Petition for Integration of renewable CCU in the RED

to those revising and extending the "Renewable Energy Directive (RED) in the 2030 Climate and Energy Framework" in the European Commission, European Parliament and the Member States

Authors and initiators of the petition

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Signatories: Every person can sign this petition and give additional input on the discussion of CCU integration in the RED at: www.co2-chemistry.eu/CCU-petition

The petition, additional ideas from the signatories and the feedback from the policy will be presented and discussed at the huge conference on CCU in December: **5th Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers**, 6 - 7 December 2016, Maternushaus, Cologne, Germany (www.co2-chemistry.eu).

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Carbon Capture & Utilization (CCU) technologies will play a crucial role in the future renewable energy system and for climate protection. Carbon Dioxide (CO_2) is not just another raw material, intermediate or waste; in terms of volume, it is the most important greenhouse gas. When being processed with renewable energy, CO_2 is an infinite resource for producing sustainable fuels and chemicals with a high potential for climate protection. When speaking about this combination of CCU with renewable energy as the only energy source to reduce CO_2, the term **renewable CCU or rCCU** has recently been coined.

In contrast to Carbon Capture and Sequestration (CCS), which needs endless subsidies and has so far failed to truly fly, rCCU can be a real business model for utilizing CO_2, storing CO_2 in products and avoiding additional GHG emissions.

The most important role of rCCU is the ability to store renewable electricity over a long time without losses and to convert fluctuating renewable electricity into fuels (for transport and for reconversion into electricity) and chemicals. Therefore, rCCU is systemically important for the liberalized electricity market, since it offers the much-needed possibility to increase the flexibility of the grid and by this, to increase the share of renewables in the European electricity mix.

The European Union cannot afford to miss or to delay the deployment of this new option to utilize and store renewable electricity, which is to extend the applications for renewable energy to renewable fuels and sustainable chemistry. The European Union should become the leader in rCCU, not only in research and development, but especially in applying and fully utilizing the potential.

The ongoing development of the 2030 Climate and Energy Framework is a unique opportunity to establish a regulatory framework in which rCCU is fully integrated. This opportunity should not be missed.

Latest assessments clearly prove that rCCU fuels and chemicals show very high GHG emission reductions compared to fossil- and bio-based fuels[1] and chemicals and need much less land and water compared to bio-based fuels and chemicals. It is also a way of overcoming the whole food vs. fuel discussion. CO_2-based fuels and chemistry have to become crucial parts of a renewable and circular economy and to contribute to energy efficiency as well as energy and material security for Europe.

We therefore ask decision makers involved in the revision of the Renewable Package to include the following mechanisms in the legislation:

- The increased flexibility of the renewable energy systems enabled by rCCU, allowing a higher share of renewables in the electricity mix, should be fully recognized in the RED reform and additional incentives for technologies delivering this "flexibility" should be implemented.
- In the methodology of the RED and the FQD, there should be a calculation method / default values accounting for "flexibility".
- The utilization of CO_2 emissions from biofuels production by rCCU should be accountable towards the reduction of the GHG emission of the biofuels.
- This should further be incentivized by introducing stronger GHG emission reduction targets for biofuels or thresholds for land efficiency in the RED and the FQD. These targets can only be fulfilled by using biowaste as input and/or utilizing CO_2 emissions by rCCU technologies.
- The utilization of green electricity via certificates of origin should be fully recognized for rCCU.
- The electricity used by rCCU should be free from extra levies for end consumers or renewables incentives, because the electricity is not consumed but transformed to another usable energy form.

1 See for example the ISCC certificate for CO_2-based methanol, ISCC-PLUS-Cert-10016121, Carbon Recycling International, Grindavik, Iceland.

The legal framework of the Renewable Energy Directive (RED)

The Renewable Energy Directive (2009/28/EC, RED) created in 2009 the very first EU legally binding framework for the use of renewable energy in the three areas of electricity, heating/cooling and transport. The goal is to meet 20% of the EU's overall energy demand ("gross final energy consumption") through renewable energy by 2020, along with a minimum of 10% of transport demand by renewables. It also defines a specific level of its final energy demand that each individual state must cover through renewables by 2020. These quotas are binding for Member States.

