to facilitate the transition from fossil-based carbon feedstocks to renewable carbon sources within the chemical and materials industries.** This system builds on the successful framework of the EU Emissions Trading System (ETS) but is tailored specifically for carbon utilisation rather than emissions reduction.

Distributors of consumer goods are obliged to disclose the carbon content of their products and to purchase carbon utilisation certificates ("CUTS certificates") for this. These certificates are comparable to ETS certificates in the energy sector, but only apply to the chemical/material use of carbon in consumer products. One CUTS certificate corresponds to one tonne of fossil carbon bound in products, for example. This type of CUTS certificate can be regarded as a "fossil" CUTS certificate. Similar to the ETS, the EU can reduce the number of certificates in order to increase the incentive to use renewable carbon from biomass, recycling and/or CO_2 by increasing the price of materially utilised carbon.

In parallel, any producer that introduces renewable carbon into the material value chains (these can be bio-based base chemicals, intermediate products such as recyclates or CCU-based products) can receive free CUTS certificates from the EU for the provision of renewable carbon. The production of renewable carbon and its material utilisation must be verified and monitored through a robust system. These types of certificates can be labelled as 'renewable' CUTS certificates and marketed by the producer of the renewable chemicals or intermediate products to distributors of consumer goods, who in turn can use them to cover the carbon content of their products. The revenue generated for the EU through the sale of certificates should be used to cover the system costs. Revenues that go beyond the system costs can be used to reimburse distributors of consumer goods that push for a change in the system by either purchasing renewable CUTS or by demonstrating a closed value chain from in entry of the renewable carbon into the values chains to the final product via all steps in between.

Unlike the EU ETS, this system targets the end of the value chain, focusing on consumer goods rather than raw materials. This way, CUTS addresses a key ETS limitation, where costs on raw materials are not fully passed through supply chains, raising concerns about European industries' competitiveness.
At the same time, CUTS maintains international competitiveness by excluding EU exports and applying only to consumer goods sold within the EU. Imported fossil-based consumer goods require certificates, while renewable imports can qualify for free certificates if their origin and use are verified.

Key Elements of CUTS:

- **Strategic Placement in the Value Chain:** The requirement for certification will be strategically placed at the end of the value chain, targeting product manufacturers rather than raw material producers. This approach reduces bureaucratic burdens on basic chemical producers while ensuring that costs are passed on to consumers, who ultimately drive demand. It also allows for more efficient implementation and monitoring of the system.
- **Certification System:** The EU issues two types of certificates for embedded carbon in products, similar to how emissions allowances are handled in the ETS. The amount of required embedded carbon (both fossil and renewable) will be determined and for this volume CUTS-certificates will be handed out by a responsible trading authority. The sum of certificates conforms to the volume of embedded carbon needed.

  - Fossil CUTS Certificates: Mandatory for embedded fossil carbon, these are sold to product/brand owners.
  - Renewable CUTS Certificates: provided free to producers introducing renewable carbon into value chains.
  - The amount of sold certificates will be gradually reduced over time, increasing their cost and incentivising renewable alternatives.

- **"Book-and-Claim" Tracking of Renewable Carbon:** The mechanism described is a so-called 'book-and-claim' system modelled on Energy Attribute Certificates (EACs), an effective market-based approach that has sustainably boosted demand for renewable energy. The fact that producers of renewable carbon products receive a marketable CUTS certificate makes it possible to offset the additional costs associated with higher raw material costs. In this way, the use of renewable carbon becomes increasingly economical. The proposed system thus incentivises both increased demand for renewable carbon ('market pull') and increased supply ('market push').
- **Dynamic Market Pricing:** The system will allow for dynamic pricing based on market supply and demand, avoiding politically set prices. The gradual reduction in available certificates over time will create a rising price trend, incentivising the shift to renewable carbon. This market-driven approach will ensure that the transition is economically viable and responsive to industry needs.
- **Compliance and Penalties:** A penalty mechanism will be put in place to ensure compliance. If companies cannot present sufficient certificates for their products, they will incur penalties and must purchase additional certificates. This mechanism will encourage investment in renewable carbon solutions and drive the transition towards sustainable practices
- **Import and Export Considerations:** The system will address import and export to maintain a level playing field. Fossil-based imports will have to purchase certificates, renewable carbon-based imports would receive free certificates that could be sold within the system. Exports from the EU will not require certificates, maintaining competitiveness on the global market.
- **Revenues can Incentivise Further Defossilisation:** It could be considered that brand owners receive an incentive for the acquisition of "renewable" certificates through the revenue pool of the trading office, creating a genuine incentive system. The additional revenue could be used, for example, to grant buyers of "renewable" CUTS certificates a partial refund for the 'renewable' CUTS certificates. This would additionally incentivise the material/chemical use of renewable carbon in order to further accelerate the sustainable transformation. As an alternative a refund may be only be granted if a closed value chain from entry of the renewable carbon to the final product can be demonstrated. This would incentivise the building of fully renewable value chains.
- **Separation from EU ETS:** While the system can leverage existing ETS structures, it will remain distinct to ensure that transformations in the chemical sector are not overshadowed by larger energy sector dynamics. This separation allows for tailored pricing strategies necessary to drive change within each sector independently.

