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CO2SMOS

Solutions for a circular biobased industry

D1.6 CO_2SMOS REGULATORY INVENTORY

CO_2 Value Europe

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Executive Summary

The CO_2SMOS *Regulatory Inventory* (D6.1) provides an overview of challenges that the CCU concept behind CO_2SMOS may encounter when targeting scale-up and deployment at a larger scale. Some of these challenges are related to the policy framework, the complexity of which is very pronounced with the introduction of the EU green Deal. Some of the challenges are more process-related and refer to technical elements in the chain of CO_2 valorisation. Challenges are also related linked to the economic viability and competitiveness of the technologies and some refer to broader social circumstances that need to be considered when bringing CCU products to the market. Furthermore, some of the challenges might be perceived differently under the lens of national circumstances that would influence how a country supports innovative and sustainable technologies for the production of CO_2-based chemicals.

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List of abbreviations

BBI	Bio-based industries
CAPEX	Capital expenditures
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilisation
CO_2	Carbon dioxide
CRCM	Carbon Removals Certification Mechanism
DA	Delegated Act
DSP	Downstream processes
ETS	Emissions Trading System
EU	European Union
GHG	Greenhouse gases
IA	Implementing Act
LCA	Life Cycle Analysis
OPEX	Operating expenses
R&D	Research and development
R&I	Research and Innovation
RCF	Recycled Carbon Fuels
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RED	Renewable Energy Directive
RFNBO	Renewable Fuels of Non-Biological Origins
RWGS	Reverse Water Gas Shift
TEA	Techno-economic Assessment
TRL	Technology Readiness Level
WP	Work package

1. Introduction

1.1. CO_2SMOS project in brief

CO_2SMOS - *Advanced chemicals production from biogenic CO_2 emissions for circular bio-based industries*, is a Horizon 2020 project funded by the European Commission.

From May 2021 to May 2025, the CO_2SMOS project will develop a set of breakthrough and cost-competitive technologies to transform the carbon emissions generated from bioprocesses (e.g. fermentation) into different sustainable bioproducts like durable polymers, renewable biochemicals and biodegradable materials. These compounds will allow the production of greener end-products such as packaging, coatings, textiles and materials for biomedical applications. The demonstration of the technical, economic and environmental sustainability of the different CO_2SMOS technologies will allow the design of an integrated platform of CO_2 conversion processes for bio-based industries (BBIs).

This approach contributes to achieve zero-waste objectives and favours the long-term sustainability of the BBI sector, reducing the carbon footprint as well as replacing fossil-based chemicals with more sustainable ones using renewable sources (green H_2 and biomass) and CO_2 as main raw materials.

1.2. Scope and methodology

The deliverable 1.6 *CO_2SMOS Regulatory Inventory* aims at highlighting the current elements and circumstances that constitute a challenge for the development of the CCU value chain in the European chemical industry and, in particular, the biobased one. The utilisation of CO_2 in the production of chemicals is a promising solution to reduce the carbon footprints of BBIs, but not yet competitive. It is therefore key to identify at an early stage the potential elements that are, or might, hinder the research, development and scale-up of these technologies.

In an effort to take a snapshot of the current standpoint of the CCU development, this report tries to identify and sort existing and potential barriers on the basis of their nature. Three are the chosen categories: regulatory, technical and socio-economic. The division reflects the complexity of the landscape and offers a starting point for future analysis.

Another dimension that is taken into account is the geographical one. This deliverable recognises that the elements identified may vary from country to country inside the EU and offers an overarching explanation for this phenomenon.

When looking at the barriers, the inventory took into consideration the particularities of the CO_2SMOS project, such as the specific sector involved (BBI), the characteristics of the CO_2 used in the process (biogenic), the hybrid nature of the proposed solutions and its proximity to the implementation phase. However, because of the similar level of development and acceptance of the different CCU applications, the majority of the barriers found might affect the whole CCU value chain, independently of the pathway.

Under these circumstances and level of complexity, the inventory builds on the direct experience of the 15 partners of the CO_2SMOS project, which represents the entire CCU value chain across seven countries and includes universities, large industries, SMEs and knowledge hubs. The expertise, internationality and multidisciplinary of the consortium, ensured a solid basis for this concise and overarching exercise. The empirical data have been gathered through a questionnaire. More focused input has been received from the partners directly involved in the task.