The RED was able to generate massive effects with relatively few mechanisms and within a relatively short period of time: In 2014, energy from renewable sources was estimated to have contributed 16% of gross final energy consumption in the EU28, compared with 8.5% in 2004, the first year for which this data is available[2].

The bioenergy and biofuel industry has made excellent use of the incentives created by the quota system, unfurling an amazing dynamic in technology development, investment and logistics and, not least, a reduction of CO_2 emissions. But there is still a lag to achieve the full targets of the renewable energy policy.

Reform of the RED in 2015

For several years, there have been intense discussions on a reform of the RED to address the issue of indirect land use changes (iLUC). In 2015 a 7% cap on food-crop based fuels (1st generation biofuels) were introduced for up until 2020 as well as a non-binding 0.5% sub-target for advanced renewable fuels. iLUC criteria were included for monitoring, and as a new element, renewable transport fuels from non-biological origin (including from carbon capture and utilization, also called CCU fuels, CO_2-based fuels, solar fuels or power-to-liquids) have been explicitly included in the RED since the reform. Advanced renewable fuels are accounted with twice their energy content in the quota ("double counting").

Reform for the time period after 2020

It is currently discussed how to reform the RED for the time after 2020. In the next months, the discussion will enter a hot phase – lobby groups are already trying to influence the process with daily press releases and meetings with representatives from the European Commission, the European Parliament and the Member States. For biofuels, strongly depending on incentives, the design of the next framework will be decisive for the survival of the industry. Already today, we see a slowdown of new investments, and without strong incentives, the whole sector is in danger of collapsing – or Member States will have to create support on national level.

The European Commission will table a revision of the Renewable Energy Directive ("Renewable Package") at the end of 2016, aiming to further push renewable resources such as wind, solar and biomass across the European Union. EU laws requiring Member States to use "at least 10%" renewable energy in transport will be scrapped after 2020, the European Commission confirmed, hoping to set aside a protracted controversy surrounding the environmental impacts caused by biofuels during cultivation and offering more freedom to the member states on how to reach their climate targets.

Phantom electricity

In member states with high shares of solar and wind, there are numerous instances in which successfully installed wind and photovoltaic power plants try to feed the national grids with a higher volume of renewable electricity than can be absorbed. If there is no corresponding demand or powerline capacity, the national grids are not able to absorb and transport the total volume all of the time. In the meantime, renewable power plants get shut down when the demand does not follow the production, resulting in "phantom electricity", which is paid for by the consumer, but never produced.

Most important rCCU technologies

CO_2 can be captured from biofuel and biogas production, various industrial processes, extracted from flue gas from coal, natural gas or crude oil plants (purified & conditioned) or directly from the air (direct air capture). To utilize the CO_2, renewable energy for the reduction of CO_2 is required. Mostly hydrogen is used as an energy carrier for the reduction, produced from wind, solar or hydro electricity by electrolysis.

From CO_2 and H_2 a wide range of fuels and chemicals can by produced by catalytic processes like methanisation, methanol synthesis (and further processes) or Fischer-Tropsch synthesis. Some chemical processes to utilize CO_2 do not need a reduction, but can realize an integration of CO_2 in chemical molecules without breaking the CO_2, for example in polyols for the polyurethane production.