Impact

By implementing CUTS, the EU can address these challenges comprehensively, driving the transition to a sustainable, climate-neutral economy while maintaining industrial competitiveness and innovation leadership. Specific impacts include:

- **Accelerated Transition to Renewable Carbon:** By implementing CUTS, the EU will drive a faster shift from fossil-based to renewable carbon sources in the chemical and materials industries. This will significantly reduce the reliance on fossil feedstocks, contributing to the EU's climate goals and promoting a more sustainable industrial sector.
- **Enhanced Market Dynamics:** The system will create a dynamic market for carbon credits and Guarantees of Origin, fostering competition and innovation in renewable carbon technologies. This market-driven approach will help identify the most cost-effective and efficient solutions for defossilisation.
- **Improved Environmental Integrity:** CUTS will ensure that carbon utilisation is properly accounted for and verified, reducing the risk of greenwashing and enhancing the credibility of sustainability claims in the chemical and materials sectors. This will lead to more transparent and environmentally responsible practices across industries.
- **Increased Competitiveness:** By providing clear economic incentives for investments in renewable carbon technologies, CUTS will foster early adoption of sustainable solutions. Companies that adapt quickly to the new system will gain a first-mover advantage in developing sustainable products and processes.
- **Stimulated Innovation:** The system will drive research and development in renewable carbon technologies, fostering innovation across the entire value chain. This could lead to breakthroughs in areas such as bio-based materials, carbon capture and utilisation, and advanced recycling technologies.
- **Reduced Carbon Leakage:** By focusing on end-products rather than raw materials and addressing import/export considerations, CUTS will minimise the risk of carbon leakage. This ensures that EU climate efforts do not simply result in the relocation of carbon-intensive industries to regions with less stringent regulations.
- **Enhanced Supply Chain Transparency:** The requirement for carbon balance reporting will increase transparency throughout the supply chain, allowing consumers and businesses to make more informed decisions about the products they purchase and use.
- **Contribution to Circular Economy Goals:** By incentivizing the use of recycled materials and promoting the development of more sustainable products, CUTS will significantly contribute to the EU's circular economy objectives, reducing waste and promoting resource efficiency.

RENEWABLE CARBON INITIATIVE

Bio-based CO_2-based Recycling

Circular Economy

Shape the Future of the Chemical and Material Industry

WHY JOIN RCI?

RCI is an organisation for all companies working in and on renewable chemicals and materials – plastics, composites, fibres and other products can be produced either from biomass, CCU or recycling. RCI members profit from a unique network of pioneers in the sustainable chemical industry, creating a common voice for the renewable carbon economy.

To officially represent the RCI in Brussels, the RCI is registered in the EU's transparency register under the number 683033243622-34.

LinkedIn:
www.linkedin.com/showcase/renewable-carbon-initiative
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Executive Managers:
Christopher vom Berg & Michael Carus
Contact: Verena Roberts
verena.roberts@nova-institut.de

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RCI Scientific Background Reports

- **Policy Proposals for Facilitating the Transition to Renewable Carbon** – April 2025
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RENEWABLE CARBON INITIATIVE

Bio-based CO_2-based Recycling