This deliverable can be considered as a starting point listing challenges along the CO_2SMOS value chain, but it does not go deep into their analysis. The work carried out in this inventory will be pivotal for the preparation of D6.7 *Regulatory framework analysis and recommendations*, which will go further in analysing the challenges listed. The main goal of this second step is to provide targeted recommendations to accelerate the deployment of CO_2SMOS technologies.

2. Regulatory barriers

When looking at regulatory barriers of CO_2 utilisation for chemicals production, we can identify essentially three types of EU initiatives that will impact the way CO_2 can be used in CCU projects, including for CO_2-to-chemicals projects:

1) Implementing acts on existing EU legislations
2) Proposed new EU legislations now being discussed and negotiated at EU level
3) Other long-term future EU initiatives (legislative or non-legislative) on CCU

2.1. Legislations in application today

The European Union has been committed to foster the development of renewable energy for decades, and how it should be used to cut CO_2 emissions. The current legislation in place, the revised Renewable Energy Directive (REDII), aims for renewable energy sources consumption to be of 32% by 2030. REDII has been adopted in 2018, but some of the subsequent legal acts (called "delegated acts") planned in REDII are still to be adopted to detail specific rules around the production and distribution of renewable energy, how it can be accessed and used around Europe. EU authorities are bound to adopt two delegated acts[1] and one implementing act[2]. They will define the way certain CCU projects, in particular on fuels, can be deployed throughout Europe, and how GHG savings and access to renewable electricity will be defined.

- REDII Delegated Act on rules for the production of renewable hydrogen from electricity (REDII DA on Additionality):
  - This act will set up the conditions for the access to renewable energy for producers of renewable fuels of non-biological origin (RFNBO), which also include CO_2- and renewable hydrogen-based fuels.
  - No clear date for adoption, but likely to be in January/February 2022 most likely together with REDII DA GHG Methodology.

- REDII Delegated Act on methodology for determining GHG savings from RFNBO and recycle carbon fuels (RCF) (REDII DA GHG Methodology, here):
  - This act will set up the methodology for calculating the 70% GHG savings for RFNBO.
  - No clear date for adoption, but likely to be in January/February 2022 together with the REDII DA on Additionality.

- REDII Implementing Act on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land use change risk criteria (REDII IA Union Database, here):
  - This act will set up the rules on GHG reduction accountability in voluntary schemes via the Union Database.

[1] Delegated act: non-legislative instrument which the European Commission is allowed to adopt when the EU legislator has delegated that ability to the Commission through an EU legislative act. It cannot change essential elements of the law. The delegated act is adopted after consulting experts from EU countries. The European Council and Parliament can formulate objections within two months of its adoption.

[2] Implementing act: non-legislative instrument containing essential implementing measures of an EU legislative act. This is especially used if uniform conditions across the EU Member states are needed for the implementation of an EU legislative act. The implementing act is due to be adopted through the Comitology procedure of the EU.

- No clear date for adoption, it was supposed to be adopted in Q2 2021 and has been pushed back.

These three acts are an extension of REDII and will condition how renewable energy is used in CCU projects:

- If it is harder for electrolysers to get access to renewable energy and demonstrate that they are using renewable energy, it will impact the availability of green hydrogen, which in turn will impact the possibility for CCU projects to be deployed.
- If rules around GHG savings are too permissive or too constraining or not consistent across instruments, it means it will be harder for CCU converters and users to demonstrate the credibility of their CCU products as contributing to mitigating climate change.
- If rules on GHG accountability are too complex, it means that it will be harder for some CCU converters and users to demonstrate they are contributing to reduce CO_2 emissions by using CCU.