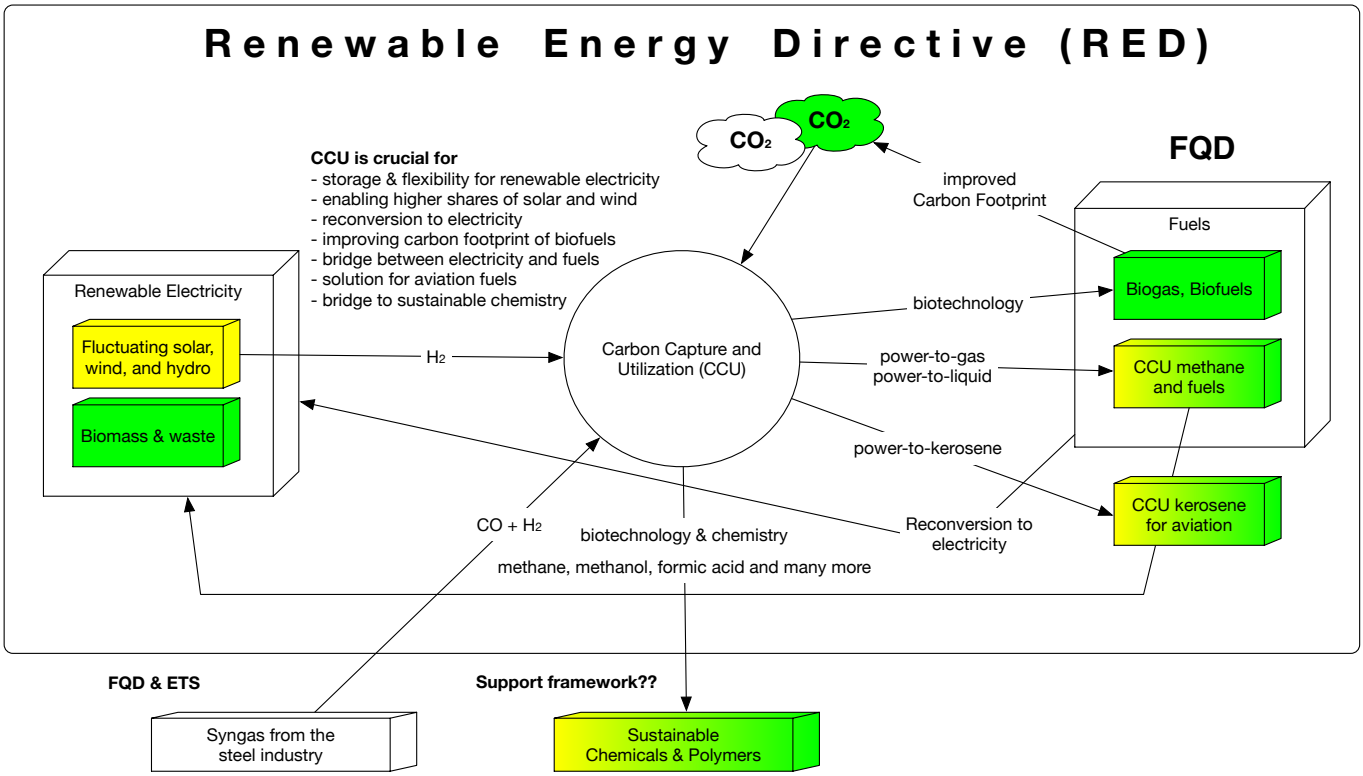
CCU technologies also include biotechnology processes with bacterial systems, algae, cyanobacteria and synthetic biology for example. The different microorganisms utilize CO_2 using different sources of energy and producing a wide range of fuels and chemicals.

Another way to use CO_2 is the so called "artificial photosynthesis", a photocatalytic water splitting with metallic or polymeric catalysts and hybrid systems using protein and photocatalytic systems to produce hydrogen for the reduction of CO_2.

Several of these technologies work today in pilot and demonstration plants, first are already commercial and several are ready for scaling up. Others are still in lab scale and will come up in the next decades.

2 Source: http://ec.europa.eu/energy/en/news/renewable-energy-share-rose-16-2014.

The comprehensive benefits of rCCU



rCCU as a new option

With rCCU, a new technology is coming to the table, offering completely new options to frame the renewable energy systems. Different names are used for this new technology such as CCU fuels, CO_2-based fuels, solar fuels or power-to-fuels, power-to-liquids, power-to-gas and many more.

The most important role of CCU is the ability to store renewable electricity and to convert fluctuating renewable electricity into fuels (either for end use in transport or for reconversion into electricity) and chemicals. Therefore, rCCU is systemically important for the liberalized electricity market, since it offers the much-needed possibility to increase the flexibility of the grid and by this, to increase the share of renewables in the European electricity mix – rCCU can help to avoid expensive "phantom electricity".

The figure above shows which crucial role rCCU can play. We clearly see that almost nobody has fully recognized the role that rCCU options could play in the current RED reform, mainly because of two reasons:

- The relevance of the rCCU concept and its potential are not yet fully understood by most of the policy makers and stakeholders.
- Unlike bioenergy and biofuels, the rCCU sector does not yet have a lobby, which is normal for a new sector consisting only of pilot plants.

These are the reasons why we want to give rCCU a strong voice. Several projects and analyses show that rCCU technologies could play a crucial part in the future renewable system. This opportunity should not be missed in the reform, but should be fully captured – otherwise we will face a relevant delay in rCCU implementation with strong negative impacts on the renewable energy system and on climate protection. The European Union cannot afford to miss or to delay the deployment of this new option to utilize and store renewable energy, which is to extend the applications for renewable energy, fuels and sustainable chemistry. The European Union should become the leader in renewable CCU, not only in research and development, but especially in applying and fully utilizing the potential.

The running reform of the Renewable Energy Directive (RED) for the time period after 2020 is a unique option to fully integrate rCCU. This option should not be missed.

Bridge between electricity and fuels

CCU can store renewable electricity in renewable fuels. For the first time renewable electricity and renewable fuels are directly linked – via CCU. This is a new situation, because so far the regulations for renewable energy and renewable fuels were not linked. This strong link offers completely new options, challenges and business models, and needs further integration in the new RED proposal.

Storage and flexibility for renewable electricity

With an increasing share of volatile solar and wind energy in the power system, intelligent and flexible large scale energy storage systems with a connection to the grid are crucial. CCU can play a significant role here and is technically available. rCCU can store surplus renewable electricity in fuels and chemicals, which is a prerequisite to further increase the share of renewable energies.

In Germany, which has a high share of wind and solar energy in its energy grid, at an increasing number of hours, the wind and solar plants have to be switched off, because the grid is too weak and the demand too low to cover the electricity production. At the same time, there is strong public resistance against building new pumping hydro storage facilities. In 2015, the electricity consumers paid 400 Mio. € to the wind and solar electricity producers for the non-fed-in (non-produced) so called "phantom electricity" (see page 2). Local rCCU plants can keep the wind and solar plant running, convert the surplus energy in power-to-gas or power-to-liquid and reduce the costs for "phantom electricity".

This increased flexibility for the renewable energy systems should be fully recognized in the RED reform and additional incentives for technologies delivering this "flexibility" should be implemented. In the methodology of the RED and FQD, there should be a calculation method / default values for "flexibility".

Only this way the surplus of solar and wind energy can be utilized and the share of renewables significantly increased. At the same time, rCCU can support the electricity market design[3], which should facilitate a better balancing between supply and demand.

Systematic problems to overcome

- To play a system relevant role in the electrical market design, the connection to the national grid is crucial for rCCU – but if the national emission factor (grid mix) is taken into account for the sustainability calculation, rCCU fuels will not have a very favourable carbon footprint for the FQD.
- The physical link between a wind or solar park and a CCU plant does not solve the grid problems and competes against feed-in tariffs. The CCU progress will be heavily delayed.
- Therefore, the utilization of green electricity via certificates of origin should be fully recognized for rCCU.
- The electricity used by rCCU should be free from extra levies for end consumers or renewables incentives, because the electricity is not consumed but transformed to another usable energy form.

That is the reason why incentives for flexibility to increase the renewable share in the energy systems needs specific incentives and regulations.

Maximize the renewable power transmission and efficiency

The energy efficiency measures have dropped down the power demand while the share of renewable energy has increased and will further continue to do so. rCCU will help in reducing the fossil share of energy in the transport sector and maximize the renewable power transmission and efficiency – renewable electricity can be always utilized, even if there is no actual electricity demand, and fed back if necessary. In the RED, a grid connection of rCCU plants should receive a sustainability bonus, if they deliver services of flexibility.

Minimizing grid extension and promoting re-industrialization

The implementation of rCCU plants as large scale energy storage at peak connection points of the power grid will reduce the demand of grid extension and will speed up introducing high capacities of renewable power plants. This is a chance for the re-industrialization of the EU, because industry will move to where energy is available and cheap.

Improving the carbon footprint of biofuels

In the production of bioethanol, biodiesel and biogas relevant amounts of CO_2 are emitted, lowering the GHG efficiency on biofuels. If these CO_2 emissions are captured and utilized in greenhouses or sparkling soft drinks a GHG benefit is given according to the current accounting rules. Also the transformation of CO_2 via rCCU technologies using renewable energy to make chemicals or fuels could improve the carbon footprint of the biofuels significantly, improve the land efficiency and reduce the iLUC risk.

This should be fully recognized in the new RED reform, for example by introducing stronger GHG emission reduction targets for biofuels or thresholds for land efficiency. These targets can only be fulfilled by using biowaste as input and/or utilizing the CO_2 emissions by rCCU technologies.