2.2. Legislations in discussion and negotiation

In order to implement the objectives of the European Green Deal which aims to make the EU carbon neutral by 2050, the European Commission tabled a package of legislations to make EU's policies fit for reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels (to be 'fit' for the '55'% emissions reduction). In this 'Fit-for-55' package, the Commission tabled 14 legislative proposals that will contribute to reshaping the way CCU is considered in Europe. As the key files that will impact CCU, we identify in particular:

- The revision of the EU Emissions Trading System (ETS) will condition how CO_2 emitters and CO_2 users are incentivised to invest in reusing CO_2 rather than surrendering ETS allowances. In concrete terms, it means that if CO_2 that is used for fuels and chemicals is eventually released into the atmosphere, the current proposal introduces that it is only to be counted once (to "avoid double counting"). EU authorities are now determining how to avoid double counting, where the CO_2 must be accounted for in its entirety but should also be maintaining flexibility for all actors to be encouraged to use CCU. This is of interest for all sources of CO_2, biogenic included, especially since some installations providing biogenic CO_2 (e.g. waste incinerators) are not regulated by the ETS at EU level.

- The revision of the REDII, known as REDIII, sets out clear objectives for shifting even further towards renewable energy and will frame the incentives for CCU projects to be deployed, e.g. the specific targets on the use of CO_2-based fuels in transport and in the industry by 2030. Importantly it is the first time of mentioning the need to use CCU products in the industry, by suggesting that 50% of the use of hydrogen in the industry should be covered by RFNBO; this means in principle that the use of CO_2-based chemicals, like products of CO_2SMOS, in the chemical industry is recognised under legislation.

- REDIII will be complemented by specific legislations on air (ReFuelEU Aviation) and maritime (FuelEU Maritime) transport that will boost the uptake of CCU-fuels in Europe. Both initiatives send positive signals: they aim to reduce the environmental footprint of the maritime and aviation sectors by putting in place concrete GHG reductions targets and even, in the case of ReFuelEU Aviation, CCU-fuels targets as clear objectives for Europe to reach: it means that the CCU value chain will be certain that, by EU law, the production of renewable chemicals and fuels will be encouraged

- The revision of the Energy Taxation Directive will set up the rules for financial exemptions for CCU products for the years to come.

- The revision of the Energy Efficiency Directive will aim to achieve a higher level of greenhouse gas reduction by 2030, to which CCU technologies, including CO_2-to-chemicals, can contribute to such objectives. This means that at national level, authorities can include CCU projects and objectives in their climate plans, in order to make one of the levers for GHG reduction.

2.3. Non-legislative initiatives and other long-term initiatives announced by the Commission

- The Communication on Restoring Sustainable Carbon Cycles include crucial elements for CO_2-to-chemicals:
    - Aspirational objectives include:
        - By 2028, any ton of CO_2 captured, transported, used and stored by industries should be reported and accounted by its fossil, biogenic or atmospheric origin.
        - At least 20% of the carbon used in the chemical and plastic products should be from sustainable non-fossil sources by 2030, in full consideration of the EU's biodiversity and circular economy objectives and of the upcoming policy framework for bio-based, biodegradable and compostable plastics. This target is totally aligned with CO_2SMOS aim to convert CO_2 and renewable bio-based feedstock into intermediate products to produce chemicals and biopolymers.
    - It is to be expected but yet unknown to what extent the reporting of the CO_2 origin will lead to certification schemes that would label CO_2-based products against alternatives.
    - Key actions on carbon cycles include:
        - Develop methodologies and carry out an integrated EU bioeconomy land-use assessment, with the aim of ensuring consistency of aggregated national and EU policies and targets, and provide technical assistance to Member States to carry out national assessments in support of their bioeconomy policies.
        - Supporting industrial CO_2 capture, transport, use, and storage in its Horizon Europe work program (2023/24).
        - Launch a study on the development of the CO_2 transport network.
    - The Communication also announces the future Carbon Removals Certification Mechanism (CRCM), but details around how CO_2-to-chemicals would be considered under the future legislation remain to be clarified.

- The EU Taxonomy for Sustainable Activities identifies part of CCU activities as sustainable, including hydrogen production, but explicit inclusion of all CCU activities, including CO_2-to-chemicals, would help promote further projects aiming to produce BioCO_2-based chemicals.

- The Sustainable Products Initiative is expected to be adopted on 30 March 2022. The proposal will be revising the Ecodesign Directive to ensure products placed on the EU market are more sustainable. Key product categories include chemicals. The EU will aim to support measures for industrial innovation climate neutral & clean production.

- REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) is a regulation of the EU, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry. Theoretically, it means that every chemical must be registered and evaluated by EU authorities. In the case of CO_2 however, if used as raw material, it is exempted from REACH obligation to register as presenting minimum risks as per the regulation. In any case, the REACH regulation is up for revision through the Chemicals Strategy for Sustainability that will encourage innovation to develop safe and sustainable alternatives to hazardous chemicals. It will be important to see how and if CO_2-based chemicals will be treated under this new Strategy.

3. Technical barriers

CO_2SMOS is developing technical processes for the conversion of biogenic CO_2 into an array of high added value chemical products. In that sense, there are technical challenges that need to be overcome that might not be specific only to the CO_2SMOS technology but in general to the bioconversion or catalytic processes, and electrochemical technologies. This chapter summarises some of those technical challenges by grouping them into relevant categories.

3.1. CO_2 capture and quality characterisation

An accurate characterization of the CO_2 stream is of high importance for the downstream conversion. Especially in high flow rates, this measurement represents a significant metrology challenge. The concentration of CO_2 and of the impurities will determine the effort required for CO_2 conditioning, the yield and productivity of the specific microorganisms to convert CO_2 into acetate/biochemicals by means of syngas fermentation to acetate and the efficiency of the catalysts in the electrocatalytic syngas production. Although biogenic CO_2 resulting from BBI operation is generally of higher purity than in other industrial flue gases, the challenge of delivering a stream corresponding to the requirements of the downstream use is higher when CO_2 streams from different BBI operations are combined. Consequently, the capture of CO_2 will need to be based on novel, robust materials for capture (membranes, solvents, adsorbents) that can deliver the required quality.

3.2. Process challenges

Some technical challenges in the gas fermentation process include the need for developing innovative fermentation processes and equipment and testing more efficient microorganisms to demonstrate that the latter biotransformation process can be cost-effective at industrial scale. This experimental approach involves increasing the productivity of the gas fermentation by optimising pressure conditions (5-10 bar) or developing a continuous fermentation strategy by avoiding elevated inhibitory acetate concentrations, optimizing the fermentation medium and integrating downstream process operation units (microfiltration, etc).

In addition, electrocatalytic CO_2 conversion processes face the challenge of catalyst poisoning by the presence of CO next to the cathode. Therefore an appropriate design of the cell architecture must enable mass transfer control, minimising the amount of CO that diffuses into the electrode; an optimised cell architecture and reactor design will enable the appropriate integration and synergic operation between electrolyzer and catalyst. Regarding the improvement of the RWGS catalyst, the optimisation of the catalyst composition and structure and the architecture of the integrated reactor will allow very high selectivity towards CO, avoiding methanation and coking keeping a high conversion. In this sense, the use of a membrane for water extraction will shift the chemical equilibrium towards products, favouring CO_2 conversion and therefore meeting the targets of yield and selectivity of the syngas production.

In general, the design of robust and selective catalysts, based on abundant materials and at scales that can support operation at industrial levels is a continuous challenge in CO_2 catalytic conversions. In analogy, the identification of a suitably engineered biocatalyst is a challenge in bioconversions.

Process intensification by integrating capture and conversion technologies will be decisive in reducing the space, energy and environmental footprint of the processes, but the development and configuration of reactor systems to allow this is still a technical challenge.

3.3. Scale-up and industrial integration

Bioconversions often suffer from low final product concentrations or low product yields. This often leads to increased effort in downstream processes (DSP) to separate and purify the final product. Additionally, when complex organic structure like biowaste are the inputs in the bioconversion, there is also generation of a variety of by-products that increase the downstream processing effort. The fact that CO_2SMOS starts with a rather pure stream of CO_2 reduces the DSP effort for by-product separation, but the challenge of low product concentration still needs to be overcome.

When considering scaling-up of the processes, the challenge of low conversion efficiencies will be translated into larger reactor volume and space requirements, but this challenge is mitigated by the fact that CO_2SMOS also targets low volume high added-value chemicals as products and not bulk chemicals as such. Therefore, such conversions are not expected to put excessive pressure on CO_2 availability or renewable energy availability.