Solution for low-carbon aviation fuels

Different LCA reports show that rCCU aviation fuels have an extreme low carbon footprint, lower than all bio-based aviation fuels – first LCAs based on the methodology of biofuels showed GHG reduction up to more than 90%[4] (depending on CO_2 source, consequent using of renewable energy and the rCCU technologies). This unique chance for the aviation fuel industry should be fully utilized for climate protection in the RED and the ETS.

Bridge to sustainable chemistry

For the first time, renewable electricity in combination with CO_2 and H_2O can be used with rCCU technologies to produce a wide range of sustainable chemicals and polymers. The CO_2 is stored in the products during their lifetime. First factories to produce for example CO_2-based Polyurethanes started their production in summer 2016 in Germany, pioneers in USA and Asia produce the new biodegradable polymer Polypropylen Carbonate (PPC).

Other techniques for producing methane or methanol as a fundament for the C1 chemistry or also even more complex building blocks like ethanol, succinic acid and others via biotechnology as precursor for a wide range of chemicals and polymers, lubricants or construction materials via mineralisation are under development and tested in first pilot facilities.

3 Link to electricity market design, see http://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v11.pdf , the Commission has promised a legal proposal for 2016 in its updated Energy Union Roadmap, see http://eur-lex.europa.eu/resource.html?uri=cellar:ebdf266c-8eab-11e5-983e-01aa75ed71a1.0008.03/DOC_3&format=HTML&lang=EN&parentUrn=CELEX:52015DC0572.

4 See for example, ISCC certificate for CO_2-based methanol, ISCC-PLUS-Cert-10016121, Carbon Recycling International, Grindavik, Iceland.

With minerals, chemicals and polymers, CO_2 can be stored for the life time of the product, which can last for years (consumer goods and automotive) or even for decades (construction). The potential of such novel carbon sinks will need to be fully exploited if the Paris agreement is taken serious with its long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels.

Default values for rCCU fuels in the Fuel Quality Directive (FQD)

The Fuel Quality Directive (98/70/EC, FQD) requires a 6% reduction in GHG intensity of road transport fuels by 2020. For full recognition of rCCU fuels, the FQD is at least as important as the RED. The first crucial step is to define and establish default values for different renewable liquid and gaseous fuels of non-biological origin, taking the potential for flexibility into account. In September 2016, the European Commission made the first step in this direction and published an initiative for "Default values for novel transport fuels":

> *"Member State authorities and/or economic operators working with technologies for Renewable liquid and gaseous transport fuels of non-biological origin and/or Carbon capture and utilisation for transport purposes not covered in Council Directive (EU) 2015/652 and wishing to have default values calculated for their technological pathways, are invited to submit suggestions accompanied by the necessary data to the Commission not later than 31 March 2017 at ENV-98-70-Implementation@ec.europa.eu" (http://ec.europa.eu/clima/policies/transport/fuel/index_en.htm)*

To promote rCCU fuels, the EU should continue the actions to reduce the GHG intensity of fuels after 2020.

Syngas from steel industry and other non-renewable industries cannot be part of RED, but of FQD and ETS?

Syngas from the European steel industry and other non-renewable industries contains CO, CO_2 and H_2 (together defined as syngas). It can be directly transformed by CCU technologies to fuels without additional process energy (energy is delivered by the hydrogen). These low-carbon fuels should be fully accounted in the FQD and ETS – but do not fit in the framework of the RED.

This is especially important for big projects with the steel industry in Belgium and Germany.

The SCOT project has worked on recommendations concerning the ETS ("EU-ETS to incentivise CO_2 utilisation?") and came to the conclusion:

> *"Currently, the Monitor and Reporting Regulation of the EU-ETS discourage the usage of CO_2 as a resource for CO_2 utilisation, as the transfer of inherent or pure CO_2 is only allowed for the purpose of long-term geological storage. It appears that the July 2015 EU-ETS revision proposal tries to incorporate the reuse of CO_2 by opening up the possibility of "permanently stored or avoided" emissions being within scope for the Innovation fund. This should be welcomed as it strongly supports the overall aim of the proposal: driving forward innovation and in that process reducing the emissions. However, it may not be straightforward to promote CO_2 utilisation activities under the EU-ETS."*
> *(www.scotproject.org)*