At large scales, the challenge of implementing CO_2SMOS conversions is closely related to the available infrastructure for providing continuous supply of CO_2, renewable H_2 and product distribution so that the CCU value chain is efficiently integrated into clusters of concentrated industrial activity. It is also noteworthy that biological conversions are often operating under different scales and different operating conditions compared to the industrial processes into which they are intended to be integrated to.

Though not of a strictly technical nature, it is often a challenge that Life Cycle Assessment (LCA) and Techno-Economic Assessment (TEA) for low TRL processes are not representative enough of the industrial reality (overestimation due to non-established optimization concepts or underestimation due to non-inclusion of auxiliary processes[3]). Also, it is often difficult to project LCA/TEA results to upscaled operation due to the uncertainty of data linked to low TRL operation. However, recent progress has provided resources to address some of these issues[4].

[3] See Müller et al., 2020, https://doi.org/10.3389/fenrg.2020.00015
[4] See https://assessccus.globalco2initiative.org/

4. Socio-economic barriers

4.1. Economic considerations

Due to technical challenges as described above, gaseous bioconversions are at low TRL and require significant effort to reach high TRL scales. Cost-competitive is not yet in sight partly because of established and long-lasting process chains of conventional products but also because of high CAPEX and OPEX costs. However, a combination of targeted policy and funding support can contribute to a more accelerated scaling-up.

The factors that will determine the economic sustainability of the CO_2SMOS process comprise the associated costs, including capital costs and operating costs (mainly energy consumption), and the expected savings and revenues. The commercialisation of the final products and even intermediate commodities will generate an income provided their acceptance and regulation compliance, while the reduction in CO_2 emissions will entail savings in emission allowances costs. All these costs and revenues rely both on internal and external factors: energy costs depend on the amount of energy required and on the price of renewable energy, income from products depends on the market situation for the given products, on the production capacity and on the product price, and savings in allowances depend on the emissions mitigated and on a functional price of CO_2. There is a certain uncertainty behind many of these factors (e.g. energy prices strongly depend on geopolitical circumstances; as we have been experiencing the last weeks, the CO_2 price has increased almost five-fold within a year as a result of ambitious climate goals and targets), which render the elaboration of a sound-proof business model a very challenging exercise.

The challenge in funding support is to be able to create and profit from an ecosystem of different types of funders, the presence of which will provide mutual signals that the process and the product has a secured interest and it will find itself in the market. Public funding can derisk the investment in lower TRL processes to a certain extent so that complementary private funding (e.g. venture capitals, corporate investors) can join more easily and accelerate the deployment of innovative technologies. Often, accessing private funding support (e.g. from a commercial bank) or accessing public funding at national or EU level, although competitive, might not be the limiting factor in the scale-up of a technology, rather than the lack of an industrial investor that is willing to invest in the scale-up and secure the product take-off.

4.2. Social considerations

Public acceptance has been attracting more attention as far as CCU products are concerned[5] partly also because of the association with the CCS concept. The challenges that should be addressed in this context are related to the lack of knowledge and awareness about the subject, the lack of accurate and accessible information, the perceived risks (also health-related) about product safety and quality, the willingness (or lack thereof) to pay at consumer level for a green premium.

[5] See Arning et al., 2020, https://doi.org/10.1016/j.eist.2019.05.003; http://bioreco2ver.eu/wp-content/uploads/2021/12/21-10-07-BioRECO2VER-eCO2nference.pdf; Lutzke et Arvai, 2021, https://doi.org/10.1007/s10584-021-03110-3; Jones et al, 2017 ; https://doi.org/10.3389/fenrg.2017.00011

Especially important is the challenge of public misinformation and of how CCU processes are treated by the media, in an era where it becomes difficult to distinguish between credible and non-credible information. Transparency, evidenced-based communication and clear messaging of benefits and limitations of CCU technologies are the key challenges that need to be addressed when the end-consumer is the final target.

What is particularly important for CCU is that it is addressed directly to the final consumer because it concerns a product that will be ultimately used by them, i.e. they have a direct vested interest in the outcome. The experience of public resistance, skepticism and mistrust about CCS, i.e. a process that is ultimately not leading to a marketable and usable product, highlights how even more important it is for CCU to provide accurate information, clear definitions and to remove confusion in areas where the consumer acceptance has the final word to the adoption of such innovative technology.

Further social challenges could be attributed to the discussions of job security and job creation and how the transition to more sustainable systems would require continuous training of the workforce in a variety of complex processes (including capture and conversion) but would also maintain existing workforce due to the use of existing infrastructure in the distribution of the products.

5. National circumstances

This section aims to identify elements where the national element may be decisive for the development of a CCU technology, e.g. specific rules that can directly or indirectly create further constraints for the production of bio-products, or specific opportunities helping the development CO_2-to-chemicals projects.

EU legislations and instruments described in this report, and specifically in chapter 2 *Regulatory Barriers*, can differ in their nature and their impact: while EU regulations (e.g. ReFuelEU Aviation, FuelEU Maritime) will be applicable immediately in all EU Member States when adopted, other instruments such as EU directives (e.g. REDII, REDIII, ETS…) are obligations of results, not obligations of means, for Member States. In practice, it means that Member States can choose the means to achieve the objectives from directives. In certain cases, this means they can even go further than the objectives set at EU level, and set their own targets and objectives, like boosting initiatives that can contribute to mitigating climate change. For example:

- The national carbon dioxide tax policy of the Netherlands includes waste incineration in the emissions trading system on top of the ETS scheme, thereby influencing the way biogenic CO_2 can become available for downstream CCU applications.
- In the context of the REDII transposition in national legislation, Portugal has opted for higher (47%) share of energy from renewable sources in gross final consumption by 2030 (compared to 32% within REDII). This opens the road for higher penetration of renewables in the energy system and therefore easier accessibility of CCU processes to renewable electricity.

Besides, some types of regulatory measures may depend only on national circumstances to condition how CO_2-to-chemicals projects are considered, funded and deployed across EU countries.

- Permitting purposes for the development of renewable energy projects are varying significantly between countries, thereby impacting the time that renewable electricity can be accessible for the production of a CCU product. Permitting purposes might also differ when it comes to the modification of an existing installation to integrate a CCU application (e.g. CO_2SMOS bioplactics), which is not considered directly related to the originally registered activity. This may lead to the need to apply for permits of substantial modification that increase the administrative complexity and discourage potential investors.
- Health & Safety regulations within an installation may be different from country to country.
- Differences in supporting instruments may lead to a more accelerated deployment of innovative technologies in one country compared to another. For example:
  - Italy has recently introduced a fund for companies of any dimension to push projects aimed to implement technologies based on circular economy;
  - Belgium has introduced an industrial innovation programme specifically to develop carbon circular technologies;
  - The Netherlands has included in 2021 CCU in its funding programme for sustainable energy production and climate transition;
  - Germany has issued in 2021 a programme for CO_2 capture and use in the industry;

- The central national policy framework (e.g. National Energy and Climate Plans, National Recovery and Resilience Plans) showcase that CCU is treated differently among countries with some considering it as a solution to invest in and others not.

6. Annex

6.1. List of EU instruments and policies impacting CO2-to-chemicals

EU instruments and policies	Timeline
Communication on Restoring Sustainable Carbon Cycles	Adopted in December 2021
REDII Delegated Act on rules for the production of renewable hydrogen from electricity	Ongoing, adoption expected Q1 2022
REDII Delegated Act on methodology for determining GHG savings from RFNBOs and RCFs	Ongoing, adoption expected Q1 2022
REDII Implementing Act on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land use change risk criteria	Ongoing, adoption expected 2022
Revision of the EU Emissions Trading System	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Revision of the REDII, known as REDIII	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Proposal on ReFuelEU Aviation	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Proposal on FuelEU Maritime	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Revision of the Energy Taxation Directive	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Revision of the Energy Efficiency Directive	Published in July 2021, negotiation throughout 2022, adoption in 2023 TBC
Carbon Removals Certification Mechanism	Proposal expected end 2022, negotiation expected in 2023
EU Taxonomy for Sustainable Activities	Ongoing, next revision in 2025 TBC
Chemicals Strategy for Sustainability	**Timeline**
Sustainable Products Initiative	Adoption expected end March 2022, negotiation throughout 2022 and 2023
REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation	Adopted in December 2006, registrations and authorisations ongoing